IMPACT OF AGRIPRENEURIAL ORIENTATIONS ON RESILIENCE AND PERFORMANCE OF DAIRY AGRIPRENEURS IN MURANG'A COUNTY, KENYA: THE MEDIATING EFFECT AGRIBUSINESS SUPPORT SERVICES

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and it has not, wholly or in part been presented for an award of degree in any other University.

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This thesis is dedicated to my lovely parents, siblings and all my friends, especially my late father Mr. Denish Owuor Okello, my dear mother Margaret Amimo Okello for their support and prayers.

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ABSTRACT

The performance of rural smallholder dairy agrienterprises in Kenya is very critical as it contributes to welfare improvement of rural people especially the youth and women. Despite this acknowledgement, the farm productivity of rural dairy agripreneurs is persistently low. Entrepreneurial orientations and utilization of agribusiness support services have been viewed as a catalyst for improvement of agrienterprises performance. This study sought to determine impact of agripreneurial orientations on resilience and performance of dairy agripreneurs in Murang'a County, Kenya. The specific objectives were to determine; dairy agripreneurs' preferences for production, animal health and marketing support services, factors influencing the usage of Agribusiness Support Services (ASS), effect of agripreneurial orientation mediated by ASS and effect of ASS on performance of smallholder dairy agripreneurs in Murang'a County. A multistage sampling method was used to select a sample of 682 dairy agripreneurs. Through a Cross-sectional survey, data were collected using a standardized questionnaire, discrete choice experiment (DCE) and analysed through a number of novel econometric approaches. Dairy agripreneurs had higher preference for group marketing, curative services and artificial insemination support services. However, dairy agripreneurs have less preference for business plan training service. In relation to willingness to pay (WTP), dairy agripreneurs were more willing to pay for group marketing (KES 8797.91/month), artificial insemination (KES 2816.01/month) and curative services (KES 2577.62/month), but were not willing to forgo KES 2411.29 per month for business plan training service. Secondly, the findings revealed that education level of household head, number of adults in the household, experience in dairy farming, land size, livestock type, number of cows owned, milk yield, price of milk, access to contract, type of road and level of buyer trust were the major factors that affect the likelihood of utilising agribusiness support services among dairy farmers. Thirdly, the findings indicate that there is positive and significant relationship between future orientation ($\beta = 0.395$, $t=12.699$, $p=0.01$), risk-taking orientation ($\beta = 0.088$, $t=2.743$, $p=0.01$) and market orientation ($\beta = 0.136$, $t=3.609$, $p=0.01$) on agripreneurial resilience. However, it was found that social orientation had a negative relationship with agripreneurial resilience ($\beta = -0.166$, $t=3.966$, $p=0.01$), while ASS had no mediating effect on the relationship between agripreneurial orientation and agripreneurial resilience. Finally, the results show that utilization of combination of ASS significantly increased milk productivity and income per year for smallholder dairy agripreneurs. The study recommended increased linkage on access of ASS and entrepreneusrhip capacity building programmes to smallholder dairy farmers.

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LIST OF ABBREVIATIONS AND ACRONYMS

AFC	Agricultural Finance Corporation
AI	Artificial Insemination
ASS	Agribusiness Support Services
ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
ATU	Average Treatment Effect on the Untreated
CFA	Confirmatory Factor Analysis
CI	Confidence Interval
CIDP	County Integrated Developmental Plan
CVM	Contingent Valuation Method
DCE	Discrete Choice Experiment
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FSD	Financial Sector Deepening
GDP	Gross Domestic Product
ICT	Information Communication Technology
KDB	Kenya Dairy Board
KNBS	Kenya National Bureau Of Statistics
MESRM	Multinomial Endogenous Switching Regression Model
MLM	Multinomial Logit Model
MSMEs	Micro-Small and Medium Enterprises
MVP	Multivariate Probit
NACOSTI	National Commission for Science Technology And Innovation
NGOs	Non-Governmental Organizations
RPL	Random Parameter Logit
SDGs	Sustainable Development Goals
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
VIF	Variance Inflation Factor
WTP	Willingness To Pay

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The Kenyan dairy sector plays an important role in creation of employment to majority of smallholder agripreneurs (Mwambi *et al.,* 2018). However, the sector is faced with instability due to lack of capital assets, poor rural infrastructure, unsteady supply of quality animal feeds, increasing animal diseases and limited skills in dairy management. The instability has resulted to poor financial performance of dairy agrienterprises which pose increasing risk to their survival. In addition, these challenges limit dairy agripreneurs capacity to make effective contribution to poverty reduction and sustainable economic growth in Kenya (Burke *et al.,* 2015; Nettle *et al.,* 2017).

Climate change has also increased uncertainty and risk in dairy farming. To ensure food security and efficient use of resources, it is necessary to find new pathways that will help to manage the changes (Goswami *et al.,* 2017). Responding to such challenges, dairy agripreneurs must build resilient farm strategies. Resilience is a key attribute that an agripreneur needs in order to cope with uncertain shocks and changes in the environment. One of the pathways that could empower smallholder dairy agripreneurs is through access and use of agribusiness support services (ASS). These services include advisory on pre-production and post-production, business plan development, financial, farmer organizations, brokerage and advocacy (Maonga *et al.,* 2017; Wongtschowski *et al*., 2013).

Smallholder dairy agripreneurs need special help for their survival and development (Shadbolt *et al.,* 2013). One of those interventions is access to agribusiness support services. The Kenyan government through the support of development partners have initiated dairy support programs that are directed towards enhancing agrienterprise development. Among the programs that are offered under assistance programs through projects from universities and NGOs are input subsidies, veterinary services, financial and credit, business plan training, extension and advisory services, infrastructure support, in addition to marketing and market research through cooperatives (Gisip & Harun, 2013; Rademaker *et al*., 2016).

Agribusiness support services are becoming an important part of promoting agripreneurial resilience in agrienterprises (Meuwissen *et al.,* 2018). In addition, studies conducted on

resilience of dairy farming in developed countries show that in order for smallholder agripreneurs to cope with a turbulent environment, they must be resilient (De Olde *et al.,* 2016; Forney & Stock, 2014; Shadbolt *et al.,* 2013). Access to agribusiness support services could act as a mediator in building agripreneurial resilience. This is in conformity to a report by Zeebaree (2017), in Malaysia, who found financial support services had a mediating role on entrepreneurial orientation and competitive advantage of small and medium enterprises.

This sought to determine the role of agribusiness support services on enhancing resilience of dairy agripreneurs. Specifically, the study focused on Murang'a County. This is because of the several interventions in relation to agribusiness support services offered to smallholder agripreneurs by both private and public institutions. The county has a well-developed supportive infrastructure including dairy hubs, processing plants and a number of dairy cooperatives. Further, dairy sector is among the county's developmental goals which has necessitated the county government to come up with interventions to upgrade this value chain. Some of these interventions include; promotion of group marketing through formation of producer cooperatives, promoting and enforcing contract farming and sensitizing farmers on business planning (Murang'a CIDP, 2018).

The county government is also availing inputs such as seed, fertilizers, pesticides, livestock feeds, equipment and veterinary drugs to dairy agripreneurs. This is through initiatives such as input subsidy programmes, bulk input purchases through producer and marketing cooperatives and linking agripreneurs to credit providers (Murang'a CIDP, 2018). Access to agribusiness support services could influence the agripreneurial behaviour of dairy farmers by changing their mindset and make them more market oriented. Despite this acknowledgement, there is paucity of information on impact of these support services on agripreneurial resilience and performance of dairy agrienterprise in Murang'a County. Hence, more rigorous impact evaluations were needed to fill the knowledge gaps.

1.2 Statement of the problem

The performance of dairy agripreneurs play an important role in promoting employment creation, food security and poverty alleviation in rural areas of Kenya. However, these dairy agripreneurs are faced with several risk factors such as animal diseases, unstable milk prices, inadequate capital, high input prices and unskilled human capital. These risk factors limit the

dairy agripreneurs from optimally benefiting from their dairy agrienterprises. In addition, these agripreneurs exhibit different orientations which influences their business success. Access to agribusiness support services could enhance the performance and resilience of agripreneurs. Previous studies have shown an association between agripreneurial orientation and firm performance, whereby these services increase the profitability of micro-small medium enterprises (MSMEs). However, little of this research, particularly in smallholder dairy agrienterprise context, has examined the impact of ASS on that association. Hence, this study sought to bridge this knowledge gap by determining the impact of agripreneurial orientation mediated by agribusiness support services on resiliency and performance of dairy agripreneurs in Murang'a County, Kenya.

1.3 General objective

To contribute to increased utilization of agribusiness support services for increased resilience and income of smallholder agripreneurs through the determination of impact of agripreneurial orientations on resilience and performance of dairy agripreneurs mediated by agribusiness support services in Murang'a County, Kenya.

1.3.1 Specific objectives

i. To determine dairy agripreneurs' preferences for production, animal health and marketing support services in Murang'a County.

ii. To determine factors influencing the usage of agribusiness support services among smallholder agripreneurs in Murang'a County.

iii. To determine the effect of agripreneurial orientation mediated by agribusiness support services on smallholder dairy agripreneurs resilience in Murang'a County.

iv. To determine effect of agribusiness support services on performance of smallholder dairy agripreneurs in Murang'a County.

1.4 Research questions

i. What are the dairy agripreneurs' preferences for production, animal health and marketing support services in Murang'a County?

ii. What are the factors influencing the usage of agribusiness support services among smallholder agripreneurs in Murang'a County?

iii. What is the effect of agripreneurial orientation mediated by agribusiness support services on smallholder dairy agripreneurs resilience in Murang'a County?

iv. What is the effect of agribusiness support services on performance of smallholder dairy agripreneurs in Murang'a County?

1.5 Justification of the study

The agribusiness sector plays a critical role in the economy of Kenya. The focus on dairy agrienterprises is an important factor due to their immense potential of creating employment, income generation to smallholder rural agripreneurs, improving living standards and hence poverty reduction as highlighted in Kenya Vision 2030. In addition, the focus of National Agribusiness Strategy of getting rid of barriers and creating incentives for investment in agribusiness can be aptly be realized through the adoption of not only efficient and effective technologies but also through resilient agripreneurs. Among the essential interventions to enhance agripreneurial resilience in agribusiness is through agribusiness support services. The dairy sector has received immense support services starting from production services such as artificial insemination, input provision services, group marketing, value addition to brokerage and business planning services. The main focus of ASS is to enhance communication, knowledge and facilitation services to agripreneurs in the sector. In addition, the dairy sector continues to struggle with seasonal supply and demand imbalances of milk and milk products. This inefficiency is expensive to both the producer and the consumer. Therefore, by exploring the effect of agribusiness support services (ASS) on agripreneurial resilience, risk management strategies and profitability of smallholder dairy agripreneurs in Kenya, the results of the study are expected to better inform research, development and policy decisions and also aid to prioritize key interventions in the dairy sector. Therefore, the results of the study will provide valuable information to agribusiness support service providers on how best to deliver agribusiness support services which could improve performance of agrienterprises. The findings would also contribute to body of knowledge on agripreneurs' preferences for agribusiness support services which could make them have informed choice of the ASS to

adopt. This may lead to increased uptake and usage of ASS in agrienterprises, leading to increased agripreneurial resilience and income.

1.6 Scope and limitations of the study

This study focused on impact of agribusiness support service interventions with specific emphasis on production, financial, cooperative and business planning services. The agripreneurial attributes included risk taking orientation, social orientation, future orientation and market orientation. Information on effect of agripreneurial orientation moderated by agribusiness support services on performance of dairy agripreneurs was collected by use of structured interviews. The data was collected in period of January-February, 2020 and the recall period was the past 12 months of production. This study had some potential limitations. The focus was dairy agripreneurs in Murang'a County hence the results may not be representative of all dairy farmers in Kenya. The study targeted 682 respondents who were the representative sample for dairy agripreneurs in Murang'a County. Majority of smallholder farmers may not keep farm records; hence the study depended on recall. This was a limitation because the study was constrained by failure of agrientrepreneurs to give accurate information about their enterprises. However, this limitation was addressed through alternative probing of respondents in order to elicit the required information.

1.7 Operational definitions of terms

Agripreneurs: within the study context these are as commercially oriented smallholder dairy farmers who are engaged in production and marketing of milk and have below 10 heads of cattle in their agrienterprise.

Agripreneurial orientation: these are entrepreneurial behaviors that are exhibited by agripreneurs in running their agrienterprises. According to this study, these will include market orientation, future orientation, social orientation and risk-taking orientation.

Agribusiness Support Services (ASS): These are support services that are offered to agripreneurs to help them manage their agrienterprises. In relation to this study, this will include production, business planning training, finance and cooperative services.

Agripreneurial resilience: this is the self-perceived behavior of agripreneurs to cope with problems that affect their agribusiness and manage their agrienterprises. The 10-item Connor-Davidson Resilience Scale (10-item K-CD-RISC) will be used.

Income: this refers to revenue that the smallholder agripreneurs received from selling milk and its products minus their production costs.

Performance: this is the improvement of dairy agripreneurs' productivity and income as a result of utilizing agribusiness support services and being agripreneurial.

Production services: in relation to this study, these will include artificial insemination, vaccination, deworming, pregnancy diagnosis, curative and use of improved dairy feeds.

CHAPTER TWO
LITERATURE REVIEW

2.1 Productivity and production systems of Kenya dairy sector

Dairy farming plays an important role in providing a source of livelihood to majority of Kenyans. About 1.8 million agripreneurs are involved in dairy farming with 80% being smallholder agripreneurs. These agripreneurs have a farm size of about 3-5 acres, keep 2-5 cows which produce about 5 kg of milk per day (Oloo, 2016). According to FAOSTAT (2018), the Kenya dairy sector produced 4 billion litres of milk in 2018 which makes it among the highest producer and consumer of milk in Africa. It is estimated that the annual per capita milk consumption ranges from 19 kg in rural areas to 125 kg in urban ones (Bosire *et al.,* 2017). The demand for milk and milk products in Kenya is among the highest in developing countries. However, the consumption patterns differ among different categories of consumers due to their differences in socio-economic attributes (Schneider, 2018).

In relation to livestock production systems and milk productivity in Kenya, about three quarters of Kenya's dairy cows are raised in extensive grazing and semi-intensive systems, in which cows obtain fodder through a combination of grazing and stall feeding. Zero-grazing systems is increasingly popular particularly in areas with high population density and small land holdings per family. Although smallholder milk production is a viable economic enterprise in Kenya it is constrained by inadequate quantity and quality of feeds, poor access to breeding, diseases, poor access to credit facilities and poor access to output markets (inadequate processing and informal milk markets) (Richards *et al.*, 2015). Therefore, in order for dairy agripreneurs to increase their productivity, they need agribusiness support services. This include artificial insemination, animal health services, access to capital which they could use to purchase improved breeds of heifers, usage of high quality forage which could improve the nutritional status of cows hence improve milk production (Wilkes *et al.,* 2018).

Blackmore *et al.* (2015), found that 86% of milk produced in Kenya was sold through the informal marketing channels while only 14% is sold to dairy processing companies through farmer organizations. This depicts the important role informal markets play in ensuring milk reaches the final consumer. Despite this acknowledgement, majority of governments in developing countries, are initiating and implementing policies that forbid the informal markets.

The Kenyan government is promoting consumption of processed milk with the aim of formalizing the dairy sector (Blackmore *et al.*, 2015). Oloo (2016), found that, due to the nature of smallholder farmers being widely scattered, this creates a dilemma for Kenya Dairy Board (KDB) to stop informal marketing of milk. The authors emphasize that governments in developing countries should develop policies that would support the informal sector through capacity building and appropriate institutional frameworks.

2.2 Agribusiness support services in Kenya dairy sector

The dairy agripreneurs in Kenya receive support services from a variety of organizations which include public, private and NGOs. According to Oloo (2016), these support services include production, cooperative, financial and business planning support services. Production support services are livestock services related to improvement of livestock productivity through genetic upgrading such as, use of improved feed and utilization of improved forages. Apart from these support services, there are services related to animal health which are divided into curative and preventive services. Curative services are related to clinical care for the animals, while preventive services include vaccination, disease control and vector control (Bardhan *et al.*, 2015).

Kimenchu *et al.* (2014) found that access to financial services is one of the constraints that smallholder dairy agripreneurs have to overcome to be able to have resilient agrienterprises. However, in the past five years' access to financial support services have dramatically increased in the dairy sector especially for smallholder agripreneurs. The development and performance of rural agrienterprises requires utilization of financial services that can support investment in modern agricultural technologies such as artificial insemination (AI) services, milking machines and adoption of information communication and technology (ICTs) (Bardhan *et al.*, 2015). Agribusiness financial support services are strategically important for increasing resilience of dairy agripreneurs from uncertain shocks and changes in the agribusiness environment (Wongtschowski *et al.*, 2013). However, there is limited empirical literature on how utilization of financial support services influences agripreneurial resilience in developing countries such as Kenya. This study sought to fill this knowledge gap.

A study conducted by Chagwiza *et al.* (2016), found cooperatives are among the innovative institutional arrangements that could help agripreneurs to overcome some challenges they face

in managing their agrienterprises. Some of agribusiness support services offered by cooperatives include purchase and marketing of milk, logistic services such as transportation of milk to processors, training and business development services, provision of inputs such as animal feeds, animal health services, artificial insemination, input credit and linkages to strategic partners such financial institutions and Kenya Dairy Board for issues of certifications and standards (Abebaw & Haile, 2013). Therefore, through cooperative business model dairy agripreneurs are able to reduce price risks hence could enhance their agripreneurial resilience which this study sought to determine.

Wongtschowski *et al*. (2013), found that sustainable agribusiness production, processing and marketing can only be achieved through empowerment of smallholder farmers to be commercial oriented. This process requires knowledge of business planning and financial management. Business plan services include support in farm planning, record keeping, search for market information and financial management which incorporates analysis of costs and benefits. Successful agripreneurs needs skills in business planning which will serve as a yardstick in managing the agrienterprises. Moreover, as agripreneurs have been encouraged to become more market oriented and to seek out new opportunities, there need to focus on the adequacy of their general business and entrepreneurial skills (Duft, 2010).

2.3 Concept of agripreneurial resilience

Korber and McNaughton (2017), defined resilience as individuals' ability to adapt to, and recover from disturbing events. Agripreneurs are faced with so many obstacles and uncertain outcomes which they need to overcome in order to have a profitable venture. Hence resiliency is an important attribute for entrepreneurs. Resiliency could assist entrepreneurs to explore and exploit opportunities, when an unexpected event occurs (Loh & Dahesihsari, 2013). In addition, it could help them to drop a venture or modify it to take advantage of the new situation (Salisu *et al.,* 2019; Yang & Danes, 2015). Dairy agripreneurs operate in a highly risky and uncertain business environment. They need to build a resilient farming system (Evans & Wall, 2019). Utilization of agribusiness support services could facilitate their resilience in the face of adversity (Shadbolt *et al.,* 2013). According to Shadbolt and Olubode Awosola (2013), entrepreneurs are currently operating in interconnected universe environmentally, technologically and socially and no entrepreneur is self-sustainable. Hence, there is no

entrepreneur who can manage to survive disruption and retain their advantage (Hmieleski *et al.*, 2015).

2.4 Agripreneurial orientations

Dairy agripreneurs exhibit different agripreneurial orientations. Some of these orientations include social capital, risk taking, market orientation and future orientations (Shadbolt *et al.*, 2013). According to Salisu *et al*. (2019), social capitals are those features such as trust, norms and networks (family and friends) that an agripreneur has which can serve as linkages to access resources especially at tough economic times. Aldrich and Meyer (2015), argue that social capital aid in accessing information, finance as well as provides emotional and psychological encouragements in critical times such as loss of properties, loss of lives and insecurities in an individual's life. The more an entrepreneur possesses social capital the greater the chance of business success (Tregear & Cooper, 2016).

Market orientation refers to the degree to which an agripreneur applies marketing concept in their strategic and marketing decisions (Didonet *et al.,* 2016). Frösén *et al. (*2016), emphasize the behavioral aspects of market oriented agripreneurs, should be organized in a manner that they focus on the current and future customer needs in order to benefit from their agribusiness. According to Shadbolt *et al*. (2013), market-oriented behaviors include three elements: customer orientation, competitor orientation, and inter-functional coordination of activities. Market-oriented agripreneur focus should ultimately be to satisfy the needs of the customers and strategically coordinate with all actors in the value chain (Ho *et al.*, 2017).

According to Sulphey (2020), future orientation is the extent to which a person thinks about the future, anticipates future consequences, and plans ahead before acting. This competence not only motivates future oriented behaviour of individuals but also influence the decision making process related to the present and future (Didonet *et al.*, 2019). Dairy agripreneurs operate in a very dynamic business environment with many risk factors which compel them to be futuristic agripreneurs (Shadbolt *et al.*, 2013). Thus, future outlook entails an agripreneur developing a strategic foresight ability which could enable him to explore all the future challenges and opportunities presented in the business (Miska *et al.,* 2018).

Previous studies done on resilience (Carmeli *et al.,* 2013; Darnhofer, 2014; Shadbolt *et al.*, 2013; Sulphey, 2020) suggest that, in order for individuals to adapt to turbulent situations, they

need to be future oriented which could enable them achieve their goals and objectives. The link between future outlook and resilience was proposed by Sloan (2013), who associated futuristic thinking with the adaptive capacity of people. Therefore, for an entrepreneur to invest their resources to a project, they ought to have the capability to appraise the future opportunities with certainty. Hence, the amount of investment entrepreneurs put in a project is directly related to their goals and preferences regarding the time distribution of cash flows (Darnhofer, 2014).

According to Kulkarni and Jahagirdar (2015), agripreneurial risk taking orientation is the ability to engage in behaviour with the probability of undesirable results. They further argue that risk bearing capacity of individuals depend upon personal, psychological, socio-economic characteristics such as age, land holding, and scientific orientation. The reason why majority of agripreneurs have medium risk orientation could be attributed that their low scientific orientation and inadequate access to resources that hinder them to take up the activities, which involve high risk (Pervez *et al.,* 2016). From the empirical review, evidence have been provided to show the importance of agripreneurial orientation on performance of agrienterprises (Carmeli *et al.,* 2013; Darnhofer, 2014; Shadbolt *et al.*, 2013). However, majority of the studies have been conducted in developed countries with paucity of information in relation to developing countries. This study sought to fill this knowledge gap by determining the influence of agripreneurial orientation on resilience and performance of dairy agripreneurs in Murang'a County, Kenya.

2.5 Factors that influence dairy agripreneurs preference for dairy support services

Oloo and Ilatsia (2015), carried out a study to analyze the factors influencing choice of dairy support service providers, using multinomial logit econometric model. They found that distance to service provider had a negative influence on the choice of the government service provider (-0.1829), tropical livestock unit had a positive effect on government service provider (0.4387), education level of the household head had a positive effect on government service provider (2.2262) while treatment cost had a positive effect on both the government (0.0099) and private veterinary service providers (0.0046). Bardhan *et al.* (2015), also used multinomial logit model to determine factors influencing choice of animal health service providers in India. They found that membership of a group and crossbred cattle holding had a negative effect on choice of para-veterinarian with coefficients of -0.712 and -0.658, respectively. Market

distance had a negative effect (-0.134) on the choice of government service providers and positive effect (0.091) on the private practitioners.

Onono *et al*. (2013), analyzed determinants of choice for veterinary service providers in Kenya using a data set of 350 randomly selected farmers in Narok County. The findings showed that transport cost and time spent seeking animal health services positively influenced the probability of choice for service providers with risk ratios of 1.53 and 19.73, respectively while distance covered to preferred service provider was negatively significant (0.04). This result indicates that farmers' preference for agribusiness support services are also influenced by the agribusiness service providers which is an important attribute in the integrated agribusiness support service model. Omondi *et al.* (2016), used choice experiment to determine farmers' preferences for agribusiness support services with special focus on artificial insemination services. They considered several attributes such as mode of payment, price of service, place of delivery, person offering the service and semen types. They found that dairy farmers prefer AI services to be offered by dairy hubs rather than private providers.

The review presented has shown that several factors influence farmers' preference for agribusiness support services. In addition, previous studies have focused on individual support services. Therefore, this study sought to fill this knowledge gap by using choice experiment to determine farmers' preference for integrated dairy support services and multivariate probit to determine factors influencing usage of agribusiness support services in Murang'a County.

2.6 Theoretical framework

There are several theories that could be used to explain the relationship between agripreneurial orientation, resilience, performance and role of agribusiness support services. Some these theories include attribution theory, utility maximization theory and successful start-up business model. However, utility and attribution theory do not put all the factors that influence resilience and performance under one framework. Therefore, this study was based on successful start-up business model which was proposed by Baum *et al.* (2007). This theory combines entrepreneurial factors such as personality, psychological capital and human capital needed to start business under one framework. These factors then contribute to four elements of business perfomance which are state of psychology, cognition, action and social capital. These elements are the ingredients for resiliency and business performance. Therefore, the agribusiness support

services and agripreneurial behavioural attributes are linked to this model and business performance. For example, human capital is related to production and business planning, financial capital which is linked to finance support services and social capital is linked to co-operative support services. Therefore, this model provided a basis to understanding agripreneurial behaviour especially how agripreneurs perceive and cope with difficulties and performace of their agrienterprise. This provided more contextual and process-oriented research such as relating access to agribusiness support services and agripreneurial resilience and perfomance.

2.7 Conceptual framework

Overall from the literature, agrientrepreneurs are operating in an environment that has several factors. In relation to this study, to determine the effect of agripreneurial orientation moderated by agribusiness support services on resilience and performance of dairy different variables were interacted in the proposed model. The independent variables included: agripreneurial orientation, socio-economic factors and institutional factors, while, agribusiness support services played a moderating role on resilience and income of dairy agripreneurs. The study assumed that dairy agripreneurs in Murang'a County exhibited the following orientations; social orientation, market orientation, future orientation and risk-taking orientation. These orientations were also assumed as status quo, whereby interaction with agribusiness support services may have a positive or negative effect which could influence their resilience and income. The agribusiness support services that were considered include; production, financial, cooperative and business planning services. This was based on the various interventions that have been made by the Murang'a County government and other stakeholders to promote this service to dairy agripreneurs (Muranga CIDP, 2018). The interaction of dairy agripreneurs with agribusiness support services was assumed to have a direct or indirect effect on the agripreneurial resilience. The resilience of dairy agripreneurs followed a pathway, whereby it could influence the milk productivity and thereby the income of dairy agripreneurs.

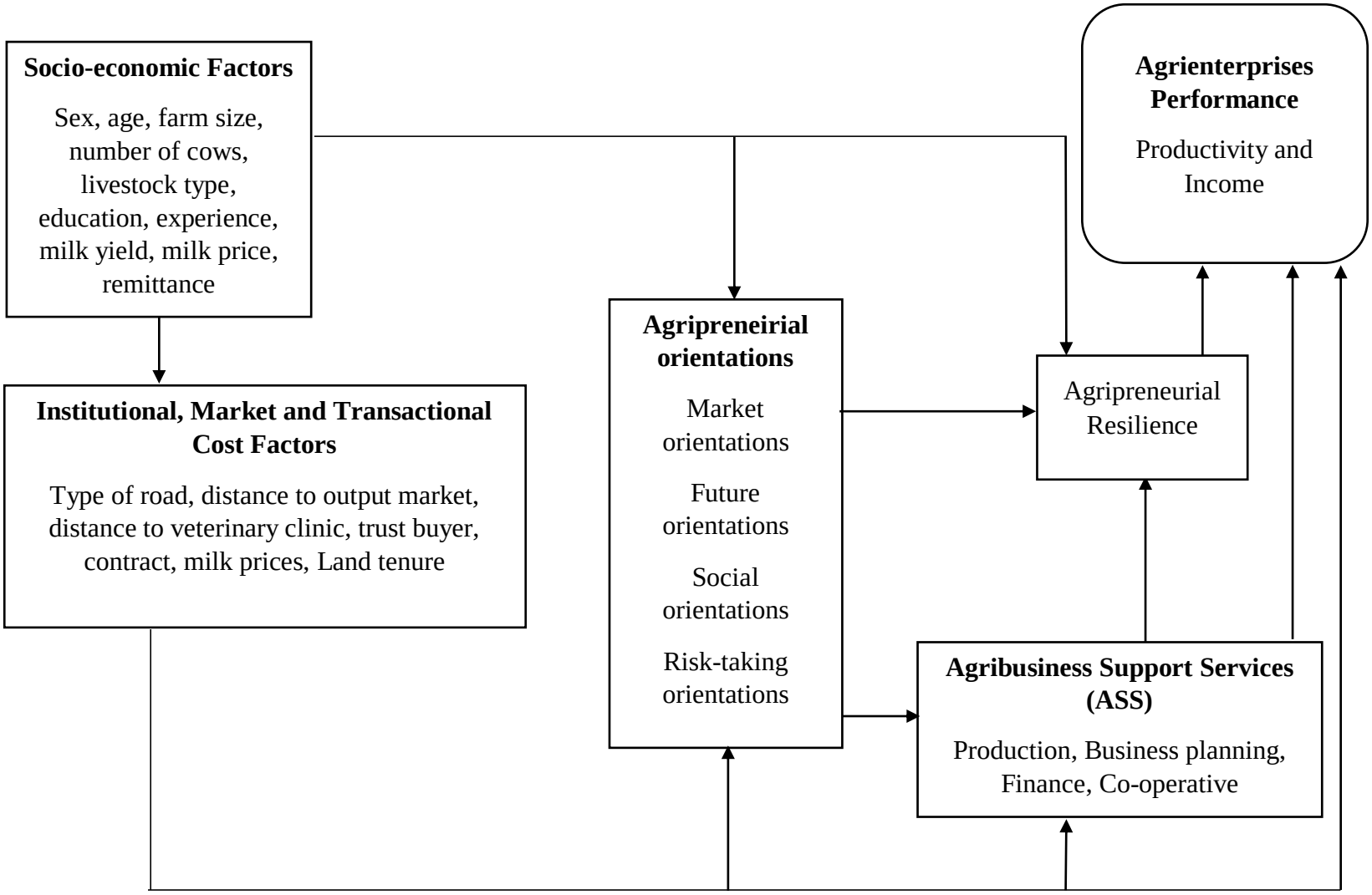

Figure 2.1 Conceptual framework

CHAPTER THREE
METHODOLOGY

3.1 Study area

The study was undertaken in Murang'a County. This county lies between longitudes 36^{o} East and 37^{o}27' East and latitudes of 0^{o} 34' South and 1^{o} 7' South of the equator. The county lies between 914m above sea level (ASL) in the East and 3,353m above sea level (ASL) along the slopes of the Aberdare ranges in the West. The county is divided into eight Sub-Counties; Kiharu, Kahuro, Kangema, Mathioya, Gatanga, Kigumo, Kandara and Maragwa. The county has a total area of 2,558.9Km^2, of which 11.2Km^2 is water mass. The arable land is, 2,135 Km^2 while non-arable land is 163.3 Km^2. The County has a good climatic condition whereby majority of the population is involved in agriculture with an average household farm size of 1.4 acres. The major cash crops grown by the smallholder farmers include tea, coffee, avocado, mangoes and macadamia. The horticultural crops include tomatoes, cabbages, kales, spinach and French beans while food crops include maize, beans, bananas, sweet potatoes and cassava. While the main livestock species in the county are cattle, pigs, goat, sheep, rabbits and chicken. Exotic cattle breeds are found in the upper parts of the county while indigenous cattle breeds are found in the lower parts of the county.

The county was purposively chosen because of the vibrant dairy sector with the county government initiating several interventions in relation to agribusiness support services. Some of the developmental needs that the county is engaged in include; increasing market access through dairy producer cooperatives, contract farming, business planning and upgrading markets and market infrastructures. The county is also involved in subsidized input provision programmes, bulk input purchases through producer and marketing cooperatives and link farmers to credit providers (Murang'a CIDP, 2018). The main aim of these initiatives is to empower the smallholder farmers for improved performance of their agrienterprises. This called for impact assessment on the role of agribusiness support services on agripreneurial resilience and performance of dairy agripreneurs in Murang'a county. The map of the study area is presented in Figure 3.1.

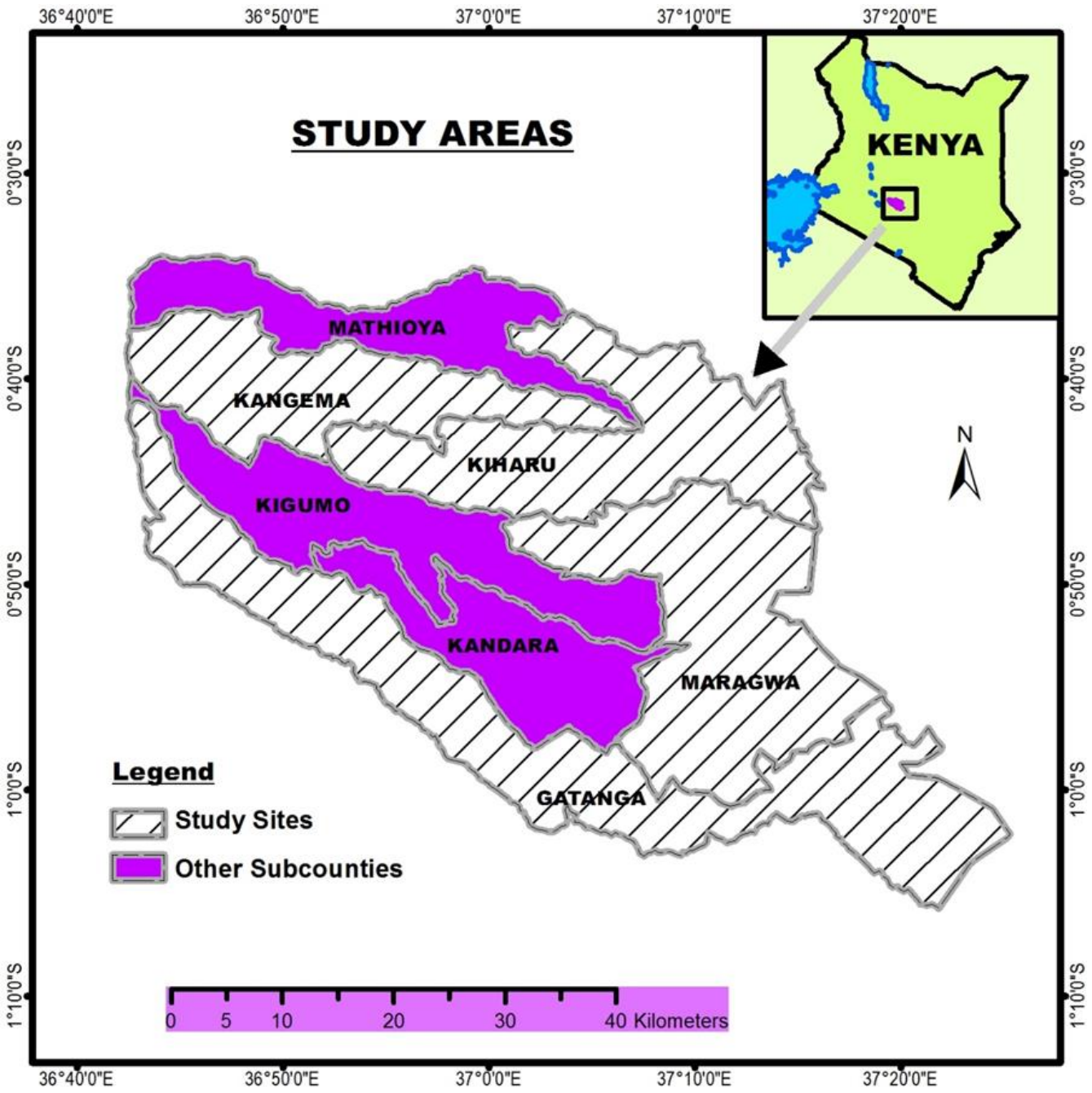

Figure 3.1. Map of Murang'a County

Source: Muranga CIDP (2018)

3.2 Research design

This study used quantitative research design through a cross-sectional survey while the attributes of agribusiness support experiment for the choice experiment were validated through focus group discussion then used to generate choice cards.

3.3 Data and sampling approach

3.3.1 Population of the study

The population of the study was all the smallholder dairy agripreneurs in Murang'a County who are engaged in production and marketing of milk and its products.

3.3.2 Sampling unit

The sampling unit for this study was the smallholder dairy agripreneurs specifically the owners of the agrienterprises in Murang'a County with focus in the following Sub-Counties Gatanga, Kiharu, Maragwa and Kangema Sub-County.

3.3.3 Sample size

The determination of the sample size followed proportionate to size sampling methodology as specified by (Cochran, 1963) as follows:

$$n = \frac{z^2 pq}{e^2} \quad \text{.....(1)}$$

Where:

n = sample size,

p= implies maximum possible variance

q = 1-p,

z = the standard value at a given confidence level (α = 0.04),

e = the acceptable error (precision).

The study desired a 96 percent confidence level and 4 percent precision level with a z score of 2.05. In addition, the study assumed that p=0.5, which was about 50 percent of smallholder dairy agripreneurs. This is because the variation of the dairy farmers targeted was not known before the survey took place. Therefore, a conservative variance of 0.5 was adopted. The sample was determined as:

$$n = \frac{\left(2.05^2\right)(0.5)(0.5)}{\left(0.04^2\right)} = 656.6 \quad \text{.....(2)}$$

The derived sample size for the study was 657 respondents. However, during the survey, the actual sample that was collected and used for analysis was 682 respondents.

3.4 Sampling method

Multistage sampling technique was employed in the study. According to Lavrakas (2008), multistage sampling is widely used for several reasons including; where a sampling frame is non-existent and where construction of one maybe too costly to construct. Smallholder dairy farmers are widely spread and there is no sampling frame for dairy agripreneurs. Another reason is that the research is constrained with time. Therefore, multistage sampling technique was justifiable. Since it enabled the researcher to take advantage of the hierarchical structure of the target population and design.

In the first stage, four Sub-Counties, of Gatanga, Maragwa, Kiharu and Kangema were purposively selected because they were the highest milk producing Sub-Counties in Murang'a (Muranga CIDP, 2018). In addition, milk coolers are found in milk collection centers in these sub-counties. Hence, there was a possibility of many agribusiness support services compared to the other four Sub-Counties. In the second stage, within the four Sub-Counties, three wards were selected randomly to give a total of 12 wards. Lastly, proportional to size random sampling was applied to select the respondents from the 12 wards since they were not equal in size. This was aided by a list from Sub-County Agricultural Officers, which was used to generate random numbers using Microsoft Excel. From the generated random numbers, systematic random sampling was used to get respondents from the different villages in the 12 wards.

Table 3.1. Distribution of the sample proportion to size of the sub-counties population

Sub-County	Population	Proportion to size	Sample
Kiharu	216,713	0.32	210
Maragwa	182,282	0.27	177
Kangema	92,129	0.12	79
Gatanga	195,865	0.29	191
Total	686,989	1	657

3.5 Tools for data collection

A semi structured questionnaire and choice cards were administered to the smallholder agripreneurs by trained enumerators. Key informant interviews was also conducted on the

input providers, financial service provider, dairy consultants, managers of farmer cooperatives and government extension agents on the possible delivery models of agribusiness support services. Input suppliers included veterinarian officers and managers of agribusiness firms such as agrovets. This was done prior to the survey in order to improve on the cards that were used in the choice experiment. Structured questionnaire was used to administer interview through the aid of trained enumerators.

3.6 Pilot study

A pilot study was conducted to test the validity and reliability of the data collection instruments. Reliability is the degree to which a research instrument would yield the same results or data after repeated trials while validity is the degree to which an instrument measures that which it purports to measure (Mugenda & Mugenda, 2013). A pretest was carried out in Kandara Sub-County since it has similar attributes to Gatanga, Maragwa, Kiharu and Kangema. The researcher administered 60 questionnaires which was approximately 10% of the required sample size for the study. The results of the pilot study were used in correcting and adjusting the final questionnaires that was administered for the study.

3.7 Data types and sources

This study utilized both primary and secondary data sources. Primary data was collected from household survey and key informants interview. Secondary sources were from publications, journals, relevant websites and books which were used in literature review. The data that was collected using standardized questionnaire included household characteristics, livestock husbandry, delivery and access of agribusiness support services, resilience and agripreneurial orientation attributes.

3.8 Data analysis

Data for the study was analyzed using the Statistical Package for Social Sciences (SPSS), STATA and Smart PLS version 3.

3.9 Analytical framework

Objective one: To determine dairy agripreneurs' preferences for production, animal health and marketing support services in Murang'a County.

This objective was achieved through a choice experiment among dairy farmers. The experiment was utilized to draw out agripreneurs' preferences and willingness to pay (WTP) for the various attributes of agribusiness support services. The attributes that were considered were; group marketing, animal health, business plan training, production support and monthly fee (KES). These attributes were selected based on previous studies (Bardhan *et al.*, 2015; Oloo & Ilatsia, 2015; Omondi *et al.*, 2016; Wongtschowski *et al*., 2013). In addition, focus groups discussions and key informants interview were conducted in order to validate the constructs and attributes that were used in choice score card. The focus group participants ranged from dairy farmers, intermediaries and dairy service providers.

The choice experiment involved presenting the hypothetical choice cards to dairy agripreneurs. Each scenario described attributes of production, animal health and marketing support services for dairy agripreneurs. The dairy agripreneurs were required to think about each scenario as if they were making a decision between them in the real world. Then, they were told to choose among the three options 1, 2 or 3 that they most prefer. If dairy agripreneur stated that he/she did not prefer either option by choosing 'None' (I would not purchase any of these plans). The respondents were asked to make a forced choice between two alternative production and animal health support services; an opt-out alternative of 'no utilization of ASS' in dairy farming lacked realism.

In order to estimate dairy agripreneurs' general preferences for production, animal health and marketing support services, the study used Random Parameter Logit (RPL)/Mixed Logit model. This model has several merits which make its suitable for this study. First, compared to multinomial or conditional logit models, mixed logit is very flexible and it relax the restrictive independence of irrelevant alternatives assumption (IIA). Hence, the unobserved variables were allowed to correlate over choice options. Moreover, RPL accounted for unobserved preferences heterogeneity across the dairy agripreneurs so that it was possible to get multiple choice sets from the same respondents with unrestricted substitution patterns. Mixed Logit Model is usually expressed as:

$$P_{ni} = \int L_{ni}(\beta)\ f(\beta)\ d\beta \quad \text{.....(3)}$$

where $L_{ni}(\beta)$ is the logit probability evaluated at parameters β:

$$L_{ni}\ (\beta) = \frac{e^{V_{ni}(\beta)}}{\sum_{j=1}^{J} e^{V_{nj}(\beta)}} \quad \text{.....(4)}$$

and $f(\beta)$ is a density function, $V_{ni}(\beta)$ is the observed portion of the utility, which depends on the parameters β. If utility is linear in β, then

$$V_{ni}(\beta) = \beta^{'} x_{ni} \quad \text{.....(5)}$$

In this case, the mixed logit probability takes its usual form:

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_{j} e^{\beta' x_{nj}}} \right) f(\beta)\ d\beta \quad \text{.....(6)}$$

The mixed logit probability is a weighted average of the logit formula evaluated at different values of β, with the weights given by the density $f(\beta)$. The weighted average of several functions is called a mixed function, and the density that provides the weights is called the mixing distribution. Mixed logit is a mixture of the logit function evaluated at different β's with $f(\beta)$ as the mixing distribution. Standard logit is a special case where the mixing distribution $f(\beta)$ is degenerate at fixed parameters b: $f(\beta) = 1$ for $\beta = b$ and 0 for $\beta\ K\ b$. The choice probability then becomes the simple logit formula;

$$P_{ni} = \frac{e^{b' x_{ni}}}{\sum_{j} e^{b' x_{ni}}} \quad \text{.....(7)}$$

The mixing distribution $f(\beta)$ can be discrete, with β taking a finite set of distinct values. Suppose β takes M possible values labeled $b_1, ..., b_M$, with probability S_m that $\beta = b_m$. In this case the choice probability is

$$P_{ni} = \sum_{m=1}^{M} s_m \left(\frac{e^{b_{,m} x_{ni}}}{\sum_j e^{b_m^{'} x_{nj}}} \right) \quad \text{.....(8)}$$

The above can be interpreted as there are M segments in the population, the share of the population in segment m is s_m, which the researcher can estimate within the model along with the b's for each segment. Using this model, the price coefficient was assumed fixed. This assumption helped to avoid price dispersion around zero, which implied excessive willingness to pay for ASS.

Objective two: To identify factors influencing the usage of agribusiness support services among smallholder agripreneurs in Murang'a County

The utilization of agribusiness support services (ASSs) was measured as a dummy variable. That is 1 if the dairy agripreneur utilizes ASSs in production, 0 otherwise. To model the decision to use ASS, a univariate binary model (logit or probit) could be appropriate due to the dichotomous nature of the dependent variable (Green, 2008). Since the estimation was based on four ASSs (production, cooperative, financial and business planning), selection of one or more ASSs was more likely due to variations unobserved and unmeasured characteristics of the dairy agripreneur. In addition, selection of one support service may affect the likelihood of selecting other alternatives due to competing, substitutability or complementarity relationship between some ASSs. Therefore, estimating independent binary equation for each ASS would lead to potential bias as it will not allow the correlation of error terms, leading to statistical bias and inefficiency in the estimates (Green, 2008). To account for such short-comings, selection decisions were modelled using Multivariate Probit (MVP) model. The MVP model simultaneously regresses a combination of several correlated binary equations against a single vector of explanatory variables. Empirically the model can be specified as shown in Equation 9.

$$Y_{i1} = X'_{ij1}\beta_1 + \varepsilon_{i1}$$

$$Y_{i2} = X'_{ij2}\beta_2 + \varepsilon_{i2}$$

$$Y_{i3} = X'_{ij3}\beta_3 + \varepsilon_{i3}$$

$Y_{i4} = X'_{ij4}\beta_4 + \varepsilon_{i4}$,…………………………………………………………..… (9)

Where, i = dairy farmers' identification, Y_{i1} = 1, if agripreneur utilizes production support services (0 = otherwise), Y_{i2} = 1, if agripreneur utilizes cooperative support services (0 = otherwise), Y_{i3} = 1, if agripreneur utilizes financial support services (0 = otherwise), Y_{i4} = 1, if agripreneur utilizes business planning support services (0 = otherwise), X'_i = Vector of factors affecting use of ASSs, βj = Vector of unknown parameters (j = 1, 2, 3, 4), and ε = is the error term. To identify the determinants of ASS utilization a multivariate probit model of the following form (Equation 10) was used to test the hypothesis:

$Y_{i1} = X'_{ij}\beta_j + \varepsilon_{ij}$, ……………………………………………………………(10)

Where Y_{ij} (j =1….,4) represent the four ASSs used by the i^{th} farmers (i = 1...…682), X'_{ij} is a 1 × k vector of observed variables that affect the choice decision of farmers, β_j is a k × 1 vector of unknown parameters (to be estimated), and ε_{ij} is the unobserved error term. It was assumed that the error terms (across j = 1… m alternatives) are multivariate and are normally distributed with mean vector equal to zero. Therefore, the unknown parameters in Equation (10) were estimated using simulated maximum likelihood. The explanatory variables used in this study were derived from review of past studies on usage of utilization of ASSs (Anang *et al.,* 2015; Kumar *et al.,* 2018; Machina & Lubungu, 2019; Maonga *et al.*, 2017; Ngeno, 2018, Twine *et al.,* 2018).

Table 3.2. Description of variables and expected signs that will be used in the Multivariate Probit Model

Variables	Description of variables	Hypothesized sign
Dependent		
Production support services	Dummy = 1 if HH utilizes dairy production support services, 0 otherwise	
Financial support	Dummy = 1 if HH utilizes financial support services, 0 otherwise	
Business plan training support services	Dummy = 1 if HH receives training on dairy farm business planning, 0 otherwise	
Cooperative support services	Dummy = 1 if HH utilizes cooperative support services to dairy cooperative, 0 otherwise	
Independent		
Sex	Dummy=1 if HH head male and 0 if female	+
Age	Age of HH head in years	+/-
Education level	Highest education level of household head	+/-
Household labour	Number of adult household members	+/-
Experience	Experience in dairy farming in years	+/-
Land tenure	Dummy = 1 if HH Owned land with title deed, 0 otherwise	+
Land size	Size of land under dairy farming in acres	+
Livestock type	Dummy = 1 if HH had improved/exotic, 0=otherwise)	+
Number of cows	Number of cows owned in the household	+
Milk yield	Average milk production per day in litres	+
Access to contracts (yes=1)	Dummy = 1 if HH had written contracts, 0 Otherwise	+
Milk price (KES)	Milk price per litre in KES	+
Distance veterinary clinic (Km)	Distance to a veterinary clinic in KM	+/-

Distance output market (Km)	Distance to the output market in KM	+/-
Type of road	Dummy = 1 if Tarmac, 0 otherwise	+/-
Trust buyers of milk	Dummy = 1 if HH had high trust, 0 otherwise	+/-
Remittance (yes=1)	Dummy = 1 if HH had access to remittance, 0 otherwise	+

Objective three: To determine the effect of agripreneurial orientation mediated by agribusiness support services on smallholder dairy agripreneurs resilience in Murang'a County

In this objective, there were two outcome variables, agripreneurial resilience and perceived agrienterprise performance that were considered as endogenous (dependent) variables. While agripreneurial orientation (social orientation, market orientation, future orientation and risk-taking orientation) were considered as exogenous (independent) variables. Moreover, to determine the gender differences in agripreneurial orientations, resilience and performance, the sex of the dairy agripreneur was used as a mediating variable. Considering the main features of the variables in the conceptual model in chapter 2, whereby there were multiple outcome variables both observed and unobserved, this objective was achieved using structural equation modeling (SEM) method. This model was appropriate due to its usefulness in analyzing both the measurement and structural models, while it allows the incorporation of both unobserved (construct/latent factors) and observed variables in the same model (Hair *et al.,* 2017; Statsoft, 2013). The method also handles errors of measurement within exogenous variables having multiple indicators by the usage of confirmatory factor analysis (CFA).

This model was used to analyse multiple linear regression between the independent variables, multiple path analysis, direct and indirect effect, and fitness of overall model which is not feasible in a traditional regression analysis method. SEM can also provide measures of fit to assess the entire model (Hair *et al.,* 2017). The general model is represented by the following equations consisting of measurement and structural models:

$$Y = v + \Lambda n + \varepsilon \text{ ,} \quad (11)$$

$$\eta = \alpha + B\eta + \xi \quad (12)$$

where Y is the vector of *p* observed variables in a considered study (p >1), ν the p × 1 vector of observed variable mean intercepts, Λ is the $p \times q$ matrix of factor loadings, η is the of q x 1 latent factors assumed in it ($q > 0$), ε the vector of *p* pertinent residuals (error terms), α is the $q \times 1$ vector of latent variable intercepts, B is a q x q matrix of latent regression coefficients and ξ is the $q \times 1$ vector of corresponding latent disturbance terms.

Based on the general equation (11) and (12), the following structural equation model for the four factors namely social orientation (ξ_3), market orientation(ξ_4), future orientation (ξ_5) and risk-taking orientation (ξ_6) with manifest endogenous variables agripreneurial resilience (Y_1) and agrienterprise performance (Y_2) will be given in the following structural equation models:

$$Y_1 = \alpha_1 + \beta_{11}\xi_1 + \beta_{12}\xi_2 + \beta_{13}\xi_3 + \beta_{14}\xi_4 + \xi_1 \quad \text{..... (13)}$$

$$Y_2 = \alpha_2 + \beta_{21}\xi_1 + \beta_{22}\xi_2 + \beta_{23}\xi_3 + \beta_{24}\xi_4 + \xi_2 \quad \text{..... (14)}$$

The general matrix expression is given in the following equation:

$$Y_1 = \alpha_1 + \Gamma_1\xi_1 + \xi_1 \quad \text{..... (15)}$$

$$Y_2 = \alpha_2 + \Gamma_2\xi_2 + \xi_2 \quad \text{..... (16)}$$

where

$$\Gamma_1 = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}), \Gamma_2 = (\beta_{21}, \beta_{22}, \beta_{23}, \beta_{24}), \ \xi_1 = (\xi_1, \xi_2, \xi_3, \xi_4)$$
$$and \ \xi_2 = (\xi_1^*, \xi_2^*, \xi_3^*, \xi_4^*)$$

In the above equations (15) and (16), Y_1 and Y_2 are the two manifest endogenous variables, α_1 and α_2 are the latent intercepts, Γ_1 and Γ_2 are the coefficient vectors for the linear effects of n latent predictors, ξ_1 and ξ_2 are the latent factors and finally ξ_1 and ξ_2 are the latent disturbance. The above model in equations (15) and (16), were constructed in SmartPLS version 3 and it finalized the significant factors.

To test for mediation effect of agribusiness support services on smallholder dairy agripreneurs resilience, the product of coefficients approach was used to test for mediation effects, as fronted by Fairchild and MacKinnon (2009). The equations that was used to analyze the products of coefficients are as specified in equation 17 and 18:

$$Y = \beta_0 + C^I X + bM + \varepsilon_i \quad \text{.....(17)}$$

$$EC = \beta_0 + aX + \varepsilon_i \quad \text{.....(18)}$$

Fairchild and MacKinnon (2009) indicate that the above equations are then used to test for mediation effects by application of the product of coefficients strategy as depicted in the formula equation 19.

$$S\hat{a}\hat{b} = \sqrt{S^2_{\hat{a}}\hat{b}^2 + S^2_{\hat{b}}\hat{a}^2} \quad \text{.....(19)}$$

where $S^2_{\hat{a}}$ is the variance of $\hat{a}^2$ coefficient, and $S^2_{\hat{b}}$ is the variance of the $\hat{b}$ coefficient.

Therefore, in order to illustrate the agripreneurial resiliency in terms of the four independent variables (IV) of social orientation, market orientation, future orientation and risk-taking orientation, while considering the mediation effect (ME) of agribusiness support services on this relationship, regression analysis was used as presented in equation 20.

$$AR = \begin{pmatrix} \beta_0 + \beta_1 SO + \beta_2 MO + \beta_3 FO + \beta_4 RO + \beta_5 ASS \times SC + \beta_6 ASS \times MO + \\ \beta_6 ASS \times FO + \beta_6 ASS \times RO \end{pmatrix} + \varepsilon \quad \text{.....(20)}$$

where: AR = Agripreneurial Resilience; β0 = constant which is the value of Y when X is zero; βi = correlation coefficient, Pearson's correlation; SO=Social Orientation, MO=Market Orientation, FO=Future Orientation, RO=Risk-taking Orientation, ASS=Agribusiness Support Services; ASS × SC = mediation effect by social capital orientation and agribusiness support services on AR; ASS × MO = mediation effect by market orientation and agribusiness support services on AR; ASS × FO = mediation effect by future orientation and agribusiness support services on AR. ASS × RO = mediation effect by risk- and agribusiness support services on AR. E = error term indicating proportion of EAPA that was not explained by constructs SO, MO,FO,RO, ASS × SO, ASS × MO, ASS × FO and ASS × RO. To determine gender effect of entrepreneurial orientation on resilience and performance of dairy agripreneurs PLS-Multi-group analysis was conducted.

Objective four: To determine impact of agribusiness support services on performance of smallholder dairy agripreneurs in Murang'a County.

The response variables for utilization of dairy support services by smallholder dairy agripreneurs was collected as dummy variables (1 if dairy agripreneur was using ASS, 0, otherwise). In addition, smallholder dairy agripreneurs were using different combinations of ASS, whereby some were using one, two, three or four ASS in their agrienterprises. Dairy agripreneurs' decision to use or not to use an ASS is determined by both observable and non-observable factors. A methodological challenge that may occur in this estimation is sample selection problem, since smallholder dairy agripreneurs may self-select themselves into utilization of ASS or have innate characteristics that correlate with productivity and income. To control for the possible bias resulting from non-observable characteristics, the study used multinomial endogenous switching regression model (MESRM). This model corrects for both observable and non-observable biases that may result from non-random assignment of dairy agripreneurs into utilization of ASS, hence providing unbiased estimates of the impact of ASS on productivity and income. Productivity was measured as milk yield per litre divided by number of milking cows per year. While income was measured as gross income from milk sales per year (total litres sold multiplied by milk price minus variable costs).

The MESRM estimated the average treatment effect of utilizing ASS on the outcome variables (productivity and income). Thus, the model was used to compare the expected returns from users and non-users of agribusiness support services. It was assumed that dairy agripreneurs aim to maximize their net productivity and income, π_h, by comparing expected returns from provided by, g, alternative agribusiness support services. The prerequisite for a dairy agripreneur, h, to select an agribusiness support service, g, over other alternative support services is that $\pi_{hg} >= \pi_{hk} k \neq g$. The expected net outcome, π_{hg}^{*}, derived from the support service, g, by a dairy agripreneur is a latent variable which is determined by observed features (X_h) and unobservable factors ($\in_{hg}$).

$$\pi_{hg}^{*} = X_h \beta_g + \in_{hg}, \quad (21)$$

where X_h is a vector of observed exogenous variables. Let H be an index representing the agripreneur's choice of an agribusiness support service, such that:

$$H=\begin{cases}1\ if\ \pi_{h1}^{*}\rangle \max\left(\pi_{hk}^{*}\right) or\ \eta_{h1}\langle 0 \\ \qquad\qquad k\neq g \\ \ldots \qquad\qquad for\ all\ k\neq g, \\ g\ if\ \pi_{hg}^{*}\rangle \max\left(\pi_{hk}^{*}\right) or\ \eta_{hg}\langle 0 \\ \qquad\qquad k\neq g\end{cases} \quad (22)$$

Where $\pi_{h1}^{*}=\max_{k\neq}\left(\pi_{hk}^{*}-\pi_{hg}^{*}\right)\langle 0$ implies that the h_{th} dairy agripreneur will select an agribusiness support service g to capitalize on the expected positive outcome if an agribusiness support service g provides a greater expected positive outcome than other support services $k\neq g$, that is, if $\eta_{hg}=\max_{k\neq g}\left(\pi_{hg}-\pi_{hk}\right)\rangle 0$ (Bourguignon *et al.*, 2007). Assuming that, $\in$ are independently and identically Gumbel distributed, the probability that an agripreneur, h, with characteristics X_h will choose an agribusiness support service g can be specified by use of a multinomial logit model according to McFadden, (1973):

$$P_{hg}=\Pr\left(\eta_{hg}\langle 0|X_h\right)=\frac{\exp\left(X_h\beta_g\right)}{\sum_{k=1}^{g}\exp\left(X_h\beta_k\right)}, \quad (23)$$

To estimate the latent variable parameters, a maximum likelihood function was used. The link between the outcome variables (productivity and income) and a set of exogenous variables J were estimated for the selected agribusiness support service in the next step of the model. Two categories were formed where the first base category was smallholder dairy agripreneurs who "did not use any support service" represented as $g=0$ and the other base category was in line with using at least one package of ASS by the dairy agripreneurs represented as $g=1,2,3,4....n=9$. Hence the likely outcome equation for both categories was given as;

$$\begin{cases}Category\,1: Q_{h1}=J_h\alpha_1+\mu_{h1}\ if\ H=1 \\ Category\,G: Q_{hg}=J_h\alpha_g+\mu_{hg}\ if\ H=G\end{cases}, \quad (24)$$

where $Q_{hg}'s$ are outcome variables of the h_{th} agripreneur in category G and the error terms $u'S$ are spread with $E\left(u_{hg}|X,Z\right)=\sigma_g^2=0$ and $\text{var}\left(u_{hg}|X,Z\right)=\sigma_g^2$, Q_{hg} is the observed variable if the agribusiness support service g is used by an agripreneur, which occurs when $\pi_{hg}\rangle \max_{k\neq g}\left(\pi_{hk}\right)$

The multinomial endogenous switching model further assumes linearity assumption as shown in Equation 25:

$$E = \left(U_{hg} \middle| \in_{h1} \ldots \in_{hg}\right) = \sigma_g \sum_{k \neq g}^{g} rg\left(\in_{hk} - E\left(\in_{hk}\right)\right), \quad (25)$$

with $\sum g_k = 1 r_g 0$ meaning that the correlations between $u's\ and \in's$ sum to zero. Hence, following this assumption in equation 24 and 25 can be summarized as:

$$\begin{cases} Category\,1: Q_{h1} = J_h \alpha_1 + \sigma_h \lambda_1 + \omega_{h1} \ if\ H = 1 \\ Category\,2: Q_{hg} = J_h \alpha_g + \sigma_h \lambda_g + \omega_{hg} \ if\ H = G' \end{cases} \quad (26)$$

Where $\omega's$ are error terms with zero expected values, α_g is the covariance between $u's\ and \in's$ and λ_g is the Inverse Mills Ratio (IMR) which was computed from the probabilities in equation 26 as:

$$\lambda_g = \sum_{k \neq g}^{g} \rho_g \left[\frac{\hat{P}_{hk}\ In\left(\hat{P}_{hk}\right)}{1 - \hat{P}_{hk}} + In\left(\hat{P}_{hg}\right) \right], \quad (27)$$

with *p* representing correlation coefficients of the $u's\ and \in's$. In the selection setting, there are $G-1$ choice outcomes, with one representing an agribusiness support service. Heteroskedasticity was further accounted for using the standard errors arising from the λ_g regressor.

The average treatment effects of the treated (ATT) was computed whereby the expected outcomes of different packages of ASS were compared. To estimate the effect of using ASS, counterfactual effect which is the outcome that dairy agripreneur could have achieved if they used a different support service from the one they had used was estimated. According to Di Falco and Veronesi (2013), the ATT in the actual and counterfactual scenarios was computed as follows;

For actual users witnessed in the sample, the outcome estimation model is given as:

$$\begin{cases} E\left(Q_{h2} \middle| H = 2\right) = J_h \alpha_2 + \sigma_2 \lambda_2, & (28a) \\ E\left(Q_{hg} \middle| H = 2\right) = J_h \alpha_g + \sigma_g \lambda_g, & (28b) \end{cases}$$

$$\begin{cases} E\left(Q_{h1} \middle| H = 1\right) = J_h \alpha_1 + \sigma_1 \lambda_1, & (29a) \\ E\left(Q_{h3} \middle| H = 3\right) = J_h \alpha_3 + \sigma_3 \lambda_3, & (29b) \end{cases}$$

If users of a given agribusiness support service had not chosen that package of agribusiness support service, counterfactual is modeled as:

$$\begin{cases} E(Q_{h1}|H=2) = J_h\alpha_1 + \sigma_1\lambda_2, \ldots\ldots(30a) \\ E(Q_{h3}|H=G) = J_h\alpha_1 + \sigma_1\lambda_G, \ldots\ldots(30b) \end{cases}$$

$$\begin{cases} E(Q_{h2}|H=1) = J_2\alpha_2 + \sigma_2\lambda_1, \ldots\ldots(31a) \\ E(Q_{hg}|H=3) = J_2\alpha_3 + \sigma_3\lambda_3, \ldots\ldots(31b) \end{cases}$$

The above estimated values are useful in the derivation of unbiased estimates of the average treatment effects on treated (ATT) and untreated (ATU). ATT is the difference between equation 28a and 30a or equation 28b and 30b is given as:

$$ATT = E[Q_{h2}|H=2] - E(Q_{h1}|H=2) = J_h(\alpha_2 - \alpha_1) + \lambda_h(\alpha_2 - \alpha_1), \ldots\ldots(32)$$

The expected change in the mean outcome for a dairy agripreneur who uses h support service is equal to the returns of a dairy farmer who does not use any support service is given by $J_h(\alpha_2 - \alpha_1) + \lambda_h(\alpha_2 - \alpha_1)$, λ_h is the choice term capturing all potential effects of the differences in unobserved variables.

On the other hand, ATU is given as the difference between Equation 29a and 31a or Equation 29b and 31b:

$$ATU = E[Q_{h1}|H=1] - E(Q_{h2}|H=1) = J_h(\alpha_2 - \alpha_2) + \lambda_2(\alpha_2 - \alpha_2), \ldots\ldots(33)$$

Table 3.3. Description of variables and expected signs that will be used in the Multinomial Endogenous Switching Regression model

Variables	Description of variables	Hypothesized sign
Dependent variables		
Milk productivity	Milk yield per litre divided by number of milking cows per year	
Milk income	Gross income from milk	
Treatment variables		
Production support services	Dummy = 1 if HH utilizes dairy production support services, 0 otherwise	
Financial support	Dummy = 1 if HH utilizes financial support services, 0 otherwise	
Business plan training support services	Dummy = 1 if HH receives training on dairy farm business planning, 0 otherwise	

Cooperative support services	Dummy = 1 if HH utilizes cooperative support services to dairy cooperative, 0 otherwise	
Independent variables		
Sex	Dummy=1 if HH head male and 0 if female	+
Age	Age of HH head in years	+/-
Education level	Highest education level of household head	+/-
Household labour	Number of adult household members	+/-
Experience	Experience in dairy farming in years	+/-
Land tenure	Dummy = 1 if HH Owned land with title deed, 0 otherwise	+
Land size	Size of land under dairy farming in acres	+
Livestock type	Dummy = 1 if HH had improved/exotic, 0=otherwise)	+
Number of cows	Number of cows owned in the household	+
Milk yield	Average milk production per day in litres	+
Access to contracts (yes=1)	Dummy = 1 if HH had written contracts, 0 Otherwise	+
Milk price (KES)	Milk price per litre in KES	+
Distance veterinary clinic (Km)	Distance to a veterinary clinic in KM	+/-
Distance output market (Km)	Distance to the output market in KM	+/-
Type of road	Dummy = 1 if Tarmac, 0 otherwise	+/-
Trust buyers of milk	Dummy = 1 if HH had high trust, 0 otherwise	+/-
Remittance (yes=1)	Dummy = 1 if HH had access to remittance, 0 otherwise	+

3.10 Diagnostic Tests

The Psychometric indicators for agripreneurial orientation and Connor-Davidson Resilience Scale (CD-RISC) were subjected to diagnostic tests to test their validity. The standardized root mean square residual (SRMR) was used to assess the model fit. In addition, validity tests

(convergent and discriminant) were conducted on the constructs. Convergent validity was measured using Cronbach's alpha (CA), rho_A, Composite Reliability (CR) and Average Variance Extracted (AVE) while discriminant validity was assessed using Cross Loadings Test, AVE-SV (Fornell-Larcker Criterion Test) and Heterotrait-Monotrait (HTMT) Ratio Matrix (Hair *et al.,* 2017; Henseler *et al.,* 2015).

3.11 Ethical Considerations

Before the start of data collection, a research permit was secured from the National Commission for Science Technology and Innovation (NACOSTI), which is the legal body mandated to regulate research activities in Kenya. The researcher also sought approval from County Government of Murang'a Ministry of Agriculture, Livestock & Fisheries to conduct interviews. Data collection took place from 4th January to 14th February, 2020. The respondents were informed of the purpose of the study and assured of confidentiality of the information they gave. They were not required to give any form of identity on the questionnaires. The researcher assured the respondents that the information they provided would be used purely for research purposes and was confidential.

CHAPTER FOUR

DAIRY AGRIPRENEURS' PREFERENCE FOR PRODUCTION, ANIMAL HEALTH AND MARKETING SUPPORT SERVICES IN KENYA—A CHOICE EXPERIMENT

Abstract

Utilization of production, animal health and marketing services among smallholder dairy agripreneurs is crucial in enhancing their productivity and income levels. However, studies have documented low uptake of these services among smallholder dairy agripreneurs in Kenya. This study utilizes a choice experiment (CE) to determine dairy agripreneurs' preferences and willingness to pay (WTP) for five attributes of production, animal health and marketing support services. The attributes examined are: group marketing service, business plan training service, animal health service (curative and preventive), production service (artificial insemination and improved feeds) and monthly fee levels. Multistage sampling procedure was used to collect data from 682 dairy farmers in Murang'a County. Data were analyzed using Random Parameter Logit (RPL)/Mixed Logit model. The results of CE reveal significant heterogeneity in preference among dairy agripreneurs. Dairy agripreneurs prefer to have group marketing services offered rather than having no service. They also prefer curative services rather than preventive services. In addition, dairy agripreneurs prefer use of artificial insemination in improving productivity of cows rather than using improved feeds such as hay and silage. The results further indicate that dairy agripreneurs have less preference for business plan training service. In relation to willingness to pay (WTP), dairy agripreneurs were more willing to pay for group marketing (KES 8797.91/month), artificial insemination (KES 2816.01/month) and curative services (KES 2577.62/month). Lastly, dairy agripreneurs were not willing to forgo KES 2411.29 per month for business plan training service. Service providers should consider the differences in preferences among dairy agripreneurs to increase the uptake of production, animal health and marketing services in dairy agrienterprises.

4.1 Introduction

Dairy farming constitutes the backbone of Kenya's economy. Small-scale agripreneurs dominate the sector (80%) with about 1.8 million farmers involved in production of milk, meat and other dairy products (Mwambi *et al.*, 2018). These agripreneurs have a farm size of about 3-5 acres, keep 2-5 cows which produce about 5 kg of milk per day (Oloo, 2016). This sector

contributed 30% of the Gross Domestic Product (GDP) in 2018. In addition, the sector produced 4 billion litres of milk in 2018 which makes it among the highest producer and consumer of milk in Africa (FAOSTAT, 2018). According to Bosire *et al.* (2017), the annual per capita milk consumption in Kenya ranges from 19 kg in rural areas to 125 kg in urban ones. Moreover, Schneider (2018), reported that the demand for milk and milk products in Kenya is among the highest in developing countries.

Despite the crucial role these smallholder dairy agripreneurs play in the sector, they are characterized by low productivity. They are constrained by inadequate quantity and quality of feeds, poor access to breeding technologies, diseases, poor access to credit facilities and poor access to output markets (Richards *et al.,* 2015). A sustainable dairy business intensification is necessary to improve the productivity and income levels of smallholder dairy agripreneurs (Lukuyu *et al.,* 2019; Van der Lee *et al.,* 2018). Such a goal cannot be attained without the greater uptake and utilization of production, animal health and marketing dairy support services that may improve yield and income of smallholder dairy agripreneurs (Wane *et al.*, 2019).

Mutenje *et al.* (2020), emphasized that one of the pathways to increase productivity of smallholder dairy farmers is through access to dairy breeding support services. This include artificial insemination, usage of high quality forage and hay which could improve the nutritional status of cows hence improve milk production. Apart from these support services, there are services related to animal health which are divided into curative and preventive services. Curative services are related to clinical care for the animals, while preventive services include vaccination, disease control and vector control (Bardhan *et al.,* 2015). Mwambi *et al.* (2018) and Ngeno (2018), also emphasize the need for group marketing support services as a pathway to improve market access and milk prices for smallholder dairy farmers in Kenya.

Chawala *et al.* (2019), also reported that utilization of dairy breeding programmes such as AI, improved feeds and animal health services such as vaccination and deworming programmes could potentially aid dairy agripreneurs increase their productivity. In appreciation of this, efforts have gone towards improving dairy production by increasing provision of these services especially through dairy hubs and cooperatives (Rao *et al.,* 2018). Despite this availability of different production, animal health and marketing support services, access and use of these

support services remain a problem for dairy agripreneurs in developing countries (Ngeno, 2018; Omondi *et al.,* 2017; Oloo, 2016).

Several studies have been done to explain the possible reason for these low uptake (Kebebe *et al.,* 2017; Mazimpaka *et al.,* 2018; Mugisha *et al.,* 2014; Mutenje *et al.,* 2020; Mwanga *et al.,* 2019; Omondi *et al.,* 2017). However, missing component in these studies is dairy agripreneurs' preferences for different attributes of production, animal health and marketing services. Majority of these studies have focused on the role of socio-economic and institutional factors on choice of production and animal health support services. In addition, most of these studies have focused on artificial insemination as a breeding services with limited empirical evidence on animal health, marketing and utilization of improved feeds services.

The contribution of this study to the literature is twofold. First, our focus on the WTP for the aforementioned attributes of production, animal health and marketing support services expands on the work of Omondi *et al*. (2017), Rao *et al.* (2018), Chawala *et al.* (2019) and Mutenje *et al.* (2020). The elicitation of WTP for these attributes provides in depth analysis of dairy agripreneurs' reactions towards utilization of dairy technologies and support services. This is an important topic considering the low uptake of these services among dairy farmers (Omondi *et al*., 2017). In addition, dairy cooperatives and input providers are taking a major role in strengthening the uptake of dairy technologies among smallholder dairy farmers. Thus, understanding preferences of dairy agripreneurs for bundle of dairy support services will facilitate effective delivery of these services. Second, by using DCE, this study sheds light on preferences heterogeneity among dairy agripreneurs. Through this experimental design, we quantitatively determined the extent to which dairy agripreneurs value different attributes of production and animal heath support services.

The remainder of the paper is structured as follows. The second section describes the DCE methodology and how it was applied in the study. The third section describes the results and discussions. The fourth section provides a final conclusion and policy implications.

4.2 Methodology

4.2.1 Study area and data collection procedure

Data were collected in Murang'a County, Kenya in four sub-counties: Gatanga, Maragwa, Kiharu and Kangema. The study areas were purposively selected since they are main milk producing sub-counties in the County, while Murang'a county among the highest milk producing counties in Kenya (Murang'a CIDP, 2018). Hence, the study areas were selected to maximize the number of dairy agripreneurs and presence of production and animal health support services. A cross-sectional survey was conducted through choice experiment to elicit dairy agripreneurs' preferences of production, animal health and marketing support services. The fieldwork was conducted between January and February 2020. A total of 682 dairy agripreneurs were interviewed based on proportionate to size of the sub-counties as follows: Gatanga, 278; Maragwa, 195; Kiharu, 143; and Kangema, 66. The collected data was cleaned, edited and coded for data analysis.

4.2.2 Choice of production and animal health attributes and levels

The selection of the attributes used in the choice experiment was based on the domain knowledge and empirical literature (Bardhan *et al.,* 2015; Chawala *et al.,* 2019; Mutenje *et al.,* 2020; Omondi *et al.,* 2017; Rao *et al.,* 2018; Wongtschowski *et al*., 2013). In addition, we carried out in-depth interviews with dairy agripreneurs and focus group discussions with key informants who included input providers, consultants in dairy sector, managers of farmer cooperatives and government extension agents; to ensure that production, animal health and marketing attributes selected were amenable to policy changes in dairy sector. The five attributes considered in this study were group marketing, animal health, business plan training, production support and monthly fee (KES). The dairy support services attributes and their levels are defined in Table 4.1.

Table 4.1. Production and animal health attributes and levels

Attributes	Definition	Levels
Group marketing	Dairy agripreneurs engaging in collective marketing of milk.	1. Yes 2. No
Animal health	Access to preventive services (vaccination and deworming) and curative (drugs to cure diseases).	1. Preventive 2. Curative
Business plan training	Training in management of resources in agrienterprises.	1. Yes 2. No
Production support	Access to services that improve productivity of cows such as improved breeds through AI or improved feeds such as silage and hay	1. AI 2. Improved feeds
Monthly fee (KES)	Amount of money paid in Kenya shillings for utilizing the bundle of ASS	1. 500 2. 1000 3. 1500 4. 2000

4.2.3 Experimental design

The choice sets for the discrete choice experiment (DCE) were generated using NLOGIT statistical program. This programme aided in generation of D-optimal design that maximized D-efficiency from the 64 combinations of the attributes. Through this method, orthogonality (attribute levels are independent of each other), level balance (attribute levels appear with the same frequency), and minimal overlap (attributes do not take the same level within a choice set) were taken care of. Twenty-four choice cards were generated and allocated to four profile so that each dairy agripreneur was assigned one profile of six cards. Each card had different attributes of production, animal health and marketing services options and one opt out option.

The choice experiment involved presenting the hypothetical choice cards to dairy agripreneurs. Each scenario described attributes of production, animal health and marketing services for

dairy agripreneurs. The agripreneurs were required to think about each scenario as if they were making a decision between them in the real world. Then, they were told to choose among the three options 1, 2 or 3 that they most prefer. If dairy agripreneur stated that he/she did not prefer either option by choosing 'None' (I would not purchase any of these plans). The respondents were asked to make a forced choice between two alternative productions, animal health and marketing support services; an opt-out alternative of 'no utilization of ASS' in dairy farming lacked realism. Figure 4.2 presents a sample of choice card used in the discrete choice experiment.

Suppose you have a bundle of agribusiness support services provided to you to run your dairy business. Below are three options, each with different attributes. If you were given a choice, which option would you choose?			
Attributes	**Option 1**	**Option 2**	**Option 3**
Group marketing	Group marketing	No group marketing	
Animal health	Preventive	Curative	
Business plan training	Business plan training	No business plan training	I would not purchase any of these plans
Production support	AI services	Improved feeds	
Monthly fee (KES)	2000	1500	
Which option would you choose?	**Plan 1**	**Plan 2**	**None**

Figure 4.1 An example of a choice card used in the experiment with dairy agripreneurs

4.2.4 Model specification and data analysis

In order to estimate dairy agripreneurs' general preferences for production, animal health and marketing support services, the study used Random Parameter Logit (RPL)/Mixed Logit model. This model has several merits which make its suitable for this study. First, compared to multinomial or conditional logit models, mixed logit is very flexible and it relax the restrictive independence of irrelevant alternatives assumption (IIA). Hence, the unobserved variables were allowed to correlate over choice options. Moreover, RPL accounted for unobserved preferences heterogeneity across the dairy agripreneurs so that it was possible to

get multiple choice sets from the same respondents with unrestricted substitution patterns. Mixed Logit Model is usually expressed as:

$$P_{ni} = \int L_{ni}(\beta)\ f(\beta)\ d\beta \quad \text{.....(3)}$$

where $L_{ni}(\beta)$ is the logit probability evaluated at parameters β:

$$L_{ni}\ (\beta) = \frac{e^{V_{ni}(\beta)}}{\sum_{j=1}^{J} e^{V_{nj}(\beta)}} \quad \text{.....(4)}$$

and $f(\beta)$ is a density function, $V_{ni}(\beta)$ is the observed portion of the utility, which depends on the parameters β. If utility is linear in β, then

$$V_{ni}(\beta) = \beta' x_{ni} \quad \text{.....(5)}$$

In this case, the mixed logit probability takes its usual form:

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_{j} e^{\beta' x_{nj}}} \right) f(\beta)\ d\beta \quad \text{.....(6)}$$

The mixed logit probability is a weighted average of the logit formula evaluated at different values of β, with the weights given by the density $f(\beta)$. The weighted average of several functions is called a mixed function, and the density that provides the weights is called the mixing distribution. Mixed logit is a mixture of the logit function evaluated at different β's with $f(\beta)$ as the mixing distribution. Standard logit is a special case where the mixing distribution $f(\beta)$ is degenerate at fixed parameters b: $f(\beta) = 1$ for $\beta = b$ and 0 for $\beta\ K\ b$. The choice probability then becomes the simple logit formula;

$$P_{ni} = \frac{e^{b' x_{ni}}}{\sum_{j} e^{b' x_{ni}}} \quad \text{.....(7)}$$

The mixing distribution $f(\beta)$ can be discrete, with β taking a finite set of distinct values. Suppose β takes M possible values labeled $b_1, ..., b_M$, with probability S_m that $\beta = b_m$. In this case the choice probability is

$$P_{ni} = \sum_{m=1}^{M} s_m \left(\frac{e^{b_m x_{ni}}}{\sum_{j} e^{b_m' x_{nj}}} \right) \quad \text{.....(8)}$$

The above can be interpreted as there are M segments in the population, the share of the population in segment m is s_m, which the researcher can estimate within the model along with

the b's for each segment. Using this model, the price coefficient was assumed fixed. This assumption helped to avoid price dispersion around zero, which implied excessive willingness to pay for production, animal health and marketing support services

4.3 Results and discussion

4.3.1 Descriptive statistics

Table 4.2 presents the socio-economic and institutional characteristics of our sample (n = 682). The majority of respondents are male dairy agripreneurs (70.4%), which reflects dairy farming being dominated by male agripreneurs due to ownership and control of resources in the households (Machina & Lubungu, 2019). The average age of the respondents was 55.6 years, with mean experience in dairy farming being 18.8 years. Majority of the respondents had primary education which indicates low literacy level among the dairy agripreneurs. In relation to land tenure, 61% of the respondents owned land with title deeds with an average land size of 1.3 acres. Majority of the dairy agripreneurs keep 3 cows, which produce about 14.3 litres of milk per day and a litre of milk is sold at KES 33.2. the mean distance to veterinary and output market is 2.8 Km and 2.1 Km respectively. Table 4.2 also shows statistical significant difference in age of household head, the level of education, household labour, experience in dairy farming, land tenure and milk yield between male- and female-headed households. Male household heads are more educated, have more household labour and produce more milk than their female counterparts. While female agripreneurs are older, more experienced in dairy farming and own land with title deeds than the male counterparts.

Table 4.2. Respondents' socio-economic and institutional characteristics

Variable	All (n=682)	Male (70.4%)	Female (29.6%)	P-value
Age (years)	55.55	54.76	57.43	0.02[b]
Education level*	3.60	3.71	3.32	0.01[a]
Household labour (number)	3.43	3.64	2.93	0.01[a]
Experience (years)	18.82	17.59	21.73	0.01[a]
Land tenure (1=with title deed)	0.61	0.59	0.66	0.08[c]
Land size (acres)	1.29	1.28	1.33	0.63
Number of cows	2.50	2.53	2.42	0.44
Milk yield (Litre/day)	14.29	15.36	11.75	0.01[a]

Milk price (KES)	33.19	33.36	32.79	0.30
Distance veterinary clinic (Km)	2.79	2.80	2.78	0.98
Distance output market (Km)	2.12	2.41	1.43	0.54

[a, b, c] Significance level at 1%, 5%, and 10% respectively. ***** 1=no formal, 2=adult, 3=primary, 4=secondary, 5=college, 6=university

4.3.2 Dairy agripreneurs' preferences for production, animal health and marketing attributes

The coefficient estimates of mixed logit are presented in Table 4.3. All the attributes were significant (at 1% confidence level). Dairy agripreneurs positively value group marketing, curative services and artificial insemination services; while they negatively value business plan training service.

Table 4.3. Mixed logit model regression results estimating preferences for production, animal health and marketing attributes

	Mean effects		**Standard deviation**	
Attributes	**Coefficient**	**SE**	**Coefficient**	**SE**
Monthly fee for service	0.0018***	(0.0005)	0.0018***	(0.0005)
Group marketing service [a]	15.9133***	(3.2267	9.9212***	(2.0568)
Business plan training service [b]	-4.3614***	(1.0221)	5.5883***	(1.1765)
Curative service [c]	4.6623***	(1.0178)	3.4416***	(0.8114)
Artificial insemination (AI) [d]	5.0935***	(1.1756)	-3.0470***	(0.7195)
Model fit				
Log Likelihood	-757.602			
Number of dairy agripreneurs	682			
Number of observations	6138			
Wald χ^2	280.40***			

Note: SE = Standard errors in (parentheses); a reference is selling individually; b reference is no business plan trainings; c reference is preventive service; d reference is improved feeds. *** coefficients are significant at 1% level.

The willingness to pay (WTP) for various production and animal health attributes are reported in Table 4.4. Willingness to pay is the amount of money dairy agripreneurs are willing to forgo

each month in order to utilize a particular attribute of production, animal health and marketing services. This is the monetary value that dairy agripreneurs place on the different attributes of dairy support services and it was derived from the coefficient estimates in Table 4.3. For group marketing attribute x_j, for example, it is simply the value β_j / β_1 where β_1 is the coefficient on monthly fee for service. Overall, group marketing service had the highest willingness to pay (KES 8797.91/month) and business plan training service had the least (KES 2411/month) among the respondents. Moreover, dairy agripreneurs were willing to pay KES 2816.01 and KES 2577.62 per month for artificial insemination and curative services respectively.

Table 4.4. Estimated willingness to pay for various production and animal health attributes

Attributes	Mean	Std. Dev	(95% Conf. Interval)
Group marketing service	8797.91***	1465.45	11670.14 to 5925.69
Business plan training service	-2411.29***	441.33	-1546.31 to -3276.28
Curative service	2577.62***	456.65	3472.63 to 1682.62
Artificial insemination (AI)	2816.01***	480.53	3757.83 to 1874.19
Number of dairy agripreneurs	682		
Number of observations	6138		

Notes: (i) Calculations based on coefficient estimates in Table 4.3. (ii) We used the nlcom command in Stata to calculate WTP and 95% confidence intervals; *** Significant at 1% level

4.3.3 Discussion

The parameter estimates for price coefficient was positive and statistically significant ($P < 0.01$) implying that dairy agripreneurs were more likely to utilize production, animal health and marketing services with higher prices, ceteris paribus (Table 4.3). This is contrary to expectation that a higher fee would reduce the probability of using agribusiness support services among dairy agripreneurs. This finding indicate that cost of service is not a limiting factor in utilization of production, animal health and marketing services. Therefore, dairy agripreneurs were willing to pay any reasonable cost in order to get dairy support services. This underscore the need for service providers to provide quality dairy services which are efficient and effective. These findings are consistent with Mwanga *et al.* (2019), who reported that farmers were more willing to pay higher cost for AI service. However, it is contrary with

those by Omondi *et al.* (2017), who reported that dairy agripreneurs had higher preference for AI profile that offered lower prices. These results indicate that in current market situation, dairy agripreneurs are more willing to pay for production, animal health and marketing services which could be attributed to increased commercialization of dairy agripreneurs.

With regard to group marketing, farmers can sell their milk through groups such dairy cooperatives or individually through middlemen, retailers and consumers. Group marketing had the highest positive significant coefficient, indicating that, above all, dairy agripreneurs would like support services that facilitate the access to stable markets and better prices. Group marketing allows farmers to manage marketing challenges such as presence of brokers, transportation limitations and managing produce quality. Through a marketing group, the farmers will easily consolidate produce in joint transportation mechanism, avoid brokers and ensure every member of the group adheres to produce standards as reported in previous studies (Kumar *et al.*, 2019; Mwambi *et al.,* 2018).

Dairy agripreneurs preference for group marketing could also be associated with increase in bargaining or negotiation power when it comes to inputs and milk market prices. Through membership to a group, dairy agripreneurs are able to negotiate with buyers for better milk prices (Ngeno, 2018). In addition, through joint marketing, dairy agripreneurs may access and procure farm inputs such as fertilizer, seeds and herbicides in bulk hence attracting quantity discounts and reducing chances of buying fake inputs (Kumar *et al.,* 2018). It's prudent to note that, majority of micro-finance firms mostly target well organized groups which also easily access market with assurance of returns (Wossen *et al.,* 2017). Hence with group marketing, members of such groups can easily access affordable credit facilities which help them to improve their farm enterprises. A similar higher preference for group marketing support services was previously reported in smallholder dairy agripreneurs in India (Kumar *et al.,* 2018) and Kenya (Ngeno, 2018).

The results further reveal that dairy agripreneurs were not willing to acquire business plan training support services. Negative preference towards business plan training support services can be related to lack of entrepreneurial mindset of dairy agripreneurs which makes them not to see the value of this support service. Business plan training is designed to help dairy agripreneurs create a written plan to start, manage or expand their farm business (Makropoulos

et al., 2020). The training may make them to view their business on a long – term perspective and embrace innovative farming approaches. Smallholder farmers need to be innovative and forward-looking in managing their businesses as long-term ventures with a view to establishing sustainable agrienterprises (Dias *et al.,* 2018).

Despite the benefits associated with business plan training, we witness farmers not interested in such trainings. Main reason being, these farmers have been into farming for decades (mean experience in dairy farming 18 years) and some took over from their previous generation (mean age 56 years), over time, they have learnt to maintain their traditional way of farming. In addition, they have been doing the farm business for long and repetitively. This could make them resistant to change hence making them reluctant to use business plan training. This brings the issue of attitude and mindset which has been a major stumbling block in improving the entrepreneurial behaviour of farmers (Korsgaard *et al.,* 2015). Low preference for business plan training could also be associated with decreasing farmlands which is major constraint to dairy farm business expansion (Ngeno, 2018).

Another important production and animal health attribute that could influence productive and profitability of dairy agripreneurs is access and uptake of curative and preventive animal health support services. The positive and significant estimate for 'curative service' suggested that dairy agripreneurs preferred curative animal health services over preventive animal health support services. The plausible reason could be due to the higher prevalence of animal diseases in Kenya dairy sector which increases the interest of dairy agripreneurs for curative services over preventive. Some of these diseases include contagious bovine pleuropneumonia, trypanosomosis, brucellosis, mastitis, foot-and-mouth and bovine tuberculosis (Oloo, 2016).

In addition, high cost of vaccination and deworming programmes limits smallholder agripreneurs to utilize preventive support services (Chawala *et al.,* 2019). Majority of farmers are poor smallholders hence will see no need of employing preventive measures like vaccination or deworming since they consider that a cost related item and will only act once the animal falls sick. They rather invite the veterinary officer when they realize the animal situation is beyond their intervention. Some farmers might prefer preventive measures, but the challenge existing is the few numbers of veterinary officers. This makes such farmers to practice wait approach and act once an animal is sick. These results are similar to findings of

Wane *et al*. (2019), who found high cost of vaccination services and low number of veterinary officers hindered dairy farmers to utilize preventive support services in Tanzania.

In relation to preference to production support services, the coefficient for artificial insemination was positive and highly significant, indicating that, dairy agripreneurs preferred 'utilization of AI services' over utilization of improved feeds. Preference for AI service is seen as more suitable option to improve the productivity of smallholder dairy agripreneurs due to genetic improvement of their cows (Mazimpaka *et al*., 2018). Low milk production, motivates smallholder agripreneurs to seek for AI services (Mutenje *et al.,* 2020; Omondi *et al.,* 2017). Further, Lukuyu *et al.* (2019), asserts that farmers have higher preference for AI services due to its ability to increase dairy productivity, reduced calving intervals and improved herd fertility. This results indicate that before smallholder farmers to consider utilizing improved feeds such as hay, silage and concentrates, they are more interested in improving the genes of their animals.

4.4 Conclusion and policy implications

The study examined dairy agripreneurs' preference for production, animal health and marketing support services among 682 farmers in Murang'a county of Kenya. The study showed that dairy agripreneurs prefer a bundle of agribusiness support services that offers group marketing, curative services and artificial insemination. However, dairy agripreneurs prefer non-utilization of business plan training services in their dairy business. In relation to willingness to pay for the attributes of production, animal health and marketing support services. It can be concluded that dairy agripreneurs were willing to pay more money (KES 8797.91/month) in order to receive group marketing support services while they were less likely to pay (KES 2411/month) for business plan training service. Furthermore, dairy agripreneurs were WTP KES 2816.01 and KES 2577.62 per month for artificial insemination and curative services respectively.

This study has demonstrated the role of smallholder agripreneurs' preferences in influencing the choice of dairy support services. It is imperative to put in place appropriate strategies that will enhance easier and quicker access to production and animal health services to smallholder agripreneurs. Policy makers in both government and non-governmental organizations need to develop training programs that suits smallholder dairy agripreneurs' preference and help them

change their attitude and mindset without advocating for forceful need to adopt a certain practice. Farmers need to be empowered and encouraged to be more enterprising which will enhance the uptake of business plan training for sustainable dairy farming intensification. They also will need to adopt a collaborative approach to work with farmers which is a two-way approach but not traditional supply-driven approach which was like compelling farmers to uptake a certain approach in their farmlands. This will encourage farmers to take up technologies such as vaccination services.

The policy makers should also advocate for practices and programs which gel with farmer need and status. Since majority of dairy agripreneurs are smallholders, there should be appropriate policy strategies targeting how to upgrade these farmers through increasing their chain governance and control of activities such as producer cooperatives. Dairy cooperatives have proved to be effective business models that enhance market access and input delivery among smallholder agripreneurs. Thus, there is need to improve the structure and business model for dairy cooperatives. By strengthening their linkage with private service providers. This will enhance timely and affordable access to production, animal health and marketing services among smallholder dairy agripreneurs.

CHAPTER FIVE
FACTORS INFLUENCING UTILIZATION OF AGRIBUSINESS SUPPORT SERVICES AMONG SMALLHOLDER DAIRY FARMERS IN KENYA

Abstract

Utilization of agribusiness support services such as production, cooperative, financial and business planning are considered as robust strategies of enhancing commercialization of smallholder dairy farmers. Globally, these agribusiness support services have been endorsed as avenue to increase productivity and income of smallholder dairy farmers. However, these support services have had low utilization in Kenya. This study sought to determine the key factors that influence utilization of these services among dairy farmers in Murang'a County, Kenya. Multistage sampling approach was used to collect cross sectional data from 682 dairy farmers selected from four sub-counties. Multivariate probit regression analysis was used to analyse the data. The study results revealed that education level of household head, number of adults in the household, experience in dairy farming, land size, livestock type, number of cows owned, milk yield, price of milk, access to contract, type of road and level of buyer trust were the major factors that affect the likelihood of utilizing agribusiness support services among dairy farmers. Multidisplinary approach that is based on engagement of dairy farmers, agribusiness service providers, public and private agricultural institutions is crucial in dissemination and delivery of agribusiness support services. This will guarantee increased utilization of agribusiness support services that are tailored to the specific needs of smallholder dairy farmers.

Keywords

Business plan, Cooperative, Dairy sector, Financial, Production, Multivariate Probit.

5.1 Introduction

The Kenyan dairy sector plays an important role in creation of employment to majority of smallholder dairy farmers (Mwambi *et al.,* 2018). However, the sector is faced with instability due to lack of capital assets, unstable supply of quality animal feeds, increasing animal diseases and limited skills in dairy management (Burke *et al.,* 2015; Nettle *et al*., 2017). The instability has resulted to poor financial performance of dairy farmers which pose increasing risk to their

survival (Herrero *et al*., 2014). In addition, these challenges limit dairy farmers' capacity to make sustainable income generation from their agrienterprises (Gelan & Muriithi, 2015).

For enhanced agricultural production, the provision of agribusiness support services which include production, cooperative, financial and business planning support services are considered as vital for improved agrienterprise performance (Maonga *et al.,* 2017). Production support services are related to improvement of livestock productivity such as artificial insemination, supply of feeds, animal health services which are divided into curative and preventive services. Curative services are related to clinical care for the animals, while preventive services include vaccination, disease control and vector control (Bardhan *et al.*, 2015).

Apart from access to production support services, dairy farmers need financial support which they could use to enlarge their capital base (Narayanan, 2015). This is because an increase in credit utilization could enable dairy farmers to invest in modern agricultural technologies such as artificial insemination (AI) services, milking machines and adoption of information communication and technology (ICTs) (Bardhan *et al*., 2015). These financial support services are strategically important for increasing productivity and resilience of dairy farmers from uncertain shocks and changes in the agribusiness environment (Wongtschowski *et al*., 2013). Although credit facilities are considered as an engine to propel commercialization of dairy farmers, only 13% of dairy farmers in Kenya are utilizing financial support from formal financial institutions. This indicates that uptake of these financial support services is still low among majority of dairy farmers (Wilkes *et al*., 2018).

Cooperatives have emerged as innovative institutional arrangements that may help dairy farmers to overcome some marketing challenges they face in managing their agrienterprises (Chagwiza *et al*., 2016). This is considering the fact that, cooperative business model is geared towards empowerment of smallholder farmers to increase their commercialization (Wortmann-Kolundžija, 2019). Some of agribusiness support services offered by cooperatives include identification of markets and negotiating prices for members, logistic services such as transportation of milk to processors, training and business development services, provision of credit linked input such as animal feeds, animal health services, artificial insemination and linkages to strategic partners such financial institutions and Kenya Dairy Board for issues of

certifications and standards (Oloo, 2016). Through cooperative membership, dairy farmers could be able to reduce price risks hence increase their production (Kumar *et al*., 2018). Despite enormous benefits related to membership to cooperatives, the participation of dairy farmers is still low (Ngeno, 2018).

Business planning support services is an emerging ASS, that smallholder dairy farmers require in managing their dairy farm business (Rademaker *et al*., 2016). Dairy farmers need to continuously innovate and improve his/her managerial and marketing skills. Business planning is one of the most important business development support service that smallholder farmers need to have in order to improve these skills (Makropoulos *et al.,* 2020). Business planning entails identification of business ideas, planning for production, management, marketing and financials (Oleksiy *et al.,* 2013). Wongtschowski *et al*. (2013), found that agribusiness planning is very key in in building resilient farm system since they aid smallholder farmers overcome risk and uncertainties such as pest and diseases, extreme weather changes due to climate change and other natural calamities (Oloo, 2016).

Due to these risks and uncertainties business planning is inevitable for smallholder dairy farmers (Wongtschowski *et al*., 2013). Moreover, one of the principal reasons for business failure is lack of planning (Makropoulos *et al.,* 2020). Farmers therefore, needs skills in business planning which will serve as a yardstick in managing the agrienterprises (Honig & Samuelsson, 2012). Access to agribusiness support services could influence the agripreneurial behaviour of dairy farmers by changing their mindset and make them more market oriented. Current efforts by private and public agricultural institution are geared towards enhancing smallholder farmers' uptake of ASS (Rademaker *et al*., 2016). However, the uptake and adoption of these support services are still low especially among smallholder dairy farmers (Ngeno, 2018; Omondi *et al.,* 2017; Wilkes *et al.,* 2018). There is limited empirical literature on the reasons for the low uptake of ASS among the smallholder dairy farmers. Therefore, understanding the determinants of dairy farmers' choice of ASS is key if the uptake rates are to be increased. This study, therefore, sought to examine the determinants of utilization of agribusiness support services among dairy farmers in Murang'a county, Kenya.

5.2 Methodology

5.2.1 Study area and data

The study was conducted in Murang'a County in central Kenya. The County was selected owing to the fact that majority of the households are involved in mixed farming, with dairy cattle being the most important livestock species in the area. In addition, the County represents a vibrant dairy sector with the county government initiating several dairy intensification programmes in relation to agribusiness support services to enhance the commercialization of smallholder dairy farmers (Murang'a CIDP, 2018). Data were collected in four Sub-Counties: Gatanga, Maragwa, Kiharu and Kangema. The study focused on dairy farmers; hence, these study sites were purposively chosen since they are main milk producing areas in the County. Data were collected through cross sectional survey of 682 dairy farmers from 4th January to 14th February 2020.

A semi-structured questionnaire was prepared and administered by 12 trained enumerators, who collected data through personal interviews. The interview took an average of 90 minutes. Information on household demographics, institutional characteristics and use of agribusiness support services were collected. Informed consent was requested from the respondents before conducting the personal interview. In addition, the researcher sought for research permit from the National Commission for Science Technology and Innovation (NACOSTI). Once the permit was approved, the researcher sought approval from County Government of Murang'a Ministry of Agriculture, Livestock and Fisheries for final approval and release of information to the respective Sub-County officers. The questionnaire was also pretested on 30 dairy farmers in Kangema Sub-County. The results of the pilot study helped to amend the questionnaire which was used for the final survey. The collected data was cleaned, coded and edited for the final analysis.

5.2.2 Estimation of the model

The utilization of agribusiness support services (ASSs) was measured as a dummy variable. That is 1 if the dairy agripreneur utilizes ASSs in production, 0 otherwise. To model the decision to use ASS, a univariate binary model (logit or probit) could be appropriate due to the dichotomous nature of the dependent variable (Green, 2008). Since the estimation was based

on four ASSs (production, cooperative, financial and business planning), selection of one or more ASSs was more likely due to variations unobserved and unmeasured characteristics of the dairy agripreneur. In addition, selection of one support service may affect the likelihood of selecting other alternatives due to competing, substitutability or complementarity relationship between some ASSs. Therefore, estimating independent binary equation for each ASS would lead to potential bias as it will not allow the correlation of error terms, leading to statistical bias and inefficiency in the estimates (Green, 2008). To account for such short-comings, selection decisions were modelled using Multivariate Probit (MVP) model. The MVP model simultaneously regresses a combination of several correlated binary equations against a single vector of explanatory variables. Empirically the model can be specified as shown in Equation 2.

$$Y_{i1} = X'_{ij1}\beta_1 + \varepsilon_{i1}$$

$$Y_{i2} = X'_{ij2}\beta_2 + \varepsilon_{i2}$$

$$Y_{i3} = X'_{ij3}\beta_3 + \varepsilon_{i3}$$

$$Y_{i4} = X'_{ij4}\beta_4 + \varepsilon_{i4}, \quad (2)$$

Where, i = dairy farmers' identification, Y_{i1} = 1, if agripreneur utilizes production support services (0 = otherwise), Y_{i2} = 1, if agripreneur utilizes cooperative support services (0 = otherwise), Y_{i3} = 1, if agripreneur utilizes financial support services (0 = otherwise), Y_{i4} = 1, if agripreneur utilizes business planning support services (0 = otherwise), X'_i = Vector of factors affecting use of ASSs, βj = Vector of unknown parameters (j = 1, 2, 3, 4), and ε = is the error term. To identify the determinants of ASS utilization a multivariate probit model of the following form (Equation 3) was used to test the hypothesis:

$$Y_{i1} = X'_{ij}\beta_j + \varepsilon_{ij}, \quad (3)$$

Where Y_{ij} (j =1….,4) represent the four ASSs used by the i^{th} farmers (i = 1..…682), X'_{ij} is a 1 × k vector of observed variables that affect the choice decision of farmers, β_j is a k × 1 vector of unknown parameters (to be estimated), and ε_{ij} is the unobserved error term. It is assumed that the error terms (across j = 1… m alternatives) are multivariate and are normally distributed

with mean vector equal to zero. Therefore, the unknown parameters in Equation (3) are estimated using simulated maximum likelihood. The explanatory variables used in this study were derived from review of past studies on usage of utilization of ASSs (Anang *et al.,* 2015; Maonga *et al.,* 2017; Kumar *et al.,* 2018; Ngeno, 2018, Twine *et al.,* 2018; Machina & Lubungu, 2019).

5.3 Results

5.3.1 Multicollinearity diagnosis

To test for multicollinearity among the variables used in the multivariate probit regression, Variance Inflation Factor (VIF) was done for the continuous explanatory variables and contingency coefficients for dummy variables. The VIF values displayed in Table 5.1 indicates that there was no multicollinearity among the nine continuous explanatory variables because their VIF was less than 10. Gujarati (2003), states that if the VIF of a variable exceeds 10, there is a multicollinearity problem.

Table 5.1. Variable Inflation Factor for the Continuous Explanatory Variables

Variable	VIF	1/VIF
Age	1.94	0.51
Experience	1.83	0.55
Milk Yield	1.63	0.61
Number of Cows	1.61	0.62
Household size	1.16	0.87
Land size	1.08	0.93
Distance to output market	1.03	0.97
Distance to veterinary clinic	1.01	0.99
Price of milk	1.01	0.99
Mean VIF	1.37	

Contingency coefficients were also computed to test for multicollinearity problem among the categorical explanatory variables. Table 5.2 presents the values of the coefficients which indicates lack of multicollinearity problem among the eight discrete variables. This is because

all the variables had less than 0.75 contingency coefficients values which is the threshold (Gujarati, 2003).

Table 5.2 Contingency Coefficients for Dummy Explanatory Variables

Variables	Sex	Education	Land tenure	Livestock type	Contract	Type of road	Trust buyer	Remittance
Sex	1.000							
Education	0.181	1.000						
Land Tenure	-0.066	-0.032	1.000					
Livestock type	0.043	0.074	0.085	1.000				
Contract	-0.016	-0.016	0.054	0.112	1.000			
Type of road	0.081	-0.001	0.061	0.003	0.178	1.000		
Trust buyer	-0.014	0.010	0.019	0.090	-0.008	0.006	1.000	
Remittance	-0.080	-0.216	0.147	0.065	0.047	-0.050	-0.068	1.000

5.3.2 Description and descriptive statistics of variables used in econometric model

Description and descriptive statistics of the variables used in the econometric analysis are presented in Table 5.3. Considering utilization of ASS on average 95%, 56%, 47% and 40% of the dairy farmers had access to production, financial, cooperative and training on business planning respectively. The result indicate majority of the dairy farmers were receiving production support services possibly because of the many input providers who were promoting their services. Result on household sex, shows that about 70% of the respondents were male, implying few females are involved in dairy farming. A plausible explanation could be because investment in dairy farming needs productive resources which are mostly owned by male-headed households. Machina and Lubungu (2019), found that male headed households, have higher access to productive resources and information that increases chances of engaging in dairy farming.

Table 5.3. Definitions and summary statistics of variables used in the Multivariate probit model

Variables	Description of variables	Mean	Std. dev
Dependent			
Production support services	Dummy = 1 if HH utilizes dairy production support services, 0 otherwise	0.95	0.22
Financial support	Dummy = 1 if HH utilizes financial support services, 0 otherwise	0.56	0.50
Business plan training support services	Dummy = 1 if HH receives training on dairy farm business planning, 0 otherwise	0.40	0.49
Cooperative support services	Dummy = 1 if HH utilizes cooperative support services to dairy cooperative, 0 otherwise	0.47	0.50
Independent			
Sex	Dummy=1 if HH head male and 0 if female	0.70	13.7
Age	Age of HH head in years	55.6	1.01
Education level	Highest education level of household head	3.60	1.33
Household labour	Number of adult household members	3.43	12.9
Experience	Experience in dairy farming in years	18.8	0.49
Land tenure	Dummy = 1 if HH Owned land with title deed, 0 otherwise	0.61	1.21
Land size	Size of land under dairy farming in acres	1.29	0.21
Livestock type	Dummy = 1 if HH had improved/exotic, 0=otherwise)	0.95	1.81
Number of cows	Number of cows owned in the household	2.50	15.6
Milk yield	Average milk production per day in litres	14.3	0.47
Access to contracts (yes=1)	Dummy = 1 if HH had written contracts, 0 Otherwise	0.66	6.54
Milk price (KES)	Milk price per litre in KES	33.2	7.92

Distance veterinary clinic (Km)	Distance to a veterinary clinic in KM	2.79	19.4
Distance output market (Km)	Distance to the output market in KM	2.12	0.48
Type of road	Dummy = 1 if Tarmac, 0 otherwise	0.36	0.48
Trust buyers of milk	Dummy = 1 if HH had high trust, 0 otherwise	0.65	0.49
Remittance (yes=1)	Dummy = 1 if HH had access to remittance, 0 otherwise	0.40	0.22

The mean age and experience of the respondents was 56 years and 19 years respectively. This finding indicate that most of these farmers were elderly and they had practiced dairy farming for long duration. Households with an older age have control over more resources and more experienced, and this could influence their decision to invest in dairy farming which requires high initial capital outlay. Youth with the age bracket of 18 to 35 years, lack capital to start dairy enterprises which justifies the reason why majority of dairy farmers were in the middle age (40-60 years). Similar findings of age distributions and experience were revealed by Gitau (2013), majority of the farmers involved in milk production were above the youthful stage (over 35 years of age) and had over ten years of experience in milk production

In this study, household size is used both as a proxy for labour endowment, representing a key factor of production, and as a push factor for participating in milk production activities (Kiwanuka & Machethe, 2016). The average household size was 4 persons. Availability of family labour in dairy farming households plays a key role in rural agricultural systems, as noted by Girma and Marco (2013). Most of the household heads completed primary school education. These results indicate low levels of literacy among the respondents despite the fact that access to education could increase the likelihood of dairy farmers utilizing agribusiness support services (Anang *et al.,* 2015). In relation to land size and tenure system, the mean land size under dairy farming was 1.29 acres and 61% of the respondents had title deeds. Ownership of land as a production asset plays an important role in household head decision to invest on the agribusiness. This could also influence the decision to access agribusiness support services (Maonga *et al.,* 2017).

In relation to dairy production parameters, 95% of the cattle domesticated by the dairy farmers were improved/exotic. The plausible reason could be the need to improve milk production, commercial nature of the farmers, though they have limited land space hence they would consider high productive cattle to optimally run their agrientreprises. The mean number of cows owned by the household was about 3 cows with per animal average milk production per day was 14.3 litres. This show that most of these farmers were smallholder and were practicing intensive farming due to limited land. But their milk yield was higher compared to majority of dairy farmers in other parts of Kenya who produce about 5 litres of milk per day (Oloo, 2016). The average milk price was KES 33.2 per litre. The price the dairy farmers receive is considerably very low compared to the high cost of production and the price paid for pasteurized milk by consumers of KES 120 per litre.

The mean distance to veterinary clinic and output market was 2.8 Km and 2.1 Km, while only 36% of the respondents had access to tarmac road. Majority of the dairy farmers (65%) had high trust for their milk buyers, which also corresponds to 66% of the respondents who had access to contracts with buyers. This is plausible because of the high number of cooperatives and milk processing companies in the county (Murang'a CIDP, 2018). Finally, 40% of the respondents received remittance from family members and relatives. This shows that majority of the respondents had low social network in relation to financial support in running the agrienterprise.

5.3.4 Correlation analysis of dependent variables

Multivariate Probit (MVP) model was used to determine the factors influencing the usage of agribusiness support services among smallholder dairy farmers. Table 5.4 shows the pairwise correlation coefficients between the error terms of the four equations of agribusiness support services usage. All the four pairs of the estimated correlation coefficients were statistically significant from zero implying a strong interdependence among the four agribusiness support services.

Table 5.4. Correlation coefficients for Multivariate Probit regression equations

Agribusiness Support Services	Production	Financial	Business planning	Cooperative
Production	1.000			
Financial	0.020***	1.000		
Business planning	0.141***	0.022***	1.000	
Cooperative	0.117***	-0.044***	0.472***	1.000

The results of multivariate probit estimation is presented in Table 5.5, which revealed significant variables that influenced the access to agribusiness support services. The Wald test $\{\chi^2(68) = 366, \mathrm{p} = 0.00712\}$ implied that multivariate regression is highly significant and the likelihood ratio test $\{\chi^2(6) = 65.91, \mathrm{p} = 0.00712\}$ of the independence of multiple usage of various agribusiness support services was strongly rejected. This indicates that multiple use of different agribusiness support services among dairy farmers is not mutually independent and multivariate probit specification fits the data.

5.3.5 Analysis of factors influencing utilization of agribusiness support services

Cooperative support services. Forty-seven percent of the dairy farmers were utilizing cooperative support services (Table 5.3). The multivariate probit results (Table 5.5) showed that smallholder farm household decision to utilize cooperative support services was positively influenced by land size (β=0.0853; 90% CI), livestock type (β=0.574; 90% CI), number of cows (β=0.159; 99% CI), access to contract (β=;1.44 99% CI) and level of buyer trust (β=0.384; 99% CI); and negatively influenced by milk price (β= -0.0697; 99% CI).

Production support services. More than 90% of dairy farmers (95%) were utilizing production support services which included artificial insemination, vaccination, deworming, pregnancy diagnosis, curative and use of improved dairy feeds. (Table 5.3). The model output revealed that the decision to use production support services was found to be positively influenced by number of adult members in the household (β=0.242; 99% CI), experience in dairy farming (β=0.0231; 95% CI) and type of road (β=0.676; 99% CI).

Financial support services. Fifty-six percent of dairy farmers were utilizing financial support services (Table 5.3). The model results reveled that, education level of household head

(β=0.215; 99% CI) positively influenced the choice of this support service; while the number of adult members in the household (β= -0.104; 99% CI), livestock type (β= -0.475; 90% CI) and level of buyer trust (β= -0.383; 99% CI) negatively affected the utilization of financial support service.

Business plan training support services. Forty percent of the sampled dairy households were utilizing business plan training support services (Table 5.3). The model output results show that land size (β=0.106; 95% CI), milk yield (β=0.00768; 90% CI), access to contract (β=0.9167; 99% CI) and type of road (β=0.493; 99% CI) positively influenced use of business plan training support services while milk price (β=-0.0371; 99% CI) had a negative influence.

Table 5.5. Determinants of utilization of agribusiness support services

	Multivariate probit estimates				Individual probit estimates			
Variables	**CS**	**PS**	**FS**	**BS**	**CS**	**PS**	**FS**	**BS**
Household characteristics								
Sex (male=1)	0.0563	0.286	0.0563	-0.00551	0.0464	0.279	0.0561	-0.00381
	(0.131)	0.202	0.116	0.124	0.131	0.203	0.116	0.124
Age (years)	-0.00576	-0.00448	-0.00180	-0.00172	-0.00533	-0.00563	-0.00162	-0.00134
	(0.00632)	0.0105	0.00561	0.00594	0.00635	0.0104	0.00559	0.00594
Education level	0.0359	-0.0701	0.215***	0.0211	0.0347	-0.0547	0.217***	0.0273
	(0.0632)	0.106	0.0570	0.0598	0.0636	0.106	0.0570	0.0600
Household labour (Number of adult members)	0.00535	0.242***	-0.104***	0.0650	0.0102	0.250***	-0.102**	0.0678
	(0.0471)	0.0855	0.0425	0.0444	0.0470	0.0859	0.0424	0.0444
Experience (years)	0.00497	0.0231**	-0.00362	-0.00166	0.00355	0.0238**	-0.00399	-0.00261
	(0.00600)	0.0105	0.00532	0.00569	0.00607	0.0105	0.00531	0.00570
Farm characteristics								
Land tenure	-0.166	0.126	-0.00537	0.0841	-0.167	0.128	0.00183	0.0805
	(0.125)	0.209	0.112	0.118	0.126	0.210	0.112	0.118
Land size	0.0853*	-0.0943	-0.0195	0.106**	0.093*	-0.0980	-0.0218	0.102**
	(0.0500)	0.0777	0.0440	0.0456	0.0498	0.0787	0.0441	0.046

Livestock type (1=improved/exotic, 0=otherwise)	0.574*	0.464	-0.475*	0.282	0.583*	0.457	-0.475*	0.312
	(0.307)	0.343	0.264	0.290	0.312	0.347	0.266	0.297
Number of cows	0.159***	0.0223	0.0255	0.0206	0.161***	0.0201	0.0258	0.0273
	(0.0446)	0.0752	0.0357	0.0358	0.0443	0.0752	0.0356	0.0365
Milk yield	-0.000275	0.000662	0.000677	0.00768*	-0.000914	0.000808	0.000610	0.00638
	(0.00516)	0.00948	0.00420	0.00421	0.00506	0.00961	0.00419	0.00431
Transaction cost characteristics								
Access to contract (yes=1)	1.44***	0.283	-0.119	0.9167***	1.442***	0.287	-0.116	0.924***
	(0.137)	0.193	0.113	0.126	0.137	0.193	0.113	0.126
Milk price (KES)	-0.0697***	-0.0188	0.00331	-0.0371***	-0.0698***	-0.0203	0.00344	-0.0350***
	(0.0110)	0.0135	0.00798	0.00942	0.0110	0.0136	0.00799	0.00948
Distance to veterinary clinics (Km)	0.000965	-0.00154	0.00448	0.00185	0.000988	-0.00173	0.00400	0.00230
	(0.00834)	0.0124	0.00851	0.00734	0.00768	0.0118	0.00816	0.00713
Distance to output market (Km)	-0.00328	0.00143	0.0440	0.00159	-0.00337	0.00163	0.0459	0.00311
	(0.00310)	0.0118	0.0297	0.00389	0.00322	0.0128	0.0294	0.00599
Type of road (1= Tarmac)	0.161	0.676***	-0.134	0.493***	0.153	0.702***	-0.133	0.449***
	(0.121)	0.259	0.106	0.110	0.121	0.263	0.106	0.111
Trust buyers of milk (1=High)	0.384***	-0.124	-0.383***	0.0719	0.371***	-0.122	-0.385***	0.0920
	(0.121)	0.209	0.110	0.114	0.121	0.210	0.110	0.116
Remittance (yes=1)	0.174	0.379	-0.0705	0.0362	0.203	0.404*	-0.0634	0.0742

	(0.131)	0.239	0.117	0.123	0.131	0.239	0.117	0.124
Constant	-0.110	0.692	0.511	-0.743	-0.109	0.718	0.484	-0.898
	(0.610)	0.893	0.538	0.569	0.616	0.893	0.536	0.576

Lr. Test for indep. Eqns. rho21=rho31= rho41=rho32= rho42= rho43=0, Chi2(6) = 65.9;

prob > chi2 =0.001

Wald chi2(68) = 366; Prob > chi2 = 0.001

*, **, *** = significant at 10%, 5% and 1% level, respectively (Figures in parentheses are robust standard errors); CS=Cooperative Support; PS=Production Support; FS=Financial Support and BS=Business Plan Training Support

5.4 Discussions

The aim of this study was to identify factors that influence utilization of agribusiness support services which are related to dairy farming. The agribusiness support services were categorized into production, cooperative, financial and business planning. The result suggest that education level positively affect dairy farmers' choice of financial support services (p=0.01). This imply that attainment of a higher education level increases the likelihood of utilizing financial support services among dairy farmers. Farmers who are more educated are better placed to understand the terms and conditions of utilizing credit services which may influence their decision to use credit in running their dairy business. This finding is similar to Sebatta *et al.* (2014), who found education had positive effect on access to credit since it enables farmers to comprehend information that are needed to apply for short-term agribusiness financing. In addition, access to education increases information access about different sources of credit among smallholder farmers.

The number of adults in the household had a positive effect on utilization of production support services and a negative effect on financial support services (p=0.01). This imply that with increase in number of adults in the household, the probability of the dairy agripreneur to use production support service would increase while the probability to use financial support services would decrease. Dairy farming is labour intensive, by having more adults which is a proxy for household labour, a dairy agripreneur is more incentivized to acquire production support services such as seeds for feeds because there exist people to work on them. At the same time, the large number of laborers makes the production orientation in the enterprise to be labor intensive rather than capital intensive hence the reduced likelihood of accessing financial services (Twine *et al*., 2018).

Experience in years of practicing dairy farming, positively influenced acquisition of production support services (p=0.05). This implies that the more years a farmer has been practicing dairy farming the more likely he would utilize production support services. Production inputs like feeds and animal health services constitute the largest proportion of production costs and farmers have always shunned away from the dairy sector or failed to grow their dairy enterprises because of these high costs. However, experienced farmers have acquired a resilience to these costs and have developed mechanisms to counter these costs. For example,

many experienced farmers purchase fodder and pasture seeds in order to cultivate them and formulate their own feeds. Kumar *et al.* (2018), also found that dairy farmers' experience helps them to know the economic importance of always observing the right husbandry practices and therefore utilize production support services like artificial insemination in order to secure high productivity and desirable genetic traits.

Dairy farmers' choice of agribusiness support services also depends on the land size under dairy farming. The probability of utilizing cooperatives and business planning support services was positively affected by land size under dairy farming at 10% and 5% levels of significance, respectively. Land size is a critical factor of production which have a bearing on production of milk. Farmers with a larger land size are more likely to join cooperatives because they have space to invest on dairy farming such as growing of animal feeds, keeping large herd of cattle and infrastructural development such as animal structures. Availability of large land could have a positive impact on the amount of milk produced by the farmer hence the likelihood of joining cooperative to access subsidized services such as credit-linked inputs and extension services. Large land size also enhances commercialization of farmers which could trigger them to seek for business planning services to enable them put their large resource base into the best productive use. The result is consistent with Kumar *et al*. (2013), who found positive significant influence of land size on farmers' participation in cooperatives.

Ownership of improved/exotic cows had a positive influence on utilization of cooperative services and a negative influence on utilization of financial support services (p=0.01). Farmers with exotic cattle breeds join cooperatives in order to cushion themselves from the high costs associated with keeping exotic breeds. These costs comprise mostly of feeding costs and medical costs. Furthermore, farmers with exotic breeds usually produce more milk and they need a market channel that offers stable market and prices hence they are more likely to seek for cooperative support services. Dairy farmers with improved/exotic breeds are less likely to utilize financial support services from formal financial institutions due to the fact that most credit services are not tailor-made to the needs of farmers. Most farmers shun from utilizing these financial services due to negative experience they have witnessed with farmers who borrowed money or themselves. Such as auctioning of their properties if they default in paying (Kumar *et al.,* 2018). Therefore, membership to dairy cooperatives prevents majority of

farmers from seeking other sources of credit so long as the cooperative could provide credit-linked inputs to its members.

The number of cows owned by the dairy farmers had positive effect the choice of cooperative support services (p=0.01). This implies that the higher the number of cows owned by the dairy agripreneur, the higher the likelihood of utilizing cooperative support services. Membership to a cooperative society comes with benefits such as subsidized inputs, credit and stable milk market. Farmers with more animals are therefore more likely to join cooperatives as they are better placed to benefit from these services since they have many animals and aim to reduce the cost of production and access market to their large milk production. The results are similar to Ngeno (2018), who found herd size positively determined participation of dairy farmers in cooperatives.

Milk yield produced by dairy farmers was associated with a positive effect on utilization of business plan training support services. This implies that if the quantity of milk produced by farmers' increases, they opt to look for business plan support services such as farm planning, record keeping, search for market information and financial management which incorporates analysis of costs and benefits. Increase in milk yield makes farmers to be more market oriented due to increased marketable surplus which warrant them to seek for more knowledge in farm business planning. This finding is consistent with Wongtschowski *et al*. (2013), who found that sustainable agribusiness production, processing and marketing can only be achieved through empowerment of smallholder farmers in business planning. Successful farmers need skills in business planning which will serve as a yardstick in managing the agrienterprises.

Access to contract exhibited a positive relationship in influencing the decision to utilize cooperative and business planning support services (p=0.01). A plausible explanation is that by securing a contractual agreement on the sale of milk, dairy farmers have a sure market and therefore seek means by which to increase their production in order to capitalize on the available market channel. These farmers are more likely to join cooperatives because of the subsidized inputs provided by the organizations that will increase their gross margin. They will also seek business planning services to enable them increase their knowledge and skills in farm management thereby maximize their profit from the resources they have in order to benefit most from the available contract (Rademaker *et al*., 2016).

Contrary to expectations, increase in milk price was found to negatively influence dairy farmers' utilization of cooperative and business planning support services. This means that if milk prices were to rise, the farmers' likelihood to join cooperatives and to seek business planning services would significantly reduce at 1% significance level. More often, cooperative milk prices tend to be lower and inflexible compared to other market channels. Availability of alternative higher milk prices will therefore reduce the likelihood of farmers selling to cooperatives. Due to the availability of high milk prices, the farmers will receive higher profits from their dairy enterprises and will therefore see no need to pay for business planning services yet their businesses are doing well. This is a negative indicator of lack of motivation in personal business development which could be attributed to the elderly nature of smallholder dairy farmers. These group of dairy farmers are interested in profit making with limited interest in improving their business skills due to their old age (Wongtschowski *et al*., 2013).

Access to tarmac road was used as a proxy for market access. The variable positively influenced utilization of production and business planning support services (p=0.01). Access to tarmac road enables cheaper and quicker access to distant markets due to reduced transportation cost. Improved road quality (tarmacked) is a positive influencer of access to production services since the availability of markets and reduced transaction costs incentivizes farmers to increase their production capacity. In the same light, the reduced transaction cost and access to distant markets makes farmers more likely to seek business planning services as they desire to capitalize on the improved marketing and therefore want to learn how to improve the performance of their dairy enterprises. The result is consistent with the findings of Akudugu (2012), who found closeness to the output markets increased farmers' demand for extension services such production and business planning.

High level of trust of dairy farmers in milk buyers was positive factor in influencing the utilization of cooperative support services and negatively influenced utilization of financial support services (p=0.01). The plausible explanation could be due to uniqueness of dairy cooperatives which are formed for economic benefit of the members. Dairy farmers would opt to utilize cooperative support services due to the group trust. In addition, if a farmer is assured of a steady source of market and is confident that the prices being offered are stable, then are more likely to seek for cooperative support services. Because of accessing cooperative services

and their high level of trust to the organization, they are less likely to seek financial services from other providers because they already receive the same services in the cooperatives. These results are in conformity with Aika *et al*. (2018), who found through collective action, farmer groups enhance trust among its members through cooperative marketing, provision of support services and advocating for farmers' interests.

5.5 Conclusion and recommendations

The objective of this study was to determine factors influencing utilization of agribusiness support services (ASSs) among dairy agripreneur in Kenya. There was moderate use of dairy support services with majority focusing on uptake of production support services. The multivariate probit results showed that smallholder dairy agripreneurs' decision to utilize cooperative support services was positively influenced by land size, livestock type, number of cows, access to contract and level of buyer trust; and negatively influenced by milk price. Number of adult members in the household, household head experience in dairy farming and type of road had significant positive effects on utilization of production support services. In relation to utilization of financial support services, education level of household head positively influenced the use of this support service; while the number of adult members in the household, livestock type and level of buyer trust negatively affected the utilization of financial support service. Finally, dairy agripreneurs' decision to use business plan training support service was positively influenced by land size, milk yield, access to contract and type of road; and negatively influenced by milk price.

The results of the study have several policy implications. Based on the findings, utilization of ASS is influenced by household, farm and transaction cost attributes. Therefore, providers of agribusiness support services should take into account these attributes when designing agribusiness support service targeted to smallholder dairy farmers. This will ensure that agribusiness support services are tailor-made to the specific needs of dairy farmers. Moreover, smallholder dairy farmers need to be empowered with knowledge and skills about the merits and demerits of agribusiness support services. Education programmes should be initiated by agribusiness support providers to enlighten smallholder dairy farmers on opportunities of utilizing agribusiness support services. This will enable them to be aware of ASS and their importance in dairy business. For example, dairy farmers need to be informed on financial

support services and optimal utilization of credit in the farm business. Optimal utilization of ASS depends milk yield, better prices and stable markets like cooperative. This necessitates dairy value chain actors, from producers, processors, marketers and input providers to strengthen their coordination in an effort to improve the efficiency of ASSs delivery in the chain. This will ensure profits trickle down to all the members of the chain with anticipated increase in income for dairy farmers. Increase in income could motivate farmers to seek agribusiness support services which would improve the performance and sustainability of their farm business.

CHAPTER SIX
EFFECT OF AGRIBUSINESS SUPPORT SERVICES ON CHOICE OF DAIRY COOPERATIVE MARKET CHANNEL IN KENYA

Abstract

Kenya is witnessing an immense increase in number of smallholder dairy agripreneurs, who are sourcing income from the dairy sub-sector. Due to their smallscale in nature, smallholder dairy agripreneurs are forced to sell milk to informal buyers such as middlemen/women, who exploit them by paying less than the market price. The Kenyan Government has made significant efforts to upgrade dairy cooperatives to link the dairy agripreneurs with consumers. In spite of this, milk marketing is still dominated by traditional informal outlets. This study sought to determine effect of provision of agribusiness support services on choice of dairy cooperative market channel. Data were collected from cross-sectional survey of 682 respondents from Muranga County in Kenya, using a semi-structured questionnaire. Results revealed that provision of business plan training, group marketing, pregnancy diagnosis and deworming support services had a significant and positive effect in the choice of cooperative market channel. In contrast, access to vaccination services and supply of improved feeds had negative effects on the choice of cooperative market channel. This study recommends strong coordination among the agribusiness support service providers and the dairy cooperatives in order to increase adoption of cooperative market channel. In addition, dairy cooperatives need to redesign their business models to ensure that their members not only receive agribusiness support services, but also get better prices and prompt payment to increase supply of milk to cooperatives by dairy agripreneurs.

Key Words: Dairy agripreneurs, agribusiness support, cooperatives

6.1 Introduction

Dairy farming plays an important role in providing nutrition and source of livelihood to majority of Kenyans. About 1.8 million agripreneurs are involved in dairy farming, with 80% of them being smallholders, with farm size of about 1.21-2.02 hectares (Kilelu *et al.,* 2018). According to FAOSTAT (2018), the Kenyan dairy sector produced 4 billion litres of milk in 2018, which made it among the highest producers and consumer of milk in Africa. Due to lack

of efficient marketing systems, 86% of milk produced in Kenya is sold through the informal marketing channels; and the rest is sold to dairy processing companies through farmer organisations (Mwambi *et al*., 2018). This depicts the important role played by informal markets that includes middlemen/women and retailers, in ensuring that milk reaches the final consumer. However, these informal buyers often exploit smallholder dairy agripreneurs, by paying less than the market price (Singh, 2018).

To address these challenges, cooperative marketing has emerged as an alternative marketing channel for milk distribution in Kenya. Cooperatives are involved in collection and bulking milk, cooling and coordinating the sale of raw milk. In addition, some cooperatives offer agribusiness support services, such as supply of improved feeds (hay, silage and concentrates), provision of artificial insemination (AI) and veterinary services, credit, and training (Van der Lee *et al*., 2018). Moreover, some are involved in processing of milk into products such as pasteurised milk, yoghurt, ice-cream and fermented milk (Ngeno, 2018). Through cooperatives, smallholder agripreneurs can potentially overcome constraints related to market inefficiencies, access to financial as well as inputs and output markets, which impede smallholder agripreneurs' access to lucrative markets (Burke *et al.*, 2015; Lutz & Tadesse, 2017; Royer *et al.*, 2016). This is because collective action empowers dairy agripreneurs to have more bargaining power and become more competitive (Kumar *et al.*, 2018).

Dairy agripreneurs in Kenya receive support services from a variety of organisations, which include public, private and Non-Governmental Organisations (NGOs). According to Oloo (2016), these support services relate to production, group marketing, financial and business planning support services. Production support services are livestock services related to supply of improved feeds and animal health services, which are divided into curative and preventive services (Van der Lee *et al.,* 2018). Curative services are related to clinical care for the animals, while preventive services include vaccination, diseases control and vector control.

Most of these services are provided by dairy cooperatives in order to motivate agripreneurs to supply milk to these cooperatives (Bardhan *et al.*,2015; Wortmann-Kolundžija, 2019). In the past decade, efforts have been made by governmental and non-governmental organizations to improve provision of dairy inputs and support services in dairy cooperatives, in order to

alleviate the constraints facing smallholder dairy agripreneurs. However, there exists a knowledge gap of the impact of these agribusiness support services on choice of dairy cooperative market channel. This study, therefore, aimed at determining the overall effect of agribusiness support services on the choice of dairy cooperative market channels among dairy agripreneurs in Kenya.

6.2 Methodology

This study was conducted in Murang'a County in central Kenya; which lies between longitudes 36^{o} East and 37^{o}27' East and latitudes of 0^{o} 34' South and 1^{o} 7' South of the equator. This is at an altitude range of 914m above sea level (asl) in the East to 3,353m asl along the slopes of the Aberdare ranges in the West. The County is heavily involved in mixed farming, with an average household farm size of 0.57 hectares. Dairy cattle are the dominant livestock species in the area. The County represents a vibrant dairy sector with the county government initiating several interventions in relation to agribusiness support services (Murang'a CIDP, 2018).

This study used both quantitative and qualitative approaches through a cross-sectional survey. This allowed the establishment of facts in relation to access to agribusiness support services and its influence of choice of markets. Prior to data collection, a research permit was secured from the National Commission for Science Technology and Innovation (NACOSTI), which is the legal body responsible for regulating research activities in Kenya. Once the permit was approved, we then sought approval from County Government of Murang'a Ministry of Agriculture, Livestock and Fisheries for final approval and release of information by the respective Sub-County officers.

A multistage sampling procedure was used to obtain respondents for the study. Within Murang'a county four sub-counties, Gatanga, Maragwa, Kiharu and Kangema sub-counties were purposively selected based on the presence of dairy cooperatives initiated by the county government, agripreneurs and non-governmental promoters. In addition, these sub-counties had milk collection centres whose objective was to link agripreneurs to the market and to offer agribusiness support services. Within the four sub-counties, three wards were randomly selected to give a total of twelve wards. Then, a proportional sampling technique was employed

to select the number of households that participated in the study. The sample size of 682 respondents was determined by using Cochran (1963) formula.

The respondents were briefed about the purpose of the study, and thereby they were requested for an informed consent to participate in the study. Upon consent by the selected agripreneurs, data were collected through interviews using semi-structured questionnaires. The interview sessions took an average of 90 minutes per household.

This study employed Multinomial logit model (MLM) to determine influence of agribusiness support services on choice of dairy cooperative market channel. The dependent variables were milk market channels, which included cooperative, middlemen/women, retailers and consumers. Multinomial logit model was used because these market choices were categorical and dairy agripreneurs were required to choose one main market channel to which they sold their milk. Singh (2018), asserts that multinomial logit model is used when the dependent variable is categorical, representing more than two categories and each category is compared with the reference category.

In this study the reference marketing channel was cooperative and it was compared with middlemen/women, retailers and direct to consumers. The independent variables were agribusiness support services, which included; financial, business training, group marketing, curative treatment services, artificial insemination services, pregnancy diagnosis services, deworming services, vaccination services and supply of feeds. The multinomial logistic regression for the choice of milk market channel is summarised in Equation 1.

$$P(Yi = j) = e^{\beta' j} X_i / \sum_{k=0}^{2} e^{\beta' k} X_i \; j = 0,1,2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 1}$$

Where: Yi = the probability of household participation in the milk market channel; j = the indicator variable of market channel (0=cooperative, 1=middlemen/women, 2= retailers and 3= direct to consumer); X_i= the vector of explanatory variables; and βs are the regression coefficients estimated by the maximum likelihood method.

The base category comprised of the households who sold milk to cooperatives. To interpret the coefficients in multinomial logit regression, marginal effects of the explanatory variables were conducted as follows:

$$\delta p(Y)/\delta X_i = \beta X_i * \exp[z]/[1+\exp(z)]^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 2}$$

Equation 2 provides an estimate βs of the effect of the determinants Xi on the market channel Y. Where z = the sum of coefficients multiplied by the means of the respective variables plus the constant term.

A positive coefficient on the explanatory variables indicates a positive influence on the dependent variable; while a negative coefficient indicates a negative influence on the dependent variable, which is choice of market channels.

The quantitative data collected on dairy agripreneurs access to financial, business training, group marketing, curative treatment services, artificial insemination services, pregnancy diagnosis services, deworming services, vaccination services, supply of feeds and choice of marketing channels were analysed using STATA version 15.

6.3 Results and discussion

6.3.1 Access to agribusiness support services

Table 6.1 presents dairy agripreneurs access to agribusiness support services. A total of 95.2% of the respondents had access to production support services,56.1% to financial support, 47.2% to group marketing support and only 39.6% of the respondents had access to business plan training support services. These results imply that majority of dairy agripreneurs respondents were keen on getting production support services, which included mainly curative treatment, artificial insemination, pregnancy diagnosis, deworming, vaccination and supply of feeds. The plausible explanation is that many dairy agripreneurs did not view dairying as a business that required business support. Instead, they could have known it as production oriented, thereby focusing on increasing their access to production support services.

Moreover, majority of service providers were reportedly mostly restricted to provision of production support services, rather than other important dairy services aspects such as business plan training and financial services. Therefore, in many cases, the transitioning to seeking financial and business support was almost by default rather than through their willingness. Overall, the market orientation of many dairy agripreneurs is still subsistence with few

transiting into commercial farming. They considered getting production support before focusing on other support services. This scenario is linked to the emergence of dairy cooperatives, which offered production support services to smallholder dairy agripreneurs as way of improving their productivity and linking them to markets. This finding is similar to that Omondi *et al.* (2017), who reported dairy agripreneurs in Kenya had high demand for production support services which were supplied by dairy cooperatives.

Table 6.1. Type of agribusiness support services accessed by dairy agripreneurs in central Kenya

Type of support service	Access to agribusiness support services	
	Yes	No
Production support	649 (95.2%)	33 (4.8%)
Financial support	382 (56.1%)	300 (43.9%)
Business plan training support	270 (39.6%)	412 (60.4%
Group marketing support	322 (47.2%)	360 (52.8%)

Table 6.2 presents the different types of production support services utilised by the dairy agripreneurs in central Kenya. Among these services, access to artificial insemination and deworming services recorded the highest demand of respondents utilising them (25.9% and 23.2%, respectively). This implies that for most dairy agripreneurs, the performance of cattle in terms of improved productivity and reduced mortality of the calves held high priority positions. The greater preference for artificial insemination and deworming support services by dairy agripreneurs was probably because they act as preventive measures and yet improve their milk production. Kumar (2018), contends that cooperative market channels play a crucial role in enhancing smallholder (agripreneurs) access to production support services including supply of inputs and animal health services, which are crucial to enhancing cattle productivity and farm income.

Table 6.2. Types of production support services utilised by smallholder diary agripreneurs in central Kenya

Types of production support services	Frequency	Percentage
Curative treatment services	330	16.3
Artificial insemination services	526	25.9
Pregnancy diagnosis services	43	2.1
Deworming services	470	23.2
Vaccination services	330	16.3
Supply of feeds services	329	16.2

The types of production service providers and types of services received by smallholder dairy agripreneurs in central Kenya are presented in Table 6.3. Majority of the respondents (84.4%) received supply of feeds support services from private veterinary clinics, which conforms to the finding of Bardhan *et al.* (2015), that majority of dairy agripreneurs in India received feed supply from private practitioners. In addition, 69.6% and 62.2% of the dairy agripreneurs were receiving artificial insemination and deworming services from private practitioners. The plausible explanation is that most of insemination and deworming services offered by public sources have high non-conception rate and service provider non-responsiveness due to limited staffing in public veterinary clinics. Due to lack of these services in the public veterinary clinics, agripreneurs opted to seek support services from private practitioners (Omondi *et al.*, 2017). Dairy cooperatives need to ensure that they supply, their members with responsive artificial and deworming services and proper staffing who would timely reach out to dairy agripreneurs.

Table 6.3. Production service providers and types of services received by dairy agripreneurs

Types of production service	Type of production service providers (%)			
	Private vet clinic	District vet clinic	NGO/project	Other, specify[a]
Curative treatment services	42.4	8.5	0.0	0.0
Artificial insemination services	69.6	11.2	0.2	0.0
Pregnancy diagnosis services	5.9	0.8	0.0	0.0
Deworming services	62.2	9.9	0.2	0.2
Vaccination services	42.1	8.6	0.2	0.0
Supply of feeds services	84.4	15.3	0.2	0.2

[a]Range of others specified included large scale dairy agripreneurs and friends

6.3.2 Choice of milk market

Table 6.4. Multinomial logit regression model outputs for the effect of agribusiness support services on choice of milk market channel in central Kenya

	Estimate Coefficients (Base outcome = Cooperative)									
Independent variables	**Middlemen/women**		**Retailers**		**Consumers**		**Marginal effects**			
	Coefficient	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Middlemen /women**	**Retailers**	**Consumers**	**Cooperatives**
Access to credit	0.1044	0.4847	0.4811	0.5096	0.2463	0.5456	0.0041	0.0364	0.0113	-0.0518
Receive business plan training	-0.9970**	0.5026	-1.7477***	0.5674	-1.2859**	0.6087	-0.0754	-0.1165	-0.0564	0.2483
Group marketing support services	-8.5474***	1.1056	-6.5312***	0.8335	-6.7128***	1.0929	-0.6336	-0.1672	-0.1329	0.9338
Curative services	-0.5194	0.4837	-0.6948	0.5067	-0.5874	0.5393	-0.0443	-0.0481	-0.0276	0.1200
AI services	-0.4236	0.6203	-0.6493	0.6474	-0.2687	0.6930	-0.0382	-0.0537	-0.0083	0.1002
Pregnancy diagnosis services	-1.2579	0.7956	-2.8411**	1.2662	-0.5086	0.9073	-0.0846	-0.0983	-0.0150	0.1979

Deworming services	-1.0046*	0.5873	0.8778	0.6577	-1.1022*	0.6336	-0.1251	0.0775	-0.0750	0.1226
Vaccination services	-0.3249	0.4756	0.8524*	0.5075	-0.3957	0.5340	-0.0424	0.0773	-0.0268	-0.0081
Supply of feeds	2.1970***	0.5779	1.0161*	0.5955	0.9525	0.6492	0.2291	0.0478	0.0306	-0.3075
Constant	3.2360***	0.8455	1.0370	0.9187	2.3282***	0.9262				
	Model fit									
	Log likelihood	- 350.96	LR $chi^2(27)$	807.62	Prob> chi2	0.0000	Pseudo R2			

Robust standard errors in parentheses *** p-value<0.01, ** p-value<0.05, * p-value<0.1

Multinomial logit regression model outputs with the corresponding marginal effects are presented in Table 6.4 with the base category was cooperative market. The estimated coefficients differed significantly across the different milk marketing outlets. Access to training in business planning had a significant and positive effect on the choice of cooperative marketing channel. In fact, training in business planning considerably reduced the probability that a dairy agripreneur would sell to middlemen/women, retailers and to consumers, relative to cooperatives by 7.5%, 11.7% and 5.6% respectively.

A plausible explanation is that access to business planning training tends to increase access to the relevant production and market information (Oleksiy *et al.*, 2013). Through business plan training, agripreneurs are empowered with knowledge in farm planning, record keeping, market information and financial management (Wongtschowski *et al.*, 2013). This, in turn, increases agripreneurs ability to be more market oriented and to seek new opportunities and stable marketing channels, such as cooperatives. Our finding is in contrary to that of Kumar *et al.* (2019), who observed that agripreneurs with agriculture training background were more likely to sell to multiple markets to diversify their risk and increase their incomes, compared to those who did not have training. However, in our scenario, dairy agripreneurs who had received training in business planning preferred the cooperative channel due to its ability to give stable prices and market. This is, considering the fact that the dairy sector in Kenya is faced with milk prices fluctuations which affects financial performance of smallholder dairy agripreneurs (Oloo, 2016). This finding illustrate that if cooperatives are able to offer business plan training to dairy agripreneurs, this would motivate the agripreneurs to sell milk to dairy cooperatives.

Access to group marketing support services had a negative effect on the dairy agripreneurs' decision to choose middlemen/women, retailers and consumers in comparison with cooperatives (Table 6.4), at significance level of 1% in all the three market choices. The finding suggests that access to group marketing decreased the probability of selling milk to middlemen/women, retailers and consumers by 63.4%, 16.7% and 13.3%, respectively. Agripreneurs accessing group support services opted to sell milk to cooperatives probably because of their stable markets and guaranteed sales. This most likely increased their incomes through greater bargaining power, which in turn probably increased the price of milk. This

finding is similar to that of Chagwiza *et al.* (2016), who found that cooperatives improved collective action among dairy agripreneurs and enabled them to access more secure markets and better prices for milk and more affordable dairy inputs.

Access to cattle pregnancy diagnosis support services had a significant negative effect ($p<0.05$) in the choice of retail marketing outlet (Table 6.4). Based on marginal effects, an increase in access to pregnancy diagnosis services reduced the likelihood of dairy agripreneurs selling milk to retailers by 9.8%, compared to the case of cooperatives. This may be attributed to the fact that most dairy cooperatives educate and offer their members this support service, by looking for veterinarian and negotiating for the members on the price of service. Pregnancy diagnosis is very vital in monitoring dairy cows' reproductive performance; however, it is costly for majority of smallholder farmers. Therefore, agripreneurs opt for cooperative since it avails pregnancy diagnosis services to its members (Kumar *et al.,* 2018). This reaffirms the need for dairy cooperatives to have the capacity to deliver this support service which could increase agripreneurs selling their milk through cooperatives.

Access to deworming support services was also had a weakly significant ($P<1\%$), yet negative influence on the choice of middlemen/women and consumers as markets for milk (Table 6.4). An increase in deworming support services lowered the likelihood of the agripreneurs selling to middlemen/women and consumers by 12.5 and 7.5%, respectively. A plausible explanation is that increase in deworming support services acted as a precautionary measure to prevent cows from worm infestation. Worms are hazardous to dairy cattle health such as suppression of nutrients, decreased milk yield, low weaning weight and decreased feed efficiency (Sharma, 2015). Cooperatives as a business organisations offer their members such essential services to cushion their animals from worm infestation. Dairy agripreneurs are, therefore, incentivised to sell to a market choice that care for their production needs, which in this case were the cooperative market channels. This finding is similar to that of Twine *et al.* (2018), who found that dairy agripreneurs opted to sell milk to cooperative due to availability of animal health services such as deworming and vaccination services. Therefore, through the access to deworming support services, it increases the likelihood of dairy agripreneurs selling milk to dairy cooperatives.

Dairy agripreneurs who received vaccination service for their cattle were more likely to sell to retailers relative to cooperatives, by about 7.7 per cent (Table 6.4). This is probably because agripreneurs who have vaccinated their cattle, were able to increase their milk yield due to increased immunity and reduced spread of disease among cattle. Many agripreneurs face the challenge of animal disease and pests which acts as stumbling blocks for increasing milk productivity in cattle in Kenya (Ngeno, 2018). Unfortunately, most of the agripreneurs in the study area had limited access to vaccination services; possibly due to poor infrastructure such as roads to reach remote villages, high cost of vaccination and poor access to good quality vaccines (Wane *et al*., 2019). In fact, dairy agripreneurs who invested in vaccination services, often sought for markets that offered quick payment and better prices in order to recover their extra investment cost, hence the choice of retailers. This was not helped by the fact that most cooperatives took long to effect payments for agripreneurs' milk, and mostly at lower than the prevailing open market price. Thus, the cooperative markets need to redesign their business model to ensure that their members receive better prices and prompt payments.

Access to supply of feeds had a positive effect on the dairy agripreneurs' decision to choose middlemen/women and retailers as milk-marketing outlets in comparison to cooperative (Table 6.4). An increase in supply of feeds increased the likelihood of dairy agripreneurs selling milk to middlemen/women and to retailers by about 22.9 and 4.8%, respectively. The biggest challenge that most agripreneurs faced was cost of production, particularly in terms of feed supply. Some agripreneurs joined cooperatives to protect themselves from this challenge, despite the presence of other markets that offered better milk prices. It is likely that if agripreneurs were able to easily access high supply of feeds, they would likely not choose cooperative as a market channel. This is because most dairy cooperative take time before they pay their members, yet majority of agripreneurs in Kenya depend on the farms as source of daily livelihood. Hence, the choice middlemen/women and retailers who offer quick payment. Kumar *et al.* (2019), found that dairy agripreneurs who had access to feeds for their animals preferred selling directly to consumer households since this market channel fetched higher prices, than selling through cooperatives.

6.4 Conclusion

The findings from this study suggest that the likelihood of selling to cooperative market channel is positively and significantly influenced by provision of business plan training, group marketing, pregnancy diagnosis and deworming support services. While access to vaccination services and supply of feeds had negative and significant effects on the choice of cooperative market channel. Taken together, these results can inform the design and targeting of policies that aim at fostering utilization of cooperative as a marketing channel for smallholder dairy agripreneurs. Strong linkages among the agribusiness support service providers and the dairy cooperatives is warranted to ensure dairy agripreneurs receive good quality, timely and consistent agribusiness support services. In addition, dairy cooperatives should redesign their business model to ensure members not only receive agribusiness support services, but also get better prices and prompt payment. This will enhance consistent supply of milk to cooperatives by smallholder dairy agripreneurs.

CHAPTER SEVEN
EFFECT OF ENTREPRENEURIAL ORIENTATIONS ON DAIRY FARMERS' AGRIPRENEURIAL RESILIENCE

Abstract

A growing interest has emerged with regard to how entrepreneurial behaviour may contribute to resilience and performance of smallholder dairy farmers. This study examined the impact of agripreneurial orientation on resilience of dairy farmers in Kenya using the partial least squares structural equation modeling (PLS-SEM). Drawing on data from 682 dairy agripreneurs, the study examined the relationship between future orientation, risk-taking orientation, social orientation and market orientation on agripreneurial resilience. The findings indicate that there is positive significant relationship between future orientation ($\beta = 0.395$, $t=12.699$, $p=0.01$), risk-taking orientation ($\beta = 0.088$, $t=2.743$, $p=0.01$) and market orientation ($\beta = 0.136$, $t=3.609$, $p=0.01$) on agripreneurial resilience. However, it was found that social orientation had a negative relationship with agripreneurial resilience ($\beta = -0.166$, $t=3.966$, $p=0.01$). The findings provide insights on the positive role of futuristic thinking, risk-taking propensity and market oriented behaviours that dairy agripreneurs could leverage to increase their resilience for better performance of their dairy agrienterprises.

Keywords: Agripreneurial orientations, Dairy agripreneurs, Resilience, Agrienterprise

7.1 Introduction

Resilience of dairy farmers has attracted global attention from researchers, policy makers and developmental agencies (Rademaker *et al.,* 2016). This is due to their low resiliency levels to cope with external shocks (Ayala & Manzano, 2014). This characteristic is worrying, given the crucial role they play in socio-economic development of Kenya (Kilelu *et al.,* 2018). Lack of capital assets, poor rural infrastructure, unsteady supply of quality animal feeds, increasing animal diseases, limited skills in dairy management and climate change create significant challenge to smallholder agripreneur success and resiliency (Mwambi *et al.,* 2018; Ngeno, 2018). Several interventions, such as access to agribusiness support services has been initiated to increase the resilience of smallholder dairy farmers (Rademaker *et al*., 2016; Oloo, 2016).

With the global competition and increasingly cost of production, dairy agripreneurs need to improve their capacity to handle stressors that are presented in the business environment (Baron *et al.,* 2016; Shadbolt & Olubode, 2013). Recent empirical evidence has demonstrated entrepreneurship is the way to trigger farm resilience and farm productivity in developing countries (Darmadji, 2016; Etriya *et al.,* 2019). According to Gellynck *et al.* (2014), farmers' entrepreneurial activity and their orientation are necessary to face the complex and multi-faceted environment in which they operate. Dayan *et al.* (2016), emphasise that willingness to change is influenced by entrepreneurial orientation. But one issue that is less examined in empirical literature is entrepreneurial orientations (EO) of farmers which may influence their performance and resilience (Dias *et al.,* 2018).

Branicki (2017), argue that entrepreneurial behavior is likely to influence small-medium enterprises (SMEs) resilience. This is supported by Dias *et al*. (2018) who emphasize that recent studies should focus on entrepreneurial behaviour of farmers. This is due to the fact that entrepreneurial orientation may enhance their recovery and transformation from shocks (Korber & McNaughton, 2018). Agripreneurial resilience is defined as the ability of dairy agripreneurs to bounce back from shocks related to business failure and be able to operate a successful and profitable agrienterprise (Shadbolt & Olubode, 2013). Scholars have emphasized the importance of entrepreneurial resilience as a key attribute that could help agripreneurs to cope with risk and uncertainty in the agribusiness environment (Ayala & Manzano 2014; Bullough *et al.,* 2014; Yang & Danes, 2015).

This is considering that, during turbulent times, entrepreneurs exhibit different attributes that are related to resilience which aid them to overcome challenges (Branicki *et al.,* 2018). Buli (2017), found that performance of business is influenced by market orientation, in relation to the ability of entrepreneur to create customer value and purse business opportunities. Furthermore, Shadbolt and Olubode (2013), recommend that, in order for individuals to adapt to uncertain situations, they need to be future oriented. Gray *et al.* (2014), argue that future oriented dairy agripreneurs are able to respond and cope with shocks which leads them to be innovators. Future orientation enables entrepreneurs to invest their resources to a project, even if they are uncertain of the future occurrence but it should be supported by their risk taking orientation (Acar *et al*., 2013).

Studies have documented the crucial role of social orientation on regulative negative shocks and challenges from the environment since they provide social capital to cope with economic pressure (Cofré-Bravo *et al.,* 2019; Salisu *et al.,* 2019). However, despite the key role of entrepreneurial orientations on resilience, this topic has received little attention in the entrepreneurship literature (Corner *et al.,* 2017; Evans & Wall, 2019; Imran *et al.,* 2018; Korsgaard *et al.,* 2015). Therefore, an empirical and theoretical focus on effect of entrepreneurial orientation on agripreneurial resilience is likely to be useful because previous studies have documented the key role of entrepreneurial orientation on performance of small-medium enterprises (Covin & Miller, 2014; Cui *et al.,* 2018; Veidal & Korneliussen, 2013).

EO is an important driver of entrepreneurial resilience (Evans & Wall, 2019). However, the relationship between EO and resilience has yet to be fully understood in the context of smallholder farmers. This paper aims to respond to this research question. Does agripreneurial orientations improve smallholder dairy farmers' resilience? To answer this research question, this study provides two contributions to entrepreneurship literature. First, the study seeks to build an integrative approach on the effect of agripreneurial orientation on agripreneurial resilience of dairy farmers. This will be through structural equation modelling between social orientation, future orientation, risk-taking orientation, market orientation and agripreneurial resilience. Second, the research design enables theory building in relation to how entrepreneurial traits and orientations has potential to build the resilience of agripreneurs in developing countries.

This paper proceeds as follows: literature review, conceptual framework, methodology, results, discussion, conclusions, contributions and policy implications.

7.2 Literature review

7.2.1 Concept of entrepreneurial resilience

Resilience can be viewed as the ability to overcome or grow in the face of adversity (Korber, & McNaughton, 2017). Loh and Dahesihsari (2013), states that resilient entrepreneurs can be portrayed as individuals thriving in hardship despite restrictive political, economic, social and technological challenges. It also connotes persistence or hardiness in the face of absent success or ability to venture again after failures (Korber & McNaughton, 2017). Hmieleski *et al.*

(2015), psychologically conceptualized entrepreneurial resilience as a collection of several personality attributes such as optimism, internal locus of control, flexibility, perseverance, tolerance to ambiguity and self-efficiency. It is thus an adoptive process of continuous transformation and learning the aftermath of disruption (Saridakis *et al.*, 2013). This study adopted the Connor-Davidson Resilience Scale (CD-RISC) which measures these attributes using 10 items (Connor & Davidson, 2003).

Evans and Wall (2019), states that entrepreneurial resilience may be exhibited in three forms; buffer, adaptive and transformability capacity. Buffer capacity is the ability of entrepreneur to maintain stable production in face of shocks, adaptive capacity is the ability of entrepreneur to acclimatize with shocks through engagement in behaviours that mitigate the shocks such as group membership (Ngeno, 2018). According to Shadbolt and Olubode Awosola (2013), adaptive resilience focuses on responses during and after disruption. Resilient entrepreneurs are able to absorb the hostile situations, even as they are aware, and in turn think of what necessary activities of adaptive transformation be done in order to survive in the long period (Sabatino, 2016). Finally, transformative capacity is the ability of entrepreneur to diversify their enterprise to more profitable ones such as changing from dairy to poultry farming (Shadbolt & Olubode Awosola, 2013). In reference to Ayala and Manzano (2014), transformative resilience equips one with the ability to deal with disruptions thus predicting entrepreneurial success. Hmieleski *et al.* (2015), adds that resilience leads to higher payoffs in challenging environments.

Entrepreneurial resilience may be improved by providing financial support as in microfinance institutions, or training (Ngoasong & Kimbu, 2016), or through training and mentoring programs that can adversely enhance crisis management skills or business insights of entrepreneurs (Ghosh & Rajaram, 2015). Branicki *et al.* (2018), stated that SMEs should leverage on their personal characteristics and relationships to build resilience. Various interventions have been initiated to improve the resilience of smallholder dairy agripreneurs. This include training in agripreneurship to improve their entrepreneurial behaviour, collective action to increase market access and credit linked-inputs to increase their productivity and income (Rademaker *et al.*, 2016). This study seeks to determine the effect of entrepreneurial orientations on dairy farmers' agripreneurial resilience.

7.2.2 Effect of entrepreneurial orientation on entrepreneurial resilience

7.2.2.1 Social orientation and entrepreneurial resilience

Social orientations are behavioural attributes such as trust, norms and networks that an entrepreneur exhibits which can serve as linkages to access resources especially at tough economic times through families and friends (Salisu *et al*., 2019). Social orientation provides social capital which is crucial especially during crisis (Aldrich & Meyer, 2015), since it aids in accessing information and finance support (Micheels & Nolan, 2016). Further, it provides emotional and psychological support in critical times such as loss of properties, loss of lives and insecurities in an individual's life (Fisher, 2013; Tregear & Cooper, 2016).

Social oriented farmers' benefits from three aspects of social capital; bonding, bridging and linking social capital (Cofré-Bravo *et al.,* 2019). Bonding social capital emanates from family members and community while linking and bridging social capital are aids that come from external sources such as cooperatives, private and public institutions. Through bridging and linking social capital, farmers have a greater absorptive capacity which may enhance their resilience (Micheels & Nolan, 2016). This is because they have a wider network to exchange knowledge and skills, financial resources and technologies (Ruiu *et al.*, 2017; Saint Ville *et al.,* 2016)

A highly social oriented entrepreneur is at a better position to improve the performance business through social networks (Martínez-Pérez *et al.,* 2016). Evans and Wall (2019), also asserts the resilience level of entrepreneurs increases if they have people such as family members and friends who can support them during grief and business failure. This is also supported by Olawuyi (2019), how stated social networks may help to build resilience of smallholder rural farmers. Despite these benefits, some studies (Cofré-Bravo *et al.,* 2019; Treagar & Cooper, 2016), have demonstrated the negative effects of social capital. For example, entrepreneur who is socially oriented through bonding social capital could prevent access to knowledge and resources from other networks, like-wise linking social capital is concentrated on specific people which could limit access to information to other members (Cofré-Bravo *et al.,* 2019). Previous studies and policy makers have concentrated on physical capital as avenues to increase resilience of SMEs with limited empirical studies on the impact

of social capital in driving resilience (Cardon & Patel, 2015). To the best of our knowledge, only one study has investigated the effect of social orientation on resilience. Salisu *et al*. (2019), found social orientation positively influence entrepreneurial resilience. Therefore, this study hypothesizes the following:

Hypothesis 1. Social orientation is positively associated with agripreneurial resilience of dairy farmers.

7.2.2.2 Future orientation and entrepreneurial resilience

Future orientation is the ability of entrepreneur to be future thinking through proper planning and budgeting (Caliendo *et al.*, 2014). This behavioural attribute not only influence decision making process which is related present and future actions but also the performance of SMEs (Didonet *et al.,* 2019). Dairy agripreneurs operate in a very dynamic business environment with many risk factors which compel them to be futuristic agripreneurs (Shadbolt *et al.*, 2013). Thus, future outlook entails an agripreneur developing a strategic foresight ability which could enable him to explore all the future challenges and opportunities presented in the business.

But one issue that is less examined in empirical literature is EO of farmers which may influence their performance and resilience (Dias *et al.,* 2018). There is dearth of empirical literature on the role of EO on resilience of entrepreneurs. Miska *et al.* (2018), found future orientation propels entrepreneurs to venture into sustainable initiatives. Franco *et al*. (2020), found SMEs are more resilient when they are future oriented. This is also supported by Sulphey (2020), who found future orientation positively influence resilience of SMEs. Most of these studies have been conducted on non-agricultural SMEs and given the key role of agripreneurs, this study sought to test this hypothesis:

Hypothesis 2. Future orientation is positively associated with agripreneurial resilience of dairy farmers.

7.2.2.3 Risk-taking orientation and entrepreneurial resilience

According to Shepherd *et al.* (2015), agripreneurial risk taking orientation is the ability to engage in behaviour which has a likelihood of negative or positive outcome. This may through investing in new machinery, penetrating new markets or even borrowing money to achieve a

certain goal. High risk-taking orientation, motivates entrepreneurs to venture into unknown environments (Ferreira *et al.*, 2015). They further argue that risk-taking propensity depends on personality and demographic characteristics of the individual. Risk orientation gives entrepreneurs an opportunity to understand the kind of risks they will face in managing the business and possible risk management strategies. It enables them to come up with strategic plans acts as reference and guiding tool when faced with uncertain circumstances (Khedhaouria *et al.*, 2015). A high risk oriented entrepreneur will seek out opportunities to maximize profits even in risky situation thereby influence their resilience.

Pervez *et al.* (2016), found that farmers in developing countries are exposed to many risks and uncertainties, which makes them less resilient (Falkowski, 2015). Shadbolt *et al.* (2013), also emphasise that managing risk is a major challenge for dairy farmers if they want to be resilient in their agrienterprises. Smallholder farmers need high risk-taking orientation in order to overcome challenges in business environment and improve their performance (Ferreira *et al.*, 2015). However, Pindado and Sánchez, (2017), found that low risk taking orientation of smallholder farmers hinders them from exploiting business opportunities. Ferreira *et al.* (2015), found that agripreneurial farmers seek risk-taking orientation as a channel to improve their performance. Fahim and Bin (2017), also found that RO has positive influence on performance of SMEs. But there is limited empirical evidence on the effect of risk-taking orientation on resilience of agripreneurs. In line with such theoretical arguments, and inconsistent with Sulphey (2020), who empirically confirmed a non-significant effect risk-taking orientation on resilience, we propose the following:

Hypothesis 3. Risk-taking orientation is positively associated with agripreneurial resilience of dairy farmers.

7.2.2.4 Market orientation and entrepreneurial resilience

Market orientation (MO) is the degree to which an agripreneur understands the tastes and preferences of the consumers and they have linkages with other actors in the value chain which makes them able to have competitive edge over competitors (Julian *et al.*, 2014). According to Bamfo and Kraa (2019), market-oriented behaviors include three orientations: competitor orientation, customer orientation and inter-functional linkages. A strong market orientation

enables entrepreneur to understand the customers and allow them to deliver value to target customers (Frösén *et al.,* 2016). A market-oriented agripreneur' focus should ultimately be to satisfy the needs of the consumers and strategically coordinate with all actors in the value chain (Didonet *et al.,* 2016). Ho *et al*. (2017), emphasize the behavioral aspects of market oriented agripreneurs, should be organized in a manner that they focus on the current and future customer needs in order to benefit from their agribusiness.

MO may help smallholder dairy agripreneurs to focus on consumers and competitors and provides them with way forward to improve their resilience (Mwambi *et al.,* 2018). With some exceptions (Ho *et al.,* 2017), the empirical evidence finds a positive and significant relationship between market orientation and performance of SMEs (Al-Ansary *et al.,* 2015; Didonet *et al.,* 2019; Frösén *et al.,* 2016; Keskin, 2015; Lansiluoto *et al.,* 2019). Market orientation is largely neglected in the context of smallholding farming literature (Ho *et al.,* 2017). This is despite the fact that MO may facilitate improvement of productivity and enhanced linkage between different actors in a value chain; thus increasing long-term competitive advantage (Didonet *et al.,* 2016).

The limited empirical literature on this issue reports that MO is not associated with performance of smallholder farmers (Ho *et al.,* 2017). Documented evidence in developed countries indicate that MO is long-term approach which improves resilience of SMEs especially in the dynamic business environment. (Keskin, 2015; Lansiluoto *et al.,* 2019). According to Najafi-Tavani *et al.* (2016) and Jogaratnam (2017), market orientation is key in enhancing profitability and sustainability of small-medium enterprises. However, limited studies have focused on role of market orientation on agripreneurial resilience. Therefore, we propose the following:

Hypothesis 4. Market orientation is positively associated with agripreneurial resilience of dairy farmers.

7.3 Conceptual framework

The conceptual framework that was used to analyze the direct effect of agripreneurial orientation on agripreneurial resilience of dairy agripreneurs is shown in Figure 1. The

independent variables were future, risk-taking, social and market orientation; which were assumed to have a direct effect on the agripreneurial resilience (dependent variable).

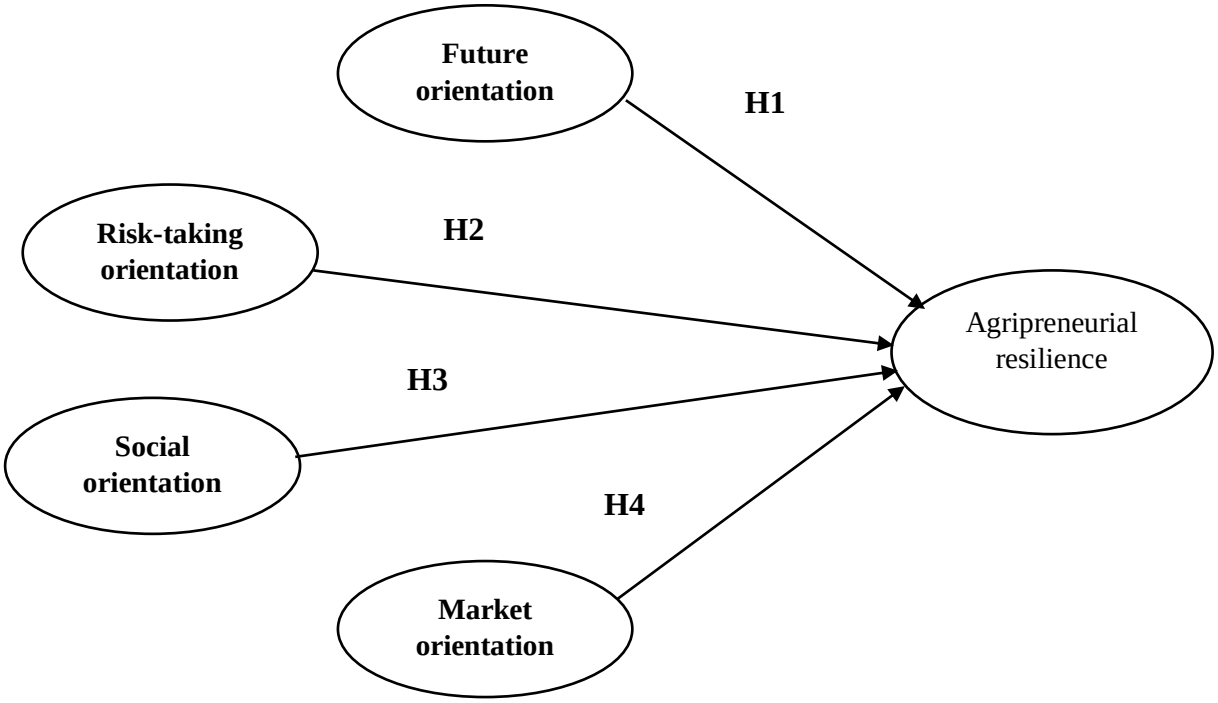

Figure 7.1. Proposed research model for effect of agripreneurial orientation on agripreneurial resilience of dairy agripreneurs

7.4 Methodology

This paper is based on a survey of dairy agripreneurs in four sub-counties of Murang'a County, Kenya. Multistage sampling technique was used to get the respondents. A semi-structured questionnaire was used to collect information from 682 dairy agripreneurs between 4th January and 14th February 2020. The information collected from the questionnaire consisted of socio-economic attributes of the dairy agripreneurs, perception of the dairy agripreneurs in relation to entrepreneurial orientation (future, risk-taking, social and market) and resilience constructs. The data were analysed using Partial Least Square Structural Equation Modelling (PLS-SEM) using SmartPLS version 3 software.

7.4.1 Variables' measurement

7.4.1.1 Dependent variable

The Connor-Davidson Resilience Scale (CD-RISC) was used to measure agripreneurial resilience. the study used (Connor & Davidson, 2003). Subjective measures of resilience have been used frequently in entrepreneurship studies (Korber & McNaughton, 2018; Salisu *et al*., 2019; Shadbolt & Olubode Awosola, 2013), since they capture valid, reliable and holistic measurement of the construct. In addition, there is a strong correlation between subjective and objective measurement of resilience (Manzano & Ayala, 2013). This scale consists of 10 items with a 5-point range of response (0=not true at all, 1=rarely true, 2=sometimes true, 3=often true and 4=true nearly all of the time). The specific items in the scale included; i) I am able to adapt to change, ii) I can deal with whatever comes my way, iii) I always try to see the humorous side of things, iv) Coping with stress strengthens me, v) I tend to bounce back after a hardship or illness, vi) I can achieve my goals despite obstacles, vii) I can stay focused under pressure, viii) I am not easily discouraged by failure, ix) I think of myself as a strong person and x) I can handle unpleasant feelings. Responses were subjected to how the dairy agripreneur felt over the past 12 months.

7.4.1.2 Independent variables

Since we wanted to analyze the individual effects of future orientation, risk-taking orientation, social orientation and market orientation on agripreneurial resilience, we treated entrepreneurial orientation (EO) as a disaggregated set of constructs. The variable measurements were carefully chosen from the existing scales in the literature. The researchers altered some items to suit the purpose and context of this study. Social-capital was measured using Hajong (2014), Market orientation was measured using the Ho *et al.* (2017), scale. The market orientation scale focused on three dimensions; customer orientation, competitor orientation and inter-functional coordination. Future orientation scales was measured, based on the works by López-Mosquera *et al.* (2014). In measurement of risk taking orientation we adopted the measurement used by Lai *et al*. (2017). In total, the EO dimensions were measured using the 18-item scale, whereby 6 items were used to measure social orientation, 13 items for

market orientation, 6 items for future orientation and 5 items for measuring risk-taking orientation.

7.4.2 Analytical estimation effect of entrepreneurial orientations on agripreneurial resilience

As indicated, all the constructs of EO and resilience were measured using likert-type five point scales. Since the dependent and independent variables were unobserved, this study used Partial Least Square-Structural Equation Modelling (PLS-SEM) to test the hypotheses. The survey items were evaluated using confirmatory factor analysis (CFA). This is because the items used were already established from previous studies hence exploratory factor analysis was not suitable. The five latent variables (AR, FO, MO, SO and RO) were included in the model. The standardized root mean square residual (SRMR) was used to assess the model fit. In addition, validity tests (convergent and discriminant) were conducted on the constructs. Convergent validity was measured using Cronbach's alpha (CA), rho_A, Composite Reliability (CR) and Average Variance Extracted (AVE) while discriminant validity was assessed using Cross Loadings Test, AVE-SV (Fornell-Larcker Criterion Test) and Heterotrait-Monotrait (HTMT) Ratio Matrix.

Once the tests were conducted, simultaneous multiple regression analysis was conducted on variables, through path analysis to test the direct effects of the constructs. The general model is represented by the following equations consisting of measurement and structural models:

$$Y = v + \Lambda n + \varepsilon \quad (1)$$

$$\eta = \alpha + B\eta + \xi \quad (2)$$

where Y is the vector of p observed variables in a considered study (p >1), ν the p × 1 vector of observed variable mean intercepts, Λ is the $p \times q$ matrix of factor loadings, η is the of q x 1 latent factors assumed in it ($q > 0$), ε the vector of p pertinent residuals (error terms), α is the $q \times 1$ vector of latent variable intercepts, B is a q x q matrix of latent regression coefficients and ξ is the $q \times 1$ vector of corresponding latent disturbance terms.

Based on the general equation (1) and (2), the following structural equation model for the four factors namely; social-capital/linkages(ξ_1), market orientation(ξ_2), future orientation (ξ_3) and risk taking orientation (ξ_4) with manifest endogenous variable agripreneurial resilience (Y_1) was given in the following structural equation models:

$$Y_1 = \alpha_1 + \beta_{11}\xi_1 + \beta_{12}\xi_2 + \beta_{13}\xi_3 + \beta_{14}\xi_4 + e_1 \quad (3)$$

The general matrix expression is given in the following equation:

$$Y_1 = \alpha_1 + \Gamma_1\xi_1 + e_1 \quad (4)$$

where;

$$\Gamma_1 = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}), \text{ and } \xi_1 = (\xi_1, \xi_2, \xi_3, \xi_4)$$

In the above equation (4) Y_1 manifest endogenous variables (AR), α_1 is the latent intercepts, Γ_1 are the coefficient vectors for the linear effects of n latent predictors, ξ_1 are the latent factors and finally e_1 is the latent disturbance

7.5 Results

7.5.1 Descriptive statistics of respondents

In terms of the sex of the household head, results in (Table 7.1) show majority (70.4%) of the dairy household heads were male while female accounted 29.6%. Sex has implication on the roles and responsibilities in the society, and therefore can influence households' resilience levels. Male headed households, have higher access to productive resources and information that increases chances of engaging in dairy farming (Machina & Lubungu, 2018). Education level of the household head was broken down into six categories, no formal education, adult education, primary, secondary, college education and university education. Majority (44.4%) of the dairy agripreneurs had attained primary education, followed by 31.7% with secondary education and only 2.3% of the respondents had attained the university education. These results indicate low levels of literacy among the respondents despite the fact that access to education

could increase the working efficiency resulting into more income and resiliency (Park *et al.*, 2014).

The finding show that the sample composed of middle aged farmers with an average age of around 55.6 years. In relation to experience in dairy farming, the minimum years of experience was found to be 1 year while maximum was 60 years with a mean of 18 years. This supports the findings on age that dairy farming is practiced by middle aged farmers who are highly experienced. The results imply that dairy farmers stay longer in this enterprise and it needs resilience to have a sustainable dairy enterprise. Household sizes ranged between 1 and 7 persons per household, with an average of 3.43 persons per household. Availability of family labour in dairy farming households plays a key role in rural agricultural systems, as noted by Kumar *et al.* (2018). Finally, the mean land size under dairy farming was 1.3 acres.

Table 7.1. Sample demographic profile of respondents

Categorical variables		**Frequency**	**Percentage (%)**
Sex	Male	480	70.4
	Female	202	29.6
Education levels	No formal education	34	5.0
	Adult education	5	0.7
	Primary education	303	44.4
	Secondary education	216	31.7
	College education	108	15.8
	University education	16	2.3

Continuous Variable	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	21.0	100.0	55.6	13.7
Experience	1.0	60.0	18.8	12.9
Household size	1.0	7.0	3.4	1.3
Land size	0.1	9.0	1.3	1.2

7.5.2 Model fit for partial least squares structural equation modelling

As presented in Table 7.2, the standardized root mean square residual (SRMR) value was 0.077, which is less than 0.08 as presented in Table 7.2. Hence, the model fitted well (Hair *et al.,* 2017).

Table 7.2 Model fit test results

Criteria	Saturated Model	Estimated Model
SRMR	0.077	0.077
d_ULS	4.662	4.662
d_G	1.373	1.373
Chi-Square	5147.819	5147.819
NFI	0.692	0.692

Note: SRMR=Standardized Root Mean Square Residual; d_ULS=Squared Euclidean Distance; d_G= Geodesic Distance (d_ULS and d_G are exact fit measures) and NFI=Normed Fit Index

7.5.3 Measurement (outer) model of structural equation

To assess the outer model of structural equation, the study determined individual item and internal consistency reliability, convergent and discriminant validity. As presented in Table 7.3, Cronbach's alpha (CA) ranged from 0.778 to 0.895, rho_A ranged between 0.831 and 0.9 and composite reliability (CR) ranged between 0.766 and 0.908. These thresholds exceed the minimum standard level of 0.70, hence internal consistency reliability was achieved. Convergent validity was also assessed by assessing average variance extracted (AVE) and the values exceed the threshold of 0.4 (Hair *et al.,* 2017).

Table 7.3 Descriptive statistics, Reliability and validity tests

Constructs	Items	CA	rho_A	CR	AVE	VIF
Agripreneurial resilience	9	0.861	0.867	0.89	0.475	
Future orientation	6	0.895	0.897	0.92	0.66	1.041
Market orientation	13	0.891	0.9	0.908	0.436	1.299
Social orientation	6	0.778	0.827	0.766	0.502	1.323
Risk-taking orientation	5	0.814	0.831	0.869	0.573	1.01

To test collinearity among the constructs, variance inflation factor (VIF) was used and the results in Table 7.3 indicate that the values were are less than the cut-off value of <5, indicating there was no multicollinearity among the variables (Henseler *et al.*, 2015).

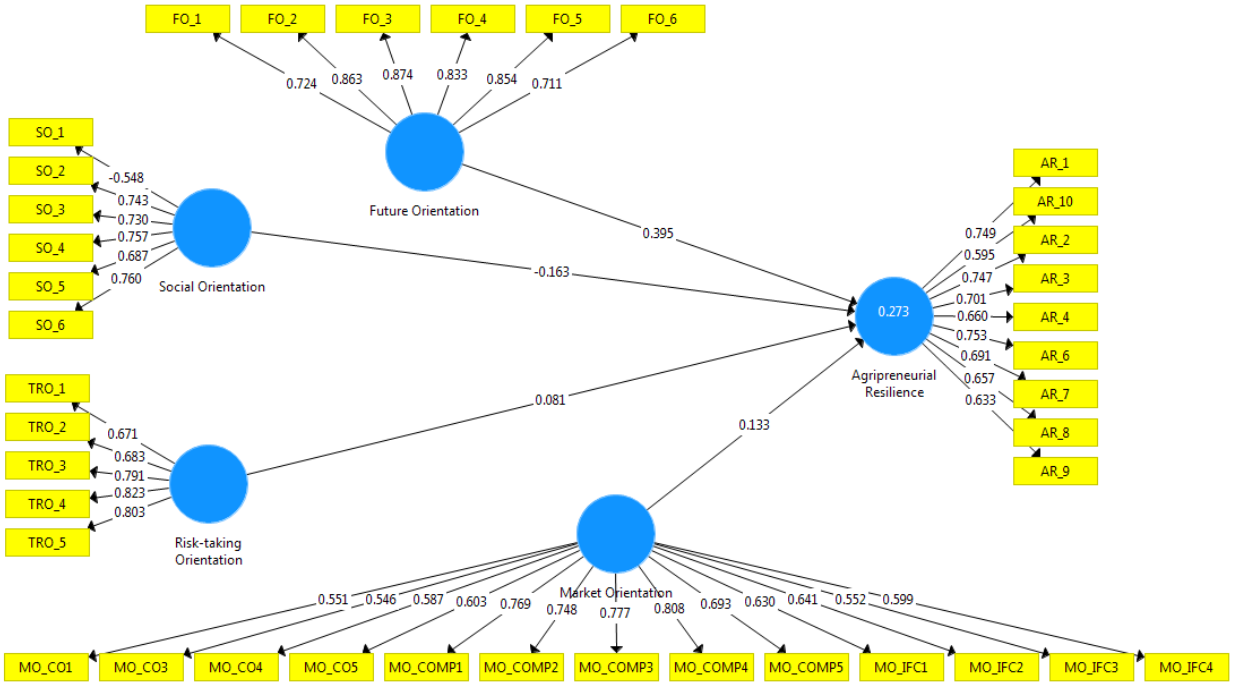

Figure 7.2. Measurement model for direct effects of agripreneurial orientation on agripreneurial resilience

The results on cross loading test is presented in Table 7.4 and figure 7.2. The findings show that all the bold values of the loading exceeded the suggested threshold of 0.50 and above, hence all the constructs had discriminant validity (Henseler *et al.*, 2015).

Table 7.4. Cross loading Test for constructs of agripreneurial orientation and resilience

Constructs	Agripreneurial Resilience	Future Orientation	Market Orientation	Risk-taking Orientation	Social Orientation
AR_1	**0.749**	0.303	0.200	0.106	-0.241
AR_2	**0.747**	0.357	0.262	0.089	-0.23
AR_3	**0.701**	0.355	0.197	0.12	-0.239
AR_4	**0.660**	0.246	0.206	0.056	-0.265
AR_6	**0.753**	0.359	0.176	0.099	-0.225
AR_7	**0.691**	0.277	0.107	0.01	-0.12
AR_8	**0.657**	0.27	0.231	0.068	-0.24

AR_9	**0.633**	0.298	0.121	0.11	-0.149
AR_10	**0.595**	0.279	0.168	0.025	-0.169
FO_1	0.417	**0.724**	0.231	0.039	-0.238
FO_2	0.352	**0.863**	0.085	0.041	-0.133
FO_3	0.341	**0.874**	0.085	0.025	-0.126
FO_4	0.292	**0.833**	0.061	-0.027	-0.123
FO_5	0.382	**0.854**	0.137	0.036	-0.13
FO_6	0.354	**0.711**	0.077	-0.007	-0.133
MO_CO1	0.158	0.089	**0.551**	0.013	-0.164
MO_CO3	0.211	0.163	**0.546**	-0.029	-0.164
MO_CO4	0.075	0.104	**0.587**	0.01	-0.282
MO_CO5	0.131	0.095	**0.603**	-0.022	-0.224
MO_COMP1	0.204	0.107	**0.769**	0.09	-0.424
MO_COMP2	0.183	0.086	**0.748**	0.078	-0.425
MO_COMP3	0.171	0.062	**0.777**	0.074	-0.46
MO_COMP4	0.191	0.081	**0.808**	0.079	-0.465
MO_COMP5	0.268	0.063	**0.693**	0.139	-0.355
MO_IFC1	0.184	0.106	**0.63**	-0.041	-0.318
MO_IFC2	0.118	0.076	**0.641**	0.031	-0.224
MO_IFC3	0.182	0.155	**0.552**	0.033	-0.212
MO_IFC4	0.084	0.054	**0.599**	-0.02	-0.246
TRO_1	0.077	0.029	0.004	**0.671**	-0.046
TRO_2	0.056	0.043	0.048	**0.683**	-0.057
TRO_3	0.1	0.022	0.063	**0.791**	-0.087
TRO_4	0.092	0.015	0.033	**0.823**	-0.079
TRO_5	0.099	-0.002	0.085	**0.803**	-0.085
SO_1	0.333	0.224	0.119	0.075	**-0.548**
SO_2	-0.111	-0.115	-0.408	-0.037	**0.743**
SO_3	-0.134	-0.069	-0.433	-0.057	**0.73**
SO_4	-0.187	-0.111	-0.474	-0.056	**0.757**
SO_5	-0.146	-0.011	-0.349	-0.099	**0.687**
SO_6	-0.166	-0.103	-0.392	-0.051	**0.76**

Using the AVE-SV technique in Table 7.5, the constructs also passed discriminant validity test as the diagonal values were greater than the horizontal and vertical values (Henseler *et al*., 2015; Hair *et al*., 2017).

Table 7.5. Fornell-Larcker Criterion Test

Constructs	Agripreneurial Resilience	Future Orientation	Market Orientation	Risk-taking Orientation	Social Orientation
Agripreneurial Resilience	0.689				
Future Orientation	0.447	0.812			
Market Orientation	0.274	0.147	0.66		
Risk-taking Orientation	0.115	0.025	0.064	0.757	
Social Orientation	-0.308	-0.186	-0.476	-0.096	0.708

Finally, using the HTMT ratio test, the values in Table 7.6 were less than 0.85 thus indicating discriminant validity (Hair *et al*., 2017). In summary, based on the results of convergent and discriminant validity, it can be concluded that the data used in the study are reliable and valid to prove the hypotheses with SmartPLS-SEM.

Table 7.6. Heterotrait-Monotrait (HTMT) Ratio

Constructs	Future Orientation	Market Orientation	Risk-taking Orientation	Social Orientation
Future Orientation	0.497			
Market Orientation	0.288	0.158		
Risk-taking Orientation	0.13	0.05	0.098	

Social Orientation	0.296	0.173	0.574	0.103

7.6. Hypotheses testing

7.6.1 Testing of direct effect between agripreneurial orientation and agripreneurial resilience

Based on the proposed model presented in the conceptual framework, hypothesis testing was performed through structural equation modelling and the results are presented in Figure 3 and Table 7.7 The results show that future orientation, market orientation, risk-taking orientation and social orientation had a significant relationship with agripreneurial resilience. There was significant positive relationship between future orientation (β = 0.395, t=12.699, p=0.000), market orientation (β = 0.136, t=3.609, p=0.000), risk-taking orientation (β = 0.088, t=2.743, p=0.008) with agripreneurial resilience. However, the relationship between social orientation and agripreneurial resilience was negative (β = -0.166, t=3.966, p=0.000).

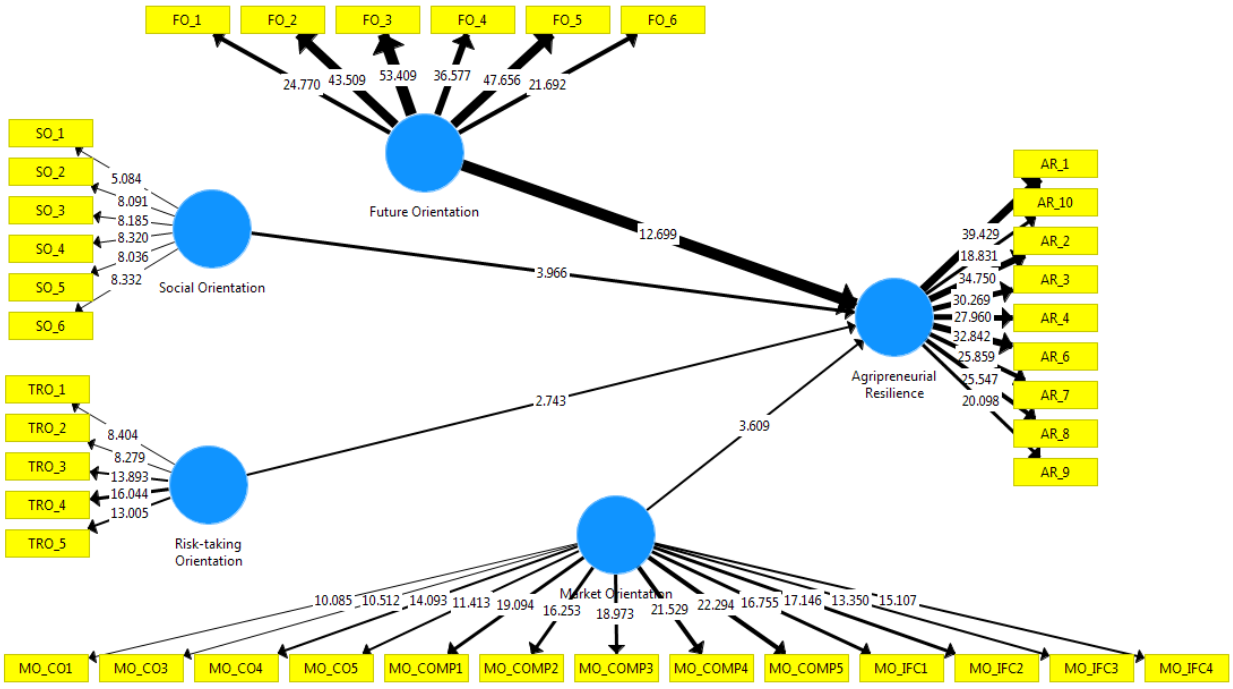

Figure 7.3. Structural Model of the relationship between agripreneurial orientation and agripreneurial resilience

Table 7.7. Path coefficients of direct effects of entrepreneurial orientations on agripreneurial resilience

Path relationship/Hypotheses	Std. Beta	SE	t-values	p-values	Decision	F^2	Q^2
H1: Future Orientation -> Agripreneurial Resilience	0.395	0.031	12.699**	0.000	Supported	0.201	0.080
H2: Risk-taking Orientation -> Agripreneurial Resilience	0.088	0.03	2.743***	0.000	Supported	0.010	0.002
H3: Social Orientation -> Agripreneurial Resilience	-0.166	0.041	3.966***	0.006	Supported	0.019	0.007
H4: Market Orientation -> Agripreneurial Resilience	0.136	0.037	3.609***	0.000	Supported	0.028	0.010

***p<0.01

- R^2 (Resilience=0.273); Effect size impact indicator are according to Cohen (1988), F^2 values: 0.35 (large), 0.15 (medium) and 0.01 (small)
- Q^2 (Resilience=0.124); Predictive relevance (Q^2) of predictor exogenous latent variables as according to Henseler *et al*. (2015), Q^2 values 0.35 (large), 0.15 (medium) and 0.01 (small).

7.6.2 Assessment of effect size and predictive power of the constructs

The outer model of the structural equation was assessed using the explanatory and predictive power of the constructs. This included determination of coefficient of determination (R^2), effect size (f^2), path coefficient (β) and predictive relevance (Q^2) and the results are presented in Table 7.7. In relation to coefficient of determination (R^2), future orientation, market orientation, risk-taking orientation and social orientation explained 27.3% of total variance in agripreneurial resilience. This means that there are other factors that influence agripreneurial resilience but they were not included in the model. For the effect size (f^2), future orientation contributed more to R^2 (0.201), followed by market orientation (0.028), then social orientation (0.019) and finally risk-taking orientation (0.010). Future orientation had moderate effect size while the other orientations (Market orientation, Risk-taking orientation and Social orientation) had small effect size (Hair *et al*., 2011). Finally, the predictive relevance (Q^2) was determined using the blindfolding procedure in PLS-SEM version 3. According to Hair *et al*. (2017), the Q^2 should be greater than zero which means that the predictor variable possesses

the predictive relevance for the criterion variable. The Q^2 values of agripreneurial resilience was 0.124 which signifies that the research model has good predictive relevance.

7.7 Discussion of findings

The objective of this study was to determine the effect of each individual dimension of AO (FO, RO, SO and MO) on AR. The influence of each dimension on AR was represented by hypothesis H1, H2, H3 and H4. The statistical results reveal a direct significant, both positive and negative relationship between each AO constructs and AR.

7.7.1 The effect of future orientation on agripreneurial resilience (H1)

Future orientation was hypothesized to be positively associated with agripreneurial resilience. Our results suggest that, the more future oriented a dairy agripreneur is, the more persistent, ambitious and positive he or she will be in running the dairy farm business. This confirms the positive impact of future orientation on agripreneurial resilience. Thus, dairy agripreneurs need to be focused on the long term results, this is through proper planning which may positively influence their resilience. In case of negative events they will be able to adapt and withstand hence prompting the adaptive resilience behaviour (Andre *et al.*, 2018). This finding is in conformity with Lens (2015), who found future oriented individual have more adaptive outcomes when confronted with shocks from external environment.

7.7.3 The effect of risk-taking orientation on agripreneurial resilience (H2)

The findings on the effect agripreneurial risk taking orientation on resilience indicated that risk-taking orientation strengthened the relationship. This imply that the more risk seeking agripreneurs, the more they are likely to adapt and cope with risk and uncertainties in the business environment. This result also confirms that, the more risk-seeking an agripreneur is, the more they are able to build resilient farm strategies (Gray *et al.*, 2014). This may be through investment in backward and forward linkages, cultivation and formulation of their own feeds and increased governance in value chains through cooperative business models (Mwambi *et al.*, 2018). This result is similar with Shadbolt and Olubode Awosola (2013), who found high risk seeking dairy farmers were more likely to reap the benefits of uncertainty and improves their farm resilience. But not consistent with Sulphey (2020), who found a non-significant effect risk-taking orientation on resilience.

7.7.4 The effect of social orientation on agripreneurial resilience (H3)

Social orientation was hypothesized to be positively associated with agripreneurial resilience, but our results do not support this hypothesis, since social orientation was found to have a significantly negative influence on agripreneurial resilience. This results confirms that dependency on family members, friends and relatives in running a business, lower the likelihood that dairy agripreneurs can absorb shocks and bounce back. This could possibly because of the enterprising nature of majority of these dairy agrienterprises who were high self-driven with little dependency on other people. Thus, for smallholder dairy agripreneurs to sustainably operate their enterprise, they should invest more of their time and resources. This results provide clear evidence the more smallholder dairy agripreneurs are committed, the more they are likely to adapt and transform their business profitably. This finding is contrary to Salisu *et al.* (2019) and Hedner *et al*. (2011), who found high social orientation increases entrepreneurial resilience.

7.7.2 The effect of market orientation on agripreneurial resilience (H4)

The relationship between market orientation and agripreneurial resilience was found to be positively and statistically significant. This suggests that market orientation is an accepted means of enhancing agripreneurial resiliency. This could be because, by the virtue that dairy agripreneur knows what the customers want, what competitors are doing and good organizational structure, they are able to improve their personal competence and standards of product which is an element of buffer capacity. A market oriented farmer also has some element of adaptive capacity and transformative capacity (Ho *et al*., 2017). Adaptive capability is reflected where a market oriented farmer is involved in group marketing to cope with unstable milk market and prices environment while transformative capability is reflected in the diversification of enterprises. These three elements are key in building agripreneurial resilience, through a clear market orientation. Market-oriented agripreneurs focus on information use, learning, and behavioral change which is likely to enhance resilience (Najafi-Tavani *et al.,* 2016).

7.8 Conclusion

The results of the structural equation model showed that agripreneurial orientation was an antecedent to agripreneurial resilience. More explicitly, future orientation, risk-taking orientation and market orientation had a positive effect on agripreneurial resilience, while social orientation had a negative effect on agripreneurial resilience. It can be concluded that, market oriented farmers are more resilient since they are more focused on quality and satisfying their customers. Futuristic and risk-taking agripreneurs are also more resilient since they have high expectations with future outcomes of the business. Hence, they can take the risk of investing in high yielding cows and purchase of equipment and inputs with anticipation of good returns. Therefore, when dairy agripreneurs are highly future oriented, market oriented and risk-taking oriented, they are more likely to absorb shocks and bounce back when faced with difficult situation in the agrienterprises. However, social oriented agripreneurs are less likely to be resilient due to unpredictability on human behaviour especially if one depends on external sources. Successful resilience depends on individuals' commitment, zeal and ambition to expand and grow the agrienterprise. These findings advance the understanding of the behavioural attributes and how they impact on resilience of dairy farmers within developing countries.

7.9 Contributions

The major contribution of this study is the modeling of agripreneurial orientations and agripreneurial resilience under one framework, which is something that has not been well researched. It empirically establishes the direct effects of market orientation, future orientation, risk-taking orientation and social orientation on resilience of dairy agripreneurs. Findings from this research practically indicates that the orientation of the farmers will significantly increase or reduce their resilience. It is essential for dairy agripreneurs to be more risk-seeking, market oriented and orient their thinking and actions on the future since it will influence their decision-making and resilience. In connection to contribution on theory development, this study presents evidenced based approach on how agripreneurial orientation could enhance resilience especially for agripreneurs in developing countries.

7.10 Implications

7.10.1 Theoretical implications

Although many studies have examined the effects of entrepreneurial orientations on performance of small and medium businesses, very little research has focused on agripreneurial orientation especially the farming community in sub-Saharan Africa countries. In addition, to the best of our knowledge, no study has attempted to combine, measure and empirically test effect of future orientation, risk-taking orientation, market orientation and social orientation on entrepreneurial resilience. As such, this is a noteworthy effort to integrate these constructs into a single model and determine their relatedness. Therefore, the main theoretical implication of this paper is to show how future orientation, risk-taking orientation, market orientation and social orientation of dairy agripreneurs could have a direct effect on their agripreneurial resilience.

The study revealed the significant positive effect of future orientation, risk-taking orientation, market orientation on agripreneurial resilience. This imply that future oriented, risk-taking and market oriented agripreneur, are able to consider future opportunities and threats in the market that are likely to impact their dairy enterprises. The study further contributes to the entrepreneurial resilience literature by explaining how social orientation negatively influence agripreneurial resilience which is contrary to previous studies. But this contributes to explaining how cross-cultural and contextual factors explain the resilience of individuals. The finding of this study greatly enrich the entrepreneurship literature especially in the context of smallholder dairy farmers by offering empirical evidence on role of agripreneurial orientation and agripreneurial resilience. Hence, contributing to body of knowledge by adding to literature the role of personality attributes on entrepreneurial resilience.

7.10.2 Managerial implications

In relation to managerial implications, the results of this study could offer important policy guidelines that can be used to upgrade the dairy value chain in Kenya and other developing countries. Lack of clear risk-taking, market, future, social orientation can hinder the development of agripreneurial resilience and chain performance. Therefore, policies should be focused on enhancing resilience of dairy agripreneurs through business capacity building

programmes to promote agripreneurs awareness of customers' needs and wants. This can be achieved by strengthening smallholder agripreneurs' competitive intelligence by understanding the strengths and weakness of their competitors and how they could improve their skills and knowledge. Development policies should also focus on empowering smallholder agripreneurs control of activities in the chain by supporting farmer groups and intra-chain linkages such as making of feeds, value addition of milk and infrastructural linkages such as roads and innovations in information and communications technologies such mobile phone connectivity could also expedite the agripreneurial orientation and resilience of dairy farmers. This can only be achieved through friendly and supportive business environment. The study also provides important strategic guidelines for dairy agripreneurs. The findings of this study should help dairy agripreneurs address agripreneurial resilience, which has emerged as a major issue (Gray *et al.,* 2014). This study provided valuable understandings into the importance of market, future, risk-taking and social orientation as the building blocks of agripreneurial resilience.

CHAPTER EIGHT
IMPACT OF ENTREPRENEURIAL ORIENTATION ON RURAL DAIRY AGRIPRENEURS' PERFORMANCE: MEDIATING ROLE OF ENTREPRENEURIAL RESILIENCE AND AGRIBUSINESS SUPPORT SERVICES

Abstract

The performance of rural smallholder dairy agrienterprises in Kenya is very critical as it contributes to welfare improvement of rural people especially the youth and women. Despite this acknowledgement, the farm productivity of rural dairy agripreneur is persistently low. Entrepreneurial orientations have been viewed as a catalyst for agrienterprise performance. This study sought to determine impact entrepreneurial orientation on dairy business performance, mediated by entrepreneurship resilience and agribusiness support services. The data were collected from 682 rural dairy agripreneurs in Kenya through cross-sectional survey. The research hypotheses were tested using partial least square structural equation modelling. The findings show that entrepreneurial resilience had a significant positive impact on performance of rural dairy agrienterprises. The interactive effect show that future orientation and market orientation positively and significantly influence dairy agrienterprise performance. While social orientation, even when mediated with entrepreneurial resilience, is associated with lower agrienterprise performance. Overall, the results suggest that, policies should focus on enhancing resilience of rural dairy agripreneurs through business capacity building programmes which will improve their managerial ability at farm-level.

8.1 Introduction

Majority rural smallholder dairy agripreneurs in Kenya depend on dairy farming as their source of livelihood (Mutura *et al.,* 2016). The performance of these smallholder agrienterprises is key for rural and national economic development. Since they could create employment among rural households, especially for youths and women (Kilelu *et al.,* 2018). However, these rural agripreneurs are faced with constraints such as lack of favourable environment/policies, poor market access and undeveloped infrastructure in rural areas (Nettle *et al., 2*017). This puts them at risk of falling into poverty trap, largely due to low productivity which limits them to produce marketable surplus (Ngeno, 2018). Being able for these rural agripreneurs to maintain

positivity and optimism when constantly faced with these hurdles requires them to be more entrepreneurial and resilient (Ayala & Manzano, 2014; Salisu *et al.*, 2018).

Rural dairy agripreneurs need to develop innovative processes and practices that may enhance their entrepreneurial behaviours (Shadbolt *et al.,* 2013). This behaviour is called entrepreneurial orientations (Cho and Lee, 2018). This study sought to determine the significance of entrepreneurial orientation (EO), on performance of dairy agripreneurs, mediated by entrepreneurial resilience. Entrepreneurial orientations are expected to increase dairy farm performance (Shadbolt *et al.,* 2013). This is attributed to the fact that several studies have been documented on the positive impact of EO on performance of SMEs. For example, exponents of market orientation (MO) suggest that entrepreneurs who are more market oriented understand the current and future customer needs (Buli, 2017; Ho *et al*., 2017).

For dairy agripreneurs market orientation may give them knowledge on milk quality and safety measures, costumers' preferences, and market system to adopt in order to reap benefits (Ho *et al*., 2017). According to Bamfo and Kraa (2019), market orientation improves performance of entrepreneurs by helping the consumer problems and providing solutions. On the contrary, Ho *et al*. (2018), found that market orientation had no significance effect on financial performance, stating that even though the smallholder entrepreneurs are market oriented they do not put it in practice as they sell their cattle to traders who in turn benefit a lot by selling to end consumers. This inconsistency in findings, calls for a study to establish the role of market orientation on dairy farm business.

Shepherd *et al.* (2015), suggests that entrepreneurs need to have higher risk-taking orientation for them to be competitive. Risk-taking orientation (RO) may enable dairy agripreneurs to assess their capabilities, use available information to calculate the likelihood of taking actions which may improve the dairy performance (Shadbolt *et al.,* 2013). Another important dimension of entrepreneurial orientation is future orientation (FO) which has also been found to improve performance of small-medium enterprises (SMEs) (Mason *et al*., 2015). Future orientation is vital when adopted as it may give agripreneurs internal locus of control to work in uncertain business environment with intention to exploit future opportunities that could provide them returns (Caliendo *et al.,* 2014).

Finally, it has been documented that due to the smallholding nature of dairy agripreneurs, social capital and networking is crucial in enhancing business success (Mwambi *et al*., 2018). Social orientation (SO) encourages agripreneurs to socialize more which may help them build social capital by developing strong business and personal ties (Evans & Wall, 2019). Social networking is beneficial in acquiring new business skills, knowledge, customer and suppliers faster which in turn helps in problem solving hence improved performance through business growth (Aldrich & Meyer, 2015). Most smallholder agripreneurs rely on their social connection to provide them with reliable and trusted information (Yang & Danes, 2015).

Despite the notable significance of entrepreneurial orientations, previous studies have focused on non-agricultural SMEs with dearth of empirical evidence on performance rural dairy agripreneurs'. To fill this knowledge gap, this study sought to examine effect of EO on dairy business performance among rural agripreneurs in Kenya. The relationship is analysed by applying entrepreneurial resilience as a mediating variable as it takes into account the ability of dairy agripreneurs to withstand the tough shocks and turbulences experienced in dairy business. This integrative analysis will capture the multidimensional nature of dairy enterprise performance. By answering the following research questions; Does dairy agripreneurs' entrepreneurial orientation influence their performance? Does entrepreneurial resilience have mediating role on the relationship between entrepreneurial orientation and dairy business performance? To answer these questions, we adopted the structural equation modelling to determine these effects.

8.2 Methodology

8.2.1 Description of study area

This study was done in Murang'a County which is in the central parts of Kenya. This county lies between longitudes 36^{o} East and 37^{o}27' East and latitudes of 0^{o} 34' South and 1^{o} 7' South of the equator. Majority of the rural households in the county are involved in mixed farming with an average household farm size of 0.57 hectares. The dominant livestock species domesticated is cattle. The county was purposively chosen because of the vibrant dairy sector with the county government initiating several programmes to promote commercialization of rural dairy agripreneurs (Murang'a CIDP, 2018).

8.2.2 Research design

The study adopted quantitative approach through a cross-sectional survey of smallholder rural agripreneurs in Kenya.

8.2.3 Sampling Design

Samples for this study were drawn through multistage sampling technique using both purposive and random sampling methods.

Selection of sub-counties: Within Murang'a County Four Sub-Counties, that is Gatanga, Maragwa, Kiharu and Kangema were selected. The selection of the four Sub-Counties was purposive based on the existence of many rural dairy agripreneurs who depend on dairy farming as their source of income. In addition, there has been several dairy commercialization interventions from the county government and non-governmental geared towards the rural agripreneurs. Moreover, these sub-counties have milk collection centres whose objective is to link dairy agripreneurs to the market and to offer agribusiness support services.

Selection of wards: Within the four Sub-Counties, three wards were randomly selected to give a total of 12 wards (Kihumbu-Ini, Gatanga, Kariara, Kambiti, Kamahuhu, Ichagaki, Mugoiri, Mbiri, Township, Kanyenya-Ini, Ng'araria and Ruchu.

Selection of households: Lastly, from the 12 wards, villages were selected through proportionate to size random sampling to get 682 respondents.

8.2.4 Survey tools

The research instrument was semi-structured questionnaire which covered information on the reflective constructs of entrepreneurial orientation, entrepreneurial resilience, agribusiness support services and dairy business performance. Entrepreneurial orientation was the independent variable measured with 5-point likert scale composing of: 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree) using four constructs: future, market, risk-taking and social orientation. These constructs were adopted from previous studies and adapted to the context of Kenya smallholder agripreneurs. Future orientation scale was measured based on the works of López-Mosquera *et al.* (2014), Market orientation was based

on Ho *et al.* (2017), scale, risk taking orientation was based on Lai *et al*. (2017) and social-capital was based on Hajong (2014).

The study tested two mediating variables; agripreneurial resilience and utilization of agribusiness support services. Entrepreneurial resilience was measured using Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003), consisting of 10 items. A 5-likert scale was used to measure this construct and it composed of: 0=not true at all, 1=rarely true, 2=sometimes true, 3=often true and 4=true nearly all of the time. Agribusiness support services considered were utilization of cooperative, production, financial and business plan services. Responses were subjected to how the dairy agripreneur felt in the past 12 months. Finally, dairy business performance was measured using the scale adopted by Ho *et al.* (2017), consisting of 5 items that were used to measure the self-reported perceived performance. The study was conducted during January-February, 2020.

8.2.5 Data analysis

Once the data was collected it was cleaned, edited and coded then analyzed through partial least square structural equation modelling (PLS-SEM) using SmartPLS version 3 software.

8.3 Results and Discussion

8.3.1 Reliability and validity tests of constructs

Hair *et al*. (2017) states that convergent validity is when indicators of a construct converge to represent a single underlying construct. This validity was measured using Cronbach's alpha (CA), rho_A, Composite Reliability (CR) and Average Variance Extracted (AVE). As presented in Table 8.1, Cronbach's alpha (CA) ranged from 0.753 to 0.895, rho_A ranged between 0.79 and 0.9 and composite reliability (CR) ranged between 0.767 and 0.908. These values exceeded the minimum standard level of 0.70. The values for average variance extracted (AVE) also exceeded the threshold of 0.4 (Hair *et al.,* 2017). Multicollinearity among the variables was tested using variance inflation factor (VIF). The results in Table 8.1 show that there was no collinearity among the constructs since the values were less than 5 which is the threshold (Hair *et al.,* 2017).

Table 8.1. Reliability and validity tests of constructs

Constructs	Items	CA	rho_A	CR	AVE	VIF
Entrepreneurial Resilience	9	0.861	0.868	0.89	0.475	
Future Orientation	6	0.895	0.897	0.92	0.660	1.041
Market Orientation	13	0.891	0.900	0.908	0.436	1.299
Risk-taking Orientation	5	0.814	0.831	0.869	0.573	1.01
Social Orientation	6	0.778	0.827	0.767	0.502	1.323
Dairy business performance	5	0.753	0.79	0.835	0.511	

CA = Cronbach Alpha, rho_A =Consistent Reliability Coefficient, CR = Composite Reliability, AVE = Average Variance Extracted, VIF = Variance Inflation Factor

To ensure that the constructs used in the study were not related, discriminant validity test was conducted using two criteria, AVE-SV (Fornell-Larcker Criterion Test) and Heterotrait-Monotrait (HTMT) Ratio Matrix. With regards to AVE-SV technique, the diagonal values of the constructs were greater than the horizontal and vertical values hence the constructs were not related (Henseler *et al*., 2015; Hair *et al*., 2017). Finally, in relation to the HTMT ratio test of discriminant validity, all the values in Table 8.2 were less than 0.85 thus indicating that there was discriminant validity among the constructs (Hair *et al*., 2017). In summary, the results of convergent and discriminant validity tests, indicate that the data used in the study are valid and reliable to prove the hypotheses with SmartPLS-SEM.

Table 8.2. Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) Ratio Test

Fornell-Larcker Criterion Test	**ER**	**FO**	**MO**	**RO**	**SO**	**AP**
ER	**0.689**					
FO	0.447	**0.812**				
MO	0.274	0.147	**0.660**			
RO	0.115	0.025	0.064	**0.757**		
SO	-0.308	-0.186	-0.476	-0.096	**0.708**	
DBP	0.100	-0.013	0.060	0.612	-0.095	**0.715**
Heterotrait-Monotrait (HTMT) Ratio						
FO	0.497					
MO	0.288	0.158				
RO	0.13	0.05	0.098			
SO	0.296	0.173	0.574	0.103		
DBP	0.124	0.035	0.105	0.813	0.115	

Note: FO=Future Orientation; SO=Social Orientation; RO=Risk-taking Orientation; MO=Market Orientation; ER=Entrepreneurial Resilience; DBP= Dairy Business Performance

8.3.2 Structural model and direct effects of EO, ER and DBP

The direct effects between entrepreneurial orientation, entrepreneurial resilience and dairy business performance was tested using partial least squares structural equation modelling. The results of the path model are shown in the Table 8.3 and Figure 8.1. The result shows that FO (β=0.396, $p<0.01$), MO (β=0.137, $p<0.01$), and RO (β=0.088, $p<0.01$) had a positive impact on entrepreneurial resilience. These findings suggest that dairy rural agripreneurs who exhibit higher levels of future orientation, market orientation and risk-taking orientation are more likely to be resilient. The plausible reason is that these orientations may enable dairy agripreneurs to develop adaptive capacities which could enhance their entrepreneurial resilience. For example, future oriented agripreneur is ambitious and optimistic for positive occurrence in the future. This keeps the farmers motivated despite the challenges they face in production and marketing. This finding is similar with Bucktowar *et al.* (2015), who found market orientation positively influences firm performance.

The more dairy agripreneur is focused on long term plans, necessitate them to invest on improved breeds of cows, quality feeds, animal health services and equipment. Through these investments, dairy agripreneurs could become more market oriented by improving their organization structure, personal competence in relation to handling and management of cows with objective of finding stable markets and prices for milk. These initiatives enhance their adaptive and buffer resilience respectively. Finally, risk-taking orientation has positive impact on entrepreneurial resilience especially when a dairy agripreneur perceives the risk having likelihood of generating high returns to the business (Yaseen *et al.,* 2018).

Table 8.3. Direct effect of entrepreneurial orientations, entrepreneurial resilience and dairy business performance

Hypotheses/Relationships		**Beta coefficient**	**SE**	**t-values**	**p-values**	**Result**
H1	FO -> ER	0.396	0.031	12.767***	0.01	Supported
H2	MO -> ER	0.137	0.036	3.658***	0.01	Supported
H3	RO -> ER	0.088	0.030	2.678***	0.01	Supported
H4	SO -> ER	-0.165	0.043	3.786***	0.01	Supported
H5	ER -> DBP	0.116	0.038	2.596***	0.01	Supported

Note: FO=Future Orientation; SO=Social Orientation; RO=Risk-taking Orientation; MO=Market Orientation; ER=Entrepreneurial Resilience; DBP= Dairy Business Performance; ***$p<0.01$

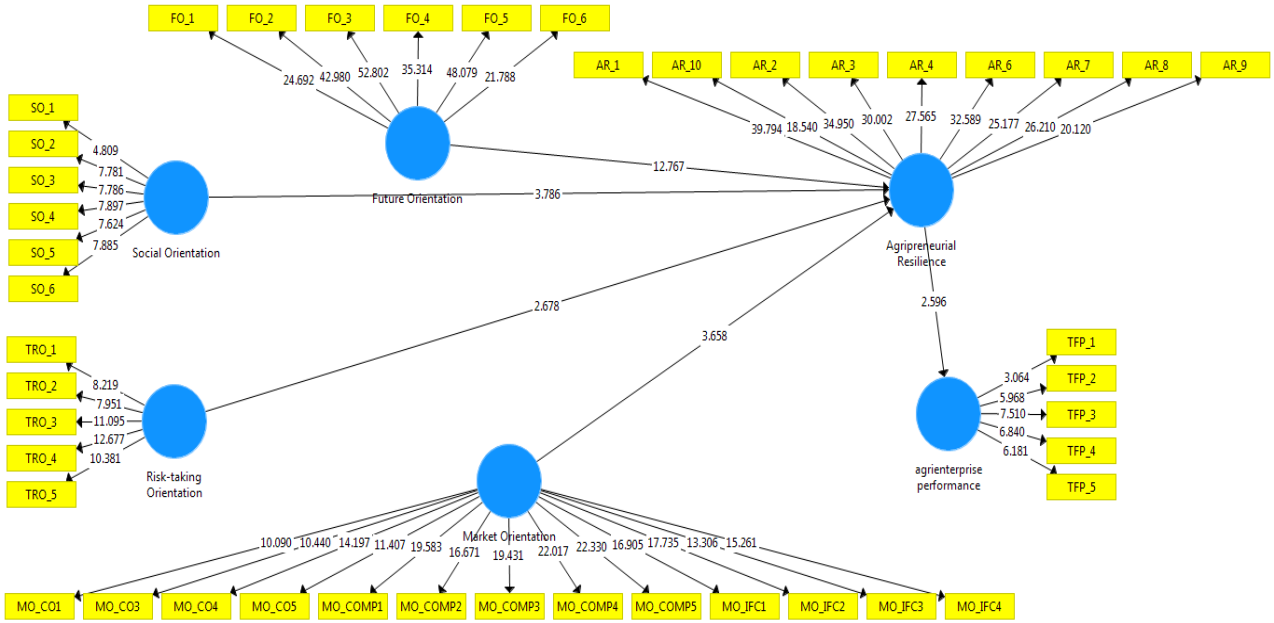

Figure 8.1. Structural model of mediating role of entrepreneurial resilience on the relationship between agripreneurial orientation and agrienterprise performance

Contrary to expectations social orientation had a negative impact on ER (β=-0.165, p<0.01). This imply that the more rural agripreneurs are socially oriented the lower the likelihood they will be resilient. This could be because of the nature of dairy business which requires high level of commitment from the owner. Therefore, if the dairy agripreneurs depends so much on external support especially from family members and friends, they are likely to succumb to the shocks from the business environment. Entrepreneurial resilience requires internal locus of control, individual commitment and tolerance to ambiguous situations (Fatoki, 2018). This finding is contrary to Salisu *et al.* (2019), who found social orientation positively influence resilience of SMEs.

Finally, results in Table 8.3 indicates that entrepreneurial resilience has a positive and statistically significant effect on dairy business performance (β=0.116, p<0.01). This finding imply that entrepreneurial resilience is a significant personal characteristic for dairy agripreneurs and may help drive dairy business performance. A possible explanation could be that a higher level of entrepreneurial resilience, makes dairy agripreneurs to be more future thinking in relation investment in the dairy business. They tend to focus more on the brighter side of the problems and try to exploit opportunities presented by the shocks in the agribusiness

environment. The finding is similar to Fatoki (2018), who found entrepreneurial resilience positively influence performance of SMEs in South Africa.

8.3.3 Mediation analysis for ER and ASS on relationship between EO and AP

The mediation analysis was done using bootstrapping method (Hair *et al.,* 2017). The result in Table 8.4 show that entrepreneurial resilience positively mediated the relationship between FO and dairy business performance (β=0.046, p<0.01); MO and dairy business performance (β=0.016; p<0.1) and negatively on SO and dairy business performance (β=-0.019, p<0.05). There was no statistical and significant influence of access to agribusiness support services (cooperative, business planning, financial and production) on the relationship between agripreneurial orientations and agrienterprises performance. This finding implies that future orientation and market orientation positively influence entrepreneurial resilience which in the long run influence dairy business performance. A plausible explanation for this is that, if rural dairy agripreneurs are market oriented, they are able to understand the market dynamics in relation to customer tastes, preferences, product quality and prices. Higher market orientation among rural agripreneurs may enhance their market knowledge competence which could increase the tenacity to build resiliency.

Table 8.4. Mediating role of entrepreneurial resilience on relationship between agripreneurial orientation and agrienterprise performance

Hypotheses/Paths	Beta coefficient	SE	t-values	Result
FO->ER->AP	0.046	0.015	2.605***	Supported
MO->ER->AP	0.016	0.007	1.858*	Supported
RO->ER->AP	0.011	0.006	1.376	Not supported
SO->ER->AP	-0.019	0.008	2.047**	Supported
FO ->CSS ->AR->AP	-0.001	0.001	1.078	Not supported
MO ->CSS ->AR->AP	0.001	0.001	0.28	Not supported
RO ->CSS ->AR->AP	0.001	0.001	0.416	Not supported
SO ->CSS ->AR->AP	-0.001	0.001	0.941	Not supported
FO ->BPSS ->AR->AP	0.001	0.001	0.622	Not supported
MO ->BPSS ->AR->AP	0.001	0.001	0.708	Not supported

RO ->BPSS ->AR->AP	-0.007	0.007	1.08	Not supported
SO ->BPSS ->AR->AP	0.001	0.001	0.63	Not supported
FO ->FSS ->AR->AP	-0.001	0.001	0.56	Not supported
MO ->FSS ->AR->AP	0.002	0.002	0.939	Not supported
RO ->FSS ->AR->AP	-0.001	0.002	0.582	Not supported
SO ->FSS ->AR->AP	-0.001	0.002	0.774	Not supported
FO ->PSS ->AR->AP	-0.001	0.002	0.555	Not supported
MO ->PSS ->AR->AP	0.002	0.002	0.932	Not supported
RO ->PSS ->AR->AP	-0.001	0.002	0.585	Not supported
SO ->PSS ->AR->AP	-0.001	0.002	0.777	Not supported

Note: FO=Future Orientation; SO=Social Orientation; RO=Risk-taking Orientation; MO=Market Orientation; ER=Entrepreneurial Resilience; AP= Agrienterprise Performance; CSS=Cooperative support services; BPSS=Business plan support services; FSS=Financial support services; PSS=Production support services ***p<0.01, **p<0.05, *p<0.10

These results are contrary to Ho *et al.* (2017), who found that market orientation had no significant effect on performance of beef agripreneurs. But Veidal and Korneliussen (2013), found consistent results with our findings. Therefore, dairy agripreneurs with clear market orientation are able to develop adaptive mechanisms such as investment on quality feeds, machineries and skills which may enhance their entrepreneurial resilience and thereby business performance. Contrary to expectations, higher social orientation is associated with lower dairy business performance even when mediated with entrepreneurial resilience. This imply that dairy business performance depends on individual agripreneur commitment and investment in the business. If rural dairy agripreneurs are more socially oriented, the performance of their agrienterprises may decrease. This is contrary to Salisu *et al.* (2019), who found entrepreneurs who were highly social oriented become more committed and resilient. However, dairy farming is labour intensive project that requires total commitment form the owner at farm level with minimal dependency form external labour. Dairy rural agripreneurs should aspire to invest more on their market orientation through strategic planning and investment in managerial business skills (Yaseen *et al.,* 2018).

8.3.5 Assessment of coefficient of determination, effect size and predictive power of the constructs

The outer model of the structural equation was assessed using the explanatory and predictive power of the constructs. This included determination of coefficient of determination (R^2), effect size (f^2), path coefficient (β) and predictive relevance (Q^2) and the results are presented in Table 8.5. In relation to coefficient of determination (R^2), future orientation, market orientation, risk-taking orientation and social orientation explained 27.3% of total variance in entrepreneurial resilience. This means that there are other factors that influence entrepreneurial resilience but they were not included in the model.

Table 8.5. Tests for coefficient of determination (R^2), effect size (F^2) and predictive relevance (Q^2)

Entrepreneurial resilience	**Effect size (F^2)**	**Predictive relevance (Q^2)**	**Effect**
FO-ER	0.201	0.080	Medium
SO-ER	0.028	0.010	Small
RO-ER	0.010	0.002	Small
MO-ER	0.019	0.007	Small
ER	R^2=0.273	Q^2=0.124	
Cooperative			
FO-AR	0.204	0.083	Medium
SO-AR	0.023	0.009	Small
RO-AR	0.001	0.001	Small
MO-AR	0.021	0.008	Small
CSS-AR	0.005	0.001	Small
Resilience	R^2=0.271	Q^2=0.123	
Business plan			
FO-AR	0.215	0.086	Medium
SO-AR	0.003	0.016	Small
RO-AR	0.003	0.001	Small
MO-AR	0.033	0.012	Small

BPSS-AR	0.040	0.027	Small
Resilience	R^2=0.246	Q^2=0.112	
Financial			
FO-AR	0.224	0.088	Medium
SO-AR	0.003	0.001	Small
RO-AR	0.001	0.001	Small
MO-AR	0.035	0.012	Small
FSS-AR	0.011	0.005	Small
Resilience	R^2=0.254	Q^2=0.116	
Production			
FO-AR	0.224	0.088	Medium
SO-AR	0.003	0.002	Small
RO-AR	0.001	0.001	Small
MO-AR	0.035	0.012	Small
PSS-AR	0.011	0.005	Small
Resilience	R^2=0.254	Q^2=0.116	

Note: FO=Future Orientation; SO=Social Orientation; RO=Risk-taking Orientation; MO=Market Orientation; ER=Entrepreneurial Resilience; CSS=Cooperative Support Services; BPSS=Business Plan Support Services; FSS=Financial Support Services; PSS=Production Support Services

For the effect size (f^2), future orientation contributed more to R^2 (0.201), followed by market orientation (0.028), then social orientation (0.019) and finally risk-taking orientation (0.010). Future orientation had moderate effect size while the other orientations (Market orientation, Risk-taking orientation and Social orientation) had small effect size (Hair *et al*., 2011). Finally, the predictive relevance (Q^2) was determined using the blindfolding procedure in PLS-SEM 3. Hair *et al*. (2017), states that Q^2 should be larger than zero for a construct to have predictive relevance. The Q^2 values of agripreneurial resilience was 0.124 which denotes that the research model had a good predictive relevance.

8.4 Conclusion and Policy Implications

This study sought to determine the impact of entrepreneurial orientation on dairy business performance, mediated by entrepreneurial resilience among smallholder rural farmers in

Kenya. We conclude that, that entrepreneurial resilience has a significant positive impact on dairy business performance. Moreover, entrepreneurial orientations (FO, MO and SO) indirectly influence rural dairy agripreneurs' performance through entrepreneurial resilience. Future orientation and market orientation positively and significantly influence dairy business performance. However, contrary to our hypotheses, social orientation, even when mediated with entrepreneurial resilience, is associated with lower dairy business performance. The practical implication is that under different business circumstances, dairy agripreneurs differ in their level of entrepreneurial resilience. Rather than focusing on enhancing social orientation through group membership policies should focus on improving individual dairy agripreneurs' managerial ability at farm-level. Further, policies should focus on enhancing resilience of rural dairy agripreneurs through business capacity building programmes such as business plan and marketing trainings, stress management and change management. This can be achieved by strengthening smallholder rural agripreneurs' access to agribusiness support services through proper coordination between the different actors in the dairy value chain.

CHAPTER NINE
GENDER EFFECT OF ENTREPRENEURIAL ORIENTATION ON DAIRY FARMING CAREER RESILIENCE IN KENYA

Abstract

This study sought to examine gender effect of entrepreneurial orientation on dairy farming career resilience in Kenya. Specifically, the study examined the moderating role of gender on the relationship between future orientation (FO), market orientation (MO), risk-taking orientation (RO), social orientation (SO) and entrepreneurial resilience of dairy agripreneurs in Kenya. We surveyed 682 respondents; 480 males and 202 female dairy agripreneurs in Murang'a County, Kenya using a cross-sectional study design. Data was collected using semi-structured questionnaire using personal interview. Data were analysed using partial least square-structural equation modelling PLS-SEM and multi-group analysis (MGA). Results show significant gender differences across the agripreneurial orientations. The direct effects relationships indicate that future, market and risk-taking orientation of female agripreneurs had a positive and significant impact on agripreneurial resilience (AR). While, for male agripreneurs, future and market orientation had a positive and significant impact on AR; but social orientation had a negative impact on AR. Gender moderates the entrepreneurial orientation-agripreneurial career resilience relationship whereby female agripreneurs had statistically significant higher risk-taking propensity of ($\beta = 0.189$, p=0.06) compared to their male counterparts ($\beta = 0.054$, p=0.06). The theoretical and practical implications of the results is discussed at the end of the paper.

Keywords: Women agripreneurs, agripreneurial orientations, resilience, dairy career, moderator

9.1 Introduction

Women agripreneurs play a crucial role in dairy farming career, where they are involved in production, processing and marketing of milk (Njuki *et al.,* 2016). Despite their contribution, their access to financial, human, physical and informational resources have always been low compared to men (Ageya *et al*., 2016; Njuki & Sanginga, 2013). However, in the past decade,

several interventions have been initiated to empower women. Some of these initiatives include increasing access to education for women, increasing property rights of women and including women in decision making (Basu *et al.,* 2019). Other interventions have been geared towards economic empowerment through access to agribusiness support services such credit linked inputs, group marketing, business plan trainings and access to subsidized animal health services (Karim *et al.,* 2018; Srivastava & Misra, 2017). The intention is to make them more entrepreneurial. This entrepreneurial behaviour is popular known as entrepreneurial orientation (EO) (Cho & Lee, 2018).

Entrepreneurial orientations are linked to exploitation of opportunities presented in the business environment (Radipere, 2013). Shadbolt and Olubode-Awosola (2013), emphasizes dairy agripreneurs should have the best processes and practices that can enable them to maximize on business opportunities. Most studies have acknowledged that entrepreneurial orientations have positive effect on profitability and sustainability of small-medium enterprises (Cho & Lee, 2018; Covin & Miller, 2014; Cui *et al*., 2018; Dayan *et al.,* 2016; Fatoki, 2014). Higher entrepreneurial orientations could increase competitive advantage and resilience of entrepreneurs during tough economic times (Linnenluecke, 2017; Radipere, 2013). Dairy agripreneurs that have high entrepreneurial orientations are viewed as risk-takers, market oriented and highly futuristic in thinking which enables them to exploit untapped opportunities in the agribusiness environment (Ho *et al.,* 2017).

There is an increasing trend in the number of female entrepreneurs and studies show that they are competing well with the male counterparts (Chatterjee & Srivastava, 2019; Van Der Merwe, 2015). Quaye *et al*. (2015), acknowledge that female and men entrepreneurs use different strategies in managing their enterprises. This is due to different entrepreneurial abilities and attributes which influences their orientations (Shinnar *et al.,* 2012). Adom and Anambane (2019), argue that gender stereotypes, limit many women from venturing into entrepreneurship in developing countries. Hence, the gender of entrepreneur is key in influencing the performance of small-medium enterprises and continuity of the business (Ayub *et al.,* 2013; Fellnhofer *et al.,* 2016). The necessity of entrepreneurial orientation (EO) is still overlooked by the many developing countries like Kenya, even though EO is important for agripreneurs especially in dairy farming career progression. Hence, this study aims to explore

the relationship between entrepreneurial orientation EO and dairy agripreneurs' resilience (AR) in Kenya and further examine the role of gender on the relationship between EO and AR.

9.1.1 Research Objectives

The following are the research objectives of this study:

1. To examine the impact of the entrepreneurial orientations (future orientation, market orientation, risk-taking orientation and social orientation) on agripreneurial resilience of dairy farmers in Kenya.

2. To analyze the moderating role of gender on the relationship between entrepreneurial orientations and agripreneurial resilience of dairy farmers in Kenya.

9.2 Literature review

9.2.1 Gender and entrepreneurship

Gender difference has been a center point of discussion by many researchers in relation to entrepreneurship (Vishnu *et al.,* 2018). Gender has been viewed different from sex in the sense that it refers to beliefs about what traits are appropriate for male or female which distinguish them from one another. Whereby, men are socialized to be aggressive, task oriented and assertive whereas women are socialized to be emotional, tender and communal (Leonidas *et al.,* 2017). In entrepreneurship male and female entrepreneurs differ in both business structure and in individual goals (Palalic *et al.,* 2017). Entrepreneurs identify opportunities, evaluate and turn them into viable businesses. To be an entrepreneur individual must have certain traits that will make him/her successful which maybe similar or different for male and female entrepreneurs (Lim and Envick). Entrepreneurs both men and women mostly have common traits but may differ in the level or extent as they have different goals, decision making strategies and perception about businesses (Zeb & Ihsan, 2020).

Most women entrepreneurs look for independence whereas male for profits and both for personal satisfaction (Srivastava & Misra, 2017). Gender has influence on behavior of men and women entrepreneurs (Zeb & Ihsan, 2020). Traditional thinking (stereotype effect) implies that men are always more successful than women (Zeffane, 2015). Women entrepreneurs were

found to perform poorly than men in their small sized businesses (Vishnu *et al.,* 2018). This happens especially in rural agribusiness sector due to difficulties they face in access to resources, and business assets as well as gendered specific behaviors which influences their decision power and control as a result men end up having higher performance (Quaye *et al.* 2015). However, there is an emerging trend from developed countries suggesting that female entrepreneurs tend to outperform their male counterparts especially due to women empowerment (Nasrolahi & Reza, 2014).

In recent studies, women have been seen to have stronger motives for entrepreneurship than men which could be as a result of women empowerment and inclusion in the labor market (Adom *et al.,* 2019; Base *et al.,* 2019). Fellnhofer *et al.* (2016), found that women perform better than men because they were motivated to survive, they have more desire for entrepreneurial knowledge and better financial control than men. Chatterjee and Srivastava (2019), found access to resources positively influences women participation in entrepreneurship. However, there is no consistency on the gender difference and performance between men and women as the entrepreneur behavior keeps on changing. This calls for a study on gender analysis in relation to entrepreneurial orientation and resilience of dairy agripreneurs where majority of women are involved in different activities.

9.2.2 Gender and entrepreneurial orientation

Most studies have been conducted to find effect of entrepreneurial orientation on firm performances and the results indicated a positive significant effect on performance (Cho & Lee, 2018; Covin & Miller, 2014; Cui *et al*., 2018; Dayan *et al.,* 2016; Fatoki, 2014). Entrepreneur orientation has also been found to be important in shaping entrepreneurs' way of thinking, behaviors and ideas making them more competitive (Ho *et al.,* 2017). Most of this studies have not considered the role of gender in influencing the performance and resilience of small-medium enterprises especially dairy agripreneurs in Kenya. Positive change of entrepreneurs' traits, behaviors and their thinking as a result of entrepreneurial orientation is different between men and women entrepreneurs (Hughes & Yang, 2020). Entrepreneurial orientation has several dimensions (risk orientation, market orientation, social orientation and future orientation) of which each may be embraced differently by men and women leading to

difference in performance and resilience levels by gender. Therefore, there is need to evaluate the impact of each dimension separately (Zeebaree & Siron, 2017).

Risk orientation affects the risk taking behaviors of entrepreneurs, in terms of ability to take bold steps in venturing into new markets and investing resources having uncertain outcomes (Zeffane, 2015; Cui *et al.,* 2018). Successes of entrepreneurs depend on their risk taking abilities which may differ based on gender (Arooj & Ihsan, 2020). It has been documented that higher risk orientation results to higher risk taking behavior hence increase in entrepreneurs' performance (Fatoki, 2014). Earlier studies concluded that women were more risk averse (Camelo-Ordaz *et al.,* 2016) while their male counterpart were high risk takers (Ayub *et al.*, 2013; Lim & Envick, 2013; Pérez-Quintana, 2013). However, Zampetakis *et al*. (2017), argue that most women are more willing to take risks compared to men due to their past background experience in life and the need to be independent. The inconsistency in findings warrant a study on multi-group analysis of entrepreneurial orientation between male and female agripreneurs which this study seeks to address. Therefore, this study will empirically demonstrate the moderating role of gender on enhancing the entrepreneurial orientations and resilience of dairy agripreneurs.

Market orientation is another dimension of entrepreneurial orientation that may equip dairy entrepreneurs with market knowledge relating to current and future customer needs. Marketing is important in the survival and development of dairy agripreneurs therefore possession of good marketing skills is beneficial (Ho *et al.,* 2017). Market orientation, therefore, is very significant in imparting marketing skills needed by dairy entrepreneurs in gaining competitive advantage. It may also enable entrepreneurs to pursue new market opportunities and innovatively produce new products (Bamfo & Kraa, 2019).

Rashid *et al*. (2020), found that women are more market oriented than men which influences their business success. Whereby women are considered to emphasize more on developing relationship with customers than men (Rezaei-Moghaddam *et al.,* 2019). In contrary, Ayub *et al.* (2013), argue that men are more market oriented than women based on their ability to create innovative business ideas. Dairy farming in Kenya is managed by both men and women and their orientations may influence the performance and dairy farming career resilience. However, there is dearth of empirical study on gendered differences on entrepreneurial orientation among

dairy agripreneurs, despite the documented evidence of gender differences in running dairy business (Njuki *et al.,* 2016).

Social orientation involves building on social capital and networking which is important for an entrepreneur success (Nasrolahi & Reza, 2014). Having social capital and networks helps in accessing beneficial information and resources which contribute indirectly to performance of the business (Salisu *et al.,* 2019). Social orientation facilitates local networks of interconnected stakeholders which promotes collective learning (Hughes & Yang, 2020). Based on gender differences, women generally have less access to important networks which affect their access to inputs, information and reaching out to potential customers compared to men (Adom & Anambane, 2019). Through social orientation female entrepreneurs have greater potential to grow when connected to the right social capital than male counterparts as women are considered to be more social than men (Basu *et al.,* 2019). This study sought to establish differences in social orientation on resilience of male and female dairy agripreneurs.

Future orientation is also very important dimension of entrepreneurial orientation as it may help dairy entrepreneurs to think of continuity and survival of the business in the long-run (Shadbolt *et al.,* 2013). Strategic planning is key element in future orientation since orients entrepreneurs to focus on the future by planning on how to accomplish goals as well as avoid emotional, financial, physical or social hardship that may occur as a result of crisis hence attaining resilience (Andre *et al.,* 2018). Men and women employ different strategies to ensure survival and continuity of business (Chatterjee *et al.,* 2019). Men are considered to adopt offensive and innovative strategies whereby they venture into new investments, innovation of new products or services, research for new markets and new customers, while women adopt defensive strategies which involves reorganizing and resizing the business structures. However, during crisis strategies adopted by men and women entrepreneurs presents no significant difference as they are both resilient (Buratti *et al.,* 2018).

The findings of gender difference on entrepreneurial orientation dimensions are not consistent; it keeps on changing depending on entrepreneur perception on entrepreneurial orientation as well as other factors. The inconsistencies can be attributed to the gender roles changes in the modern society where women are actively engaged in entrepreneurship (Vishnu *et al.,* 2019; Zeb & Ihsan, 2020). Again, with gender equality and women empowerment policies which are

advocating for equal and fair ground for both men and women participation in entrepreneurship, women are more inspired to start their own enterprises (Batjargal *et al.*, 2019; Rashid *et al*., 2020).

The literature presented shows that entrepreneurial orientation positively or negatively impacts on performance which tends to be different on gender basis. However, the documented literature shows inconsistent results regarding the relationship between gender and EO, therefore, examining possible differences in EO and resilience in the dairy sector where male and female actively participates could make a useful contribution. In addition, the resilience of most dairy agripreneurs with regard to gender and EO has not been clearly established in developing countries like Kenya especially in the agribusiness sector. Therefore, there is a need to find out the effect of gender difference on entrepreneurial orientation and resilience of dairy agripreneurs.

9.2.3 Entrepreneurial resilience

Evans and wall (2019), defined resilience as the capacity of entrepreneur to bounce back from business challenges and maintain his/her profitability. Shadbolt and Olubode Awosola (2013) define agripreneurial resilience as the ability of dairy agripreneurs to adopt and adapt to changes in agribusiness environment; while taking advantage of opportunities presented by the changes. Agripreneurs are faced with so many obstacles and uncertain outcomes which they need to overcome in order to have a profitable venture. Hence, resiliency is an important attribute for entrepreneurs.

Agripreneurial resilience has three elements, buffer, adaptive and transformability capacity (Evans & Wall, 2019). Buffer capacity is the ability of an agripreneur to main constant production while faced with shocks and disturbances in the business. Adaptive capacity is the capability of agripreneur to respond to change through change in the structure of the agrienterprise such as membership to groups without affecting the function of the farm. Finally, transformability capacity is the ability of dairy agripreneurs to engage in intra-chain upgrading such as diversification into new enterprises (Shadbolt & Olubode Awosola, 2013).

Dairy agripreneurs operate in a highly risky and uncertain business environment. They ought to build a resilient farming system. Agripreneurial orientation could enhance agripreneurial

resilience especially if they are market and future oriented (Shadbolt *et al.*, 2013). According to Evans and Wall (2019), entrepreneurs are currently operating in a dynamic business environment and no entrepreneur is self-sustainable. Hence, there is no entrepreneur who can manage to survive disruption and retain their advantage without resilient agripreneurial orientation.

9.2.4 Conceptual framework

Four dimensions of entrepreneurial orientations construct (future orientation, market orientation, risk-taking orientation and social orientation) were used as the exogenous variables in the proposed model. Agripreneurial resilience was the endogenous variable while gender of the dairy agripreneurs was the moderating variable as depicted in figure 1.

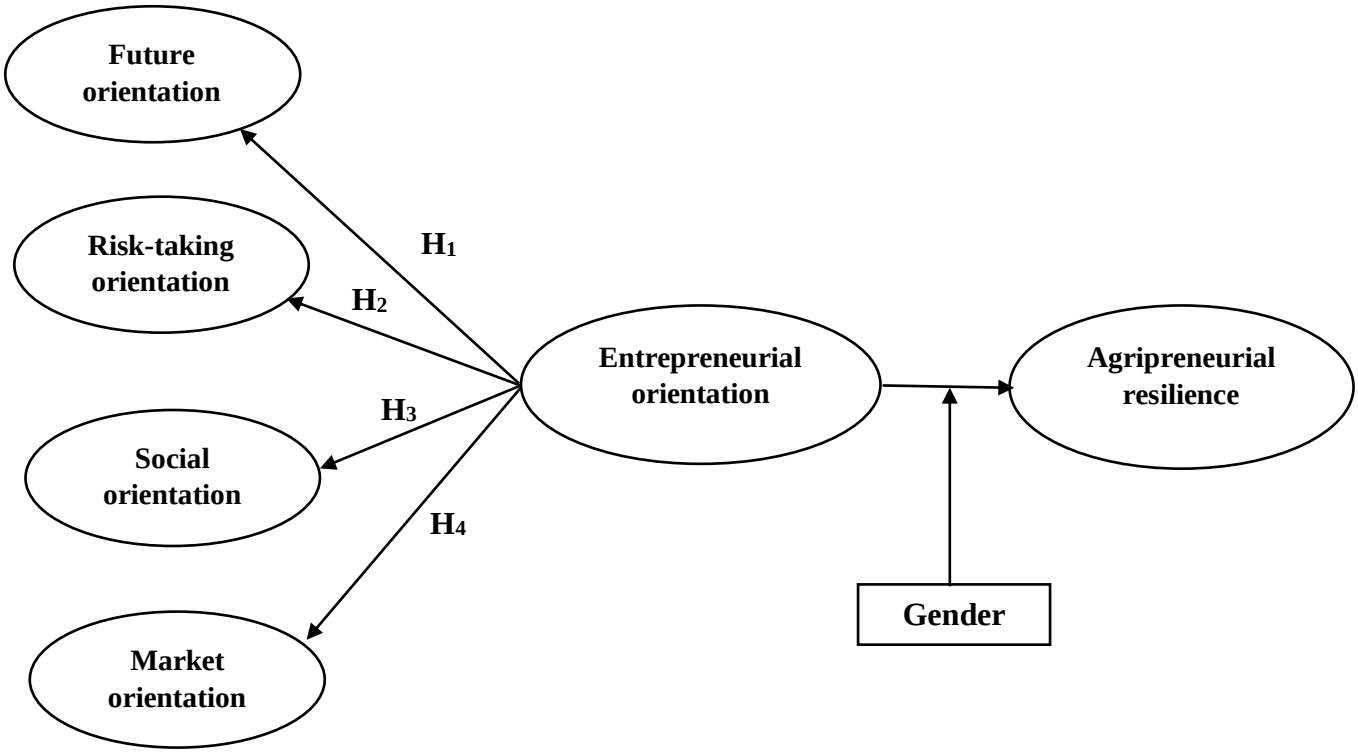

Figure 9.1. Proposed model for moderating role of gender on the relationship between entrepreneurial orientations and agripreneurial resilience

From the literature review, the following are the hypothesis that were formulated to be tested in the study;

H1. Future orientation is positively related to entrepreneurial resilience

H2. Market orientation is positively related to entrepreneurial resilience

H3. Risk-taking orientation is positively related to entrepreneurial resilience

H4. Social orientation is positively related to entrepreneurial resilience

H5. Gender positively moderates the relationship between entrepreneurial orientation and entrepreneurial resilience

9.3 Methodology

9.3.1 Data

Data was collected through a cross-sectional survey on a sample of 682 dairy agripreneurs in Murang'a County, Kenya. Multistage sampling procedure was employed to get the sample of dairy agripreneurs. Within the county four sub-counties, that is Gatanga, Maragwa, Kiharu and Kangema were selected. The four Sub-Counties were purposively selected, based on the existence of dairy cooperatives initiated both by the county government, the dairy agripreneurs and non-governmental promoters. In addition, these sub-counties have high number of dairy agripreneurs who depend on production and marketing of milk as their source of livelihood. This enabled the researchers to get random female and male agripreneurs. Within the four Sub-Counties, three wards were randomly selected to give a total of twelve wards. Lastly, proportionate to size sampling was used to select 682 respondents (480 males and 202 females)

This study used a semi-structured questionnaire, as the main instrument for data collection. The questionnaire consisted of information on socio-economic and institutional characteristics of the respondents, dairy production, marketing parameters, entrepreneurial orientation and resilience constructs. Before the survey was conducted the researcher secured research permit from the National Commission for Science Technology and Innovation (NACOSTI), which is the legal body responsible for regulating and approving research activities in Kenya. Approval was also sought from Ministry of Agriculture, Livestock and Fisheries in Murang'a county government. Once the approvals were made, the researcher with the help of Sub-County agricultural officers and village heads identified the dairy agripreneurs who took part in the

survey. The respondents were informed about the objective of the study and were requested for informed consent. Upon the consent of the dairy agripreneurs, data was collected using personal interview by twelve trained enumerators. The interview took an average of 90 minutes per household.

9.3.2 Variables

9.3.2.1 Dependent variable

Agripreneurial resilience which was dependent variable which was measured using the Connor-Davidson Resilience Scale (CD-RISC; Connor and Davidson, 2003), consisting of 10 items. A 5-likert scale was used to measure this construct and it composed of: 0=not true at all, 1=rarely true, 2=sometimes true, 3=often true and 4=true nearly all of the time.

9.3.2.2 Independent variables

The independent variables were entrepreneurial orientation constructs which were measured using the likert scale (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree). These included social orientation (6 items), market orientation (14 items), future orientation (7 items) and risk taking orientation (6 items). The entrepreneurial orientation items were adapted and updated to fit the context of the study from the works of Hajong (2014), for social orientation Ho *et al.* (2017), for market orientation, López-Mosquera *et al. (*2014), for future orientation and Lai *et al*. (2017), for risk-taking orientation.

9.3.2.3 Mediating variable

Gender was used as the mediating variable which was coded as a binary variable: 1 for male and 0 for female respondents.

9.3.3 Methods

Considering the main features of the dependent, independent and mediating variable, whereby there are multiple outcome variables both observed and unobserved, this study used Partial Least Square-Structural Equation Modelling (PLS-SEM) to test the hypotheses. This model was appropriate since it enabled the researchers to analyze both the measurement and structural

models, while it allowed the incorporation of both unobserved (construct/latent factors) and observed variables in the same model (Statsoft, 2013). This analytical method also handles errors of measurement within exogenous variables having multiple indicators by the usage of confirmatory factor analysis (CFA). SEM permits simultaneous analysis of multiple linear regression between the independent variables, multiple path analysis, assess the direct and indirect effect, and fitness of overall model which is not feasible in a traditional regression analysis method. SEM can also provide measures of fit to assess the entire model (Hair *et al.*, 2017). The general model is represented by the following equations consisting of measurement and structural models:

$$Y = \nu + \Lambda n + \varepsilon \quad (1)$$

$$\eta = \alpha + B\eta + \xi \quad (2)$$

where Y is the vector of *p* observed variables in a considered study ($p > 1$), ν the p × 1 vector of observed variable mean intercepts, Λ is the $p \times q$ matrix of factor loadings, η is the of q x 1 latent factors assumed in it ($q > 0$), ε the vector of *p* pertinent residuals (error terms), α is the $q \times 1$ vector of latent variable intercepts, B is a q x q matrix of latent regression coefficients and ξ is the $q \times 1$ vector of corresponding latent disturbance terms.

Based on the general equation (1) and (2), the following structural equation model for the four factors namely; social-capital/linkages(ξ_1), market orientation(ξ_2), future orientation (ξ_3) and risk taking orientation (ξ_4) with manifest endogenous variable agripreneurial resilience (Y_1) was given in the following structural equation models:

$$Y_1 = \alpha_1 + \beta_{11}\xi_1 + \beta_{12}\xi_2 + \beta_{13}\xi_3 + \beta_{14}\xi_4 + e_1 \quad (3)$$

The general matrix expression is given in the following equation:

$$Y_1 = \alpha_1 + \Gamma_1\xi_1 + e_1 \quad (4)$$

where;

$$\Gamma_1 = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}), \text{ and } \xi_1 = (\xi_1, \xi_2, \xi_3, \xi_4)$$

In the above equation (4) Y_1 manifest endogenous variables (AR), α_1 is the latent intercepts, Γ_1 are the coefficient vectors for the linear effects of n latent predictors, ξ_1 are the latent factors and finally e_1 is the latent disturbance. PLS-MGA (multi-group analysis) was used test the differences in agripreneurial orientations between male and female dairy agripreneurs. The product of coefficients approach was used to test for mediation effects, as fronted by Fairchild and MacKinnon (2009). The equations that were used to analyze the products of coefficients are as presented in equation 5 and 6:

$$Y = \beta_0 + C^I X + bM + \varepsilon_i \quad (5)$$

$$EC = \beta_0 + aX + \varepsilon_i \quad (6)$$

Fairchild and MacKinnon (2009) indicate that the above equations are then used to test for mediation effects by application of the product of coefficients strategy as depicted in the formula below:

$$S_{\hat{a}\hat{b}} = \sqrt{S^2_{\hat{a}}\hat{b}^2 + S^2_{\hat{b}}\hat{a}^2} \quad (7)$$

Where $S^2_{\hat{a}}$ is the variance of $\hat{a}^2$ coefficient, and $S^2_{\hat{b}}$ is the variance of the $\hat{b}$ coefficient.

Therefore, in order to illustrate the agripreneurial resiliency in terms of the four independent variables (IV) of social capital orientation, market orientation, future orientation and risk-taking orientation, while considering the mediating effect of gender on this relationship, regression analysis was used as presented in equation 8;

$$AR = \begin{pmatrix} \beta_0 + \beta_1 SO + \beta_2 MO + \beta_3 FO + \beta_4 RO + \beta_5 gender \times SO + \beta_6 gender \times MO + \\ \beta_7 gender \times FO + \beta_8 gender \times RO \end{pmatrix} + \varepsilon \quad (8)$$

where: *AR* = Agripreneurial Resilience; $\beta 0$ = constant which is the value of *Y* when *X* is zero; βi = correlation coefficient, Pearson's correlation; *SO=Social Orientation, MO=Market Orientation, FO=Future Orientation, RO=Risk-taking Orientation, gender=male or female*; *gender × SO*; *gender × MO; gender × FO and gender × RO* = mediating effect of gender on relationship between social, market, risk-taking and future orientation, respectively. ε = error

term indicating proportion of AR that is not to be explained by constructs *SO, MO, FO, RO, gender × SO, gender × MO, gender × FO* and *gender × RO.*

9.4. Results and Discussions

9.4.1 Descriptive statistics of female and male dairy agripreneurs

As presented in Table 9.1 there was statistically and significant difference between female and male dairy agripreneurs in connection to eleven variables. In relation to household demographic attributes, female agripreneurs have higher mean age (57.43 years), experience in dairy farming (21.73 years) and access to land with title deed (66%). While male had higher mean education level (3.71) and number of adult members (3.64). In connection to milk production parameters, male agripreneurs have higher number of milk yield (15.36 litres/day), milk productivity (69.44 liters/annum), total milk income (KES 136,095.73 per annum) and gross margin (KES106,678.48 per annum). In addition, the mean access to production support services was significantly higher among male agripreneurs (96%).

Finally, female agripreneurs received significantly high remittance (47%) from family members than male counterparts. These results indicate that male agripreneurs are still benefiting more in comparison to female agripreneurs. However, it is important to note that women agripreneurs are on the right track considering the fact, that entrepreneurship has always been considered as a men affairs. Critical analysis of the differences, indicate that men had slightly higher productivity and profitability compared to women. For example, the mean productivity for female was 58.15 litres/per annum and for male was 69.44 litres/per annum; while the gross margin for female and male was KES 76,713.69 and KES 106,678.48 respectively. These figures indicate that female agripreneurs are showing a positive trend in managing their agrienterprises.

Table 9.1. Demographic profile of female and male dairy agripreneurs

	Female		Male		Pooled		
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**f-value**
Age (years)	57.43	13.49	54.76	13.70	55.55	13.68	5.45**
Education level (years)	3.32	1.03	3.71	0.97	3.60	1.01	22.91***
Household labour (number of adults)	2.93	1.23	3.64	1.31	3.43	1.32	43.5***
Experience (years)	21.73	13.51	17.59	12.56	18.82	12.97	14.72***
Land tenure (1=with title deed)	0.66	0.48	0.59	0.49	0.61	0.49	3.01*
Land size (acres)	1.33	1.29	1.28	1.18	1.29	1.21	0.23
Livestock type (1=exotic/improved)	0.94	0.24	0.96	0.20	0.95	0.21	1.29
Number of cows	2.42	1.57	2.54	1.90	2.50	1.81	0.59
Milk yield (liters)	11.75	8.64	15.36	17.57	14.29	15.56	7.73***
Productivity (Annual Litres/cow)	58.15	38.59	69.44	48.79	66.10	46.27	8.56***
Milk price (KES)	32.79	6.24	33.36	6.66	33.19	6.54	1.09
Total milk income	103583.17	157959.53	136095.73	215046.45	126465.91	200281.82	3.76**
Total variable cost	26869.48	64071.56	29417.25	92966.75	28662.63	85394.22	0.13
Gross margin	76713.69	155906.92	106678.48	189459.76	97803.28	180580.96	3.93**
Distance output market (Km)	1.43	1.98	2.41	23.04	2.12	19.36	0.36
Trust buyers of milk (1=high)	0.66	0.48	0.64	0.48	0.65	0.48	0.13

Access to contracts (1=yes)	0.67	0.47	0.66	0.48	0.66	0.47	0.18
Access Production services(1=yes)	0.93	0.26	0.96	0.19	0.95	0.21	4.19**
Receive Business plan training(1=yes)	0.38	0.49	0.40	0.49	0.40	0.49	0.46
Access to credit(1=yes)	0.53	0.50	0.57	0.50	0.56	0.50	0.75
Cooperative membership	0.48	0.50	0.47	0.50	0.47	0.50	0.01
Received remittance	0.47	0.50	0.38	0.49	0.40	0.49	4.4**

*** = statistically significant at 1% probability level, ** = statistically significant at 5% probability level, * = statistically significant at 10% probability level

9.4.2 Disintegrated gender roles in dairy farming career in Kenya

The results on gendered household roles in dairy farming career in Murang'a County are presented in Table 9.2. The findings show that majority of the household members are involved in different activities in dairy farming with men and women having the biggest contribution. This imply that dairy farming career is a labour intensive investment. More women were involved in morning milking, evening milking and cleaning the barn with 52.3%, 53.5% and 47.4% respectively. Men contributed more proportion of labour in grass cutting, feeding of animals and fetching feeds with 52.2%, 48.7% and 51.2% respectively. There was almost equal contribution to labour in relation to watering with men and women contributing 46.3% and 45.7% respectively. These findings indicate that women agripreneurs are involved on a daily basis management of cattle (Njuki & Sanginga, 2013). The implication being that they are crucial actors in dairy value chain career resilience. Another implication of the findings is that female agripreneurs are mainly involved in domestic dairy cattle management (Katothya. 2017). There was low participation of boys and girls in the different activities which was less than 5% of total labour for most of the activities except for cleaning the barn which was about 5.4%. These results are similar with Kimaro *et al.* (2013), and Nyongesa *et al*. (2016), who found that gender roles in dairy farming is jointly done by men and women.

Table 9.2. Gender roles in dairy farming career

Activities	**Percentage (%)**						
Who is involved (%)	**Milking Morning**	**Milking Evening**	**Cleaning Barn**	**Grass cutting**	**Feeding**	**Watering**	**Fetching feeds**
Men	43.7	42.2	43.8	52.2	48.7	46.3	51.2
Women	52.3	53.5	47.4	39.1	43.8	45.7	40.6
Boys	2.6	2.6	5.0	4.0	3.5	3.8	4.1
Girls	0.1	0.1	0.4	0.0	0.0	0.0	0.1
Men and boys	1.0	1.0	2.6	3.8	3.4	3.8	3.2
Women and girls	0.1	0.4	0.7	0.9	0.6	0.6	0.7

9.4.3 Validity and reliability tests of entrepreneurship orientation and resilience constructs

According to Hair *et al*. (2017), convergent validity is achieved when a set of indicators of a construct converge or represents a single underlying construct. This validity was measured using Cronbach's alpha (CA), rho_A, Composite Reliability (CR) and Average Variance Extracted (AVE). As presented in Table 9.3, Cronbach's alpha (CA) ranged from 0.778 to 0.895, rho_A ranged between 0.831 and 0.9 and composite reliability (CR) ranged between 0.766 and 0.908. These thresholds exceed the minimum standard level of 0.70, hence internal consistency reliability is achieved. Convergent validity was also assessed by assessing average variance extracted (AVE) and the values exceed the threshold of 0.4 (Hair *et al.*, 2017).

Table 9. 3. Reliability and validity tests

Constructs	Items	CA	rho_A	CR	AVE	VIF
Agripreneurial Resilience	9	0.861	0.867	0.89	0.475	
Future orientation	6	0.895	0.897	0.92	0.66	1.041
Market orientation	13	0.891	0.9	0.908	0.436	1.299
Social orientation	6	0.778	0.827	0.766	0.502	1.323
Risk-taking orientation	5	0.814	0.831	0.869	0.573	1.01

Using the AVE-SV technique in Table 9.4, the constructs passed discriminant validity test as the diagonal values were greater than the horizontal and vertical values (Henseler *et al*., 2015; Hair *et al*., 2017).

Table 9.4. Fornell-Larcker Criterion Test

Constructs	Agripreneurial Resilience	Future Orientation	Market Orientation	Risk-taking Orientation	Social Orientation
Agripreneurial Resilience	0.689				
Future Orientation	0.447	0.812			
Market Orientation	0.274	0.147	0.66		

Risk-taking Orientation	0.115	0.025	0.064	0.757	
Social Orientation	-0.308	-0.186	-0.476	-0.096	0.708

According to Hair *et al*. (2017), HTMT ratio values should be below 0.85. The values in Table 9.5 were less than 0.85 thus indicating there was discriminant validity in the constructs. In summary, based on the results of convergent and discriminant validity, it can be concluded that the data used in the study are reliable and valid to prove the hypotheses with SmartPLS-SEM.

Table 9.5. Heterotrait-Monotrait (HTMT) Ratio

Constructs	**Future Orientation**	**Market Orientation**	**Risk-taking Orientation**	**Social Orientation**
Future Orientation	0.497			
Market Orientation	0.288	0.158		
Risk-taking Orientation	0.13	0.05	0.098	
Social Orientation	0.296	0.173	0.574	0.103

9.4.5 Gendered impact of agripreneurial orientations on agripreneurial resilience

Table 9.6 shows the differences between female and male, in relation to the path coefficients and p- values. It is clear that the direct impact of entrepreneurial orientations constructs on agripreneurial resilience displayed significant differences for men and women agripreneurs. The results show positive and significant impact of future orientation (FO) on agripreneurial resilience (AR) among females ($\beta = 0.381$, $p = 0.01$) and males ($\beta = 0.398$, $p = 0.01$). Moreover, the results show positive and significant influence of market orientation (MO) on agripreneurial resilience (AR) on females ($\beta = 0.193$, $p= 0.01$) and male agripreneurs ($\beta = 0.150$, $p = 0.01$).

Table 9.6. Direct effects path models for female vs male agripreneurs

	Female				Male			
Hypotheses	**Beta**	**Std. dev**	**t-value**	**p-value**	**Beta**	**Std. dev**	**t-value**	**p-value**
FO -> AR	0.381	0.058	6.653***	0.01	0.398	0.035	11.371***	0.01
MO -> AR	0.193	0.064	2.628***	0.01	0.150	0.045	3.285***	0.01
RO -> AR	0.189	0.064	2.758***	0.01	0.054	0.04	1.096	0.27
SO -> AR	-0.028	0.210	0.842	0.40	-0.164	0.043	3.672***	0.01

The results on impact of FO and MO on AR imply that if female and male agripreneurs are put on the same social and economic status, these entrepreneurial orientation constructs would have the same impact on resilience for both groups. A plausible explanation could be futuristic thinking and being market oriented are key ingredients for building a resilient business for any business, whether it is operated by male or female. Dairy agripreneurs need these behavioral characteristics to help them tolerate ambiguous situations and exploit opportunities that will provide them income in future (Andre *et al.,* 2018; Lens, 2015). Further, marketing orientation enable dairy agripreneurs to understand the needs of current and future customer. For example, it will give them knowledge on milk quality and safety measures, costumers' preferences, and market system to adopt in order to reap benefits. This result is in conformity with Ho *et al*. (2017), who found market orientation improves the resilience dairy agripreneurs since it enables to supply what is demanded in the market.

In relation to impact of risk-taking orientation (RO) on agripreneurial resilience (AR), the relationship was significant for women ($\beta = 0.189$, $p = 0.01$) but for men it was not significant ($\beta = 0.0.054$, $p = 0.273$). Risk-taking ability is a significant factor that makes women agripreneurs more resilient than male counterparts in managing their dairy farm career. The plausible reason could be due to the empowerment of women which has awoken their spirit of financial independence and need for success. In addition, women tend to be the higher attendees on most social empowerment programmers where they acquire new knowledge on how to venture into new economic activities unlike men who rarely create time to attend such forums (Hughes & Yang, 2020). This imply that most women are able to access more informational resources which are likely to influence their risk-taking capability thereby their

dairy career resilience. This makes women agripreneurs not to be afraid to purse their career goals hence becoming more risk-takers which positively impacts on their agripreneurial resilience. Further, the general orientation of women agripreneurs is that they are more susceptible to learn and retry previously failed ventures unlike men who easily gives up. This finding is in contrary to Ayub *et al.* (2013), who found men having higher risk-taking propensity than female.

Finally, we note negative and significant influence of social orientation (SO) on agripreneurial resilience (AR) among male agripreneurs (β = -0.164, p = 0.01) but for women it was non-significant (β = -0.028, p = 0.400). This result show that social orientation reduces the resilience of male agripreneurs. This is intuitive because compared to females, men are less socially oriented in Murang'a county, Kenya. The society has portrayed men in this county as independent and they have to struggle alone to make end meet. Therefore, the result indicates that if men perceive themselves as more social oriented, the agripreneurial resilience decreases. This finding is contrary to Vishnu *et al.* (2018), who indicated that smallholder agripreneurs rely on their social connection to provide them with reliable and trusted information. The finding is also not consistent with Batjargal *et al.* (2019), who found that social network contributes to growth of male-owned enterprises.

9.4.6 Mean Comparison Between female and male entrepreneurial orientations

Table 9.7. Mean differences between female vs male agripreneurs entrepreneurial orientations

	Parametric Test					PLS-MGA	
Hypotheses	**Path female**	**Path male**	**Path (female-male)**	**t-value (female vs male)**	**p-value (female vs male)**	**p-value original (female vs male)**	**p-value new (female vs male)**
FO -> AR	0.381	0.398	-0.008	0.117	0.91	0.54	0.92
MO -> AR	0.193	0.15	0.02	0.253	0.80	0.40	0.79
RO -> AR	0.189	0.054	0.133	1.806	0.07	0.03	0.06
SO -> AR	-0.028	-0.164	-0.017	0.115	0.91	0.63	0.74

Table 9.7 shows the mean for each of the entrepreneurship orientations variables by gender, as well as the results obtained from t-test analysis. The results on the influence of risk taking

orientation on agripreneurial resilience show that female agripreneurs had statistically significant higher risk-taking propensity of (β = 0.189, *p*=0.06) compared to their male counterparts (β = 0.054, *p*=0.06). While the remaining path relationships between entrepreneurial orientation constructs and agripreneurial resilience were found to be similar across the two groups. It may be concluded that women have significantly higher risk-taking propensity which increases their AR, when compared with male agripreneurs. This imply that women would pursue agripreneurship due to their risk-taking propensity which is slightly stronger than males. A plausible explanation for this is due to the empowerment of women through access to and control of resources which has increased their desire for financial independence and need for achievement.

This could be attributed to women empowerment initiatives driven by both Government and Non-governmental agencies, women driven social groupings such as merry go round which support them to empower their families. In addition, the inherent women performance driven personalities and nature of women spending more time with the family and at the homestead and their nature of being self-organized in all they do which have given them access to productive resources. Finally, access to productive resources such as land and ownership of livestock has always been biased towards men, which has always restricted women in any investment in agriculture. However, in the past decade, women in Kenya have been given the right to own and inherit productive assets which has triggered them to have internal locus of control and need for achievement which triggers their risk-taking capability. This result is in contrary to most studies (Ayub *et al.,* 2013; Lim & Envick, 2013; Pérez-Quintana, 2013) that have found higher scores in risk-taking propensity among men. However, it contributes to the body of knowledge in the case that dairy women agripreneurs are more risk taking if they have access to productive resources which may propel their resilience. Hence, dispelling the stereotypes that women are risk averse. This is similar to Hundera *et al.* (2019), who found access to resources accelerate the risk-taking and resilience of women entrepreneurs. Another explanation can be attributed to the fact that, dairy industry needs good organization, management and time as compared to crop farming. Women being more precise in nature and present at home as compared to men, will play significant role in dairy enterprises hence take high risk in such investments (Njuki *et al.,* 2016).

9.5 Conclusions

This study sought to determine whether impact of agripreneurial orientation on agripreneurial career resilience differs between male and female agripreneurs in Kenya's dairy sector. The results show significant gender differences across the agripreneurial orientations. Whereby, future, market and risk-taking orientation of female agripreneurs had a positive and significant impact on AR. While, for male agripreneurs, future and market orientation had a positive and significant impact on AR; but social orientation had a negative impact on AR. Our results on mediation analysis revealed that gender decisively influences dairy agripreneurs entrepreneurial resilience through risk-taking orientation. Female agripreneurs had a higher risk-taking propensity than their male counterparts. Therefore, it can be concluded that female agripreneurs in the Kenyan dairy sector are risk-takers which positively impacts on their dairy career resilience.

The implication of this study is that, future, market, risk-taking and social orientation may be considered as influential factors for entrepreneurship to grow among dairy agripreneurs. These factors, if enhanced, can help in entrepreneurial process of dairy farmers which may enhance their income and dairy career resiliency. The findings also reveal that women are very critical in the dairy career resilience, considering the fact that they are involved in majority of roles in dairy production, processing and marketing. In addition, this study adds credence to the role played by future orientation in mediating the relationship between entrepreneurial orientation and entrepreneurial career resilience which potentially encourages women agripreneurs to allocated more time and resources in dairy farming due to their high risk-taking orientation. Thus, to upgrade and improve performance of the dairy sector, there is need to increase and advocate for women control of activities and resources, whereby they became the chain co-owners through strategic partnership with male agripreneurs who seem to have control of resources but they have low risk-taking propensity. In addition, there is need for entrepreneurial training among female agripreneurs as a crucial factor in developing resiliency. This could be enhanced by linking female agripreneurs with role models who may have a positive influence on the entrepreneurial intention and resilience of female agripreneurs.

CHAPTER TEN
IMPACT OF AGRIBUSINESS SUPPORT SERVICES ON MILK PRODUCTIVITY AND INCOME: EVIDENCE FROM KENYA'S DAIRY SECTOR

Abstract

The use of agribusiness support services (ASS) has been promoted as a pathway to increase productivity and income of smallholder dairy agripreneurs in Kenya. However, many dairy farmers in Kenya use a single or mix of ASS rather than all the available services. This study analyzes the dairy agripreneurs' choice of combination of production, financial, cooperative and business plan training support services and evaluates its impact on productivity and income using cross-sectional data from 682 dairy farmers in Murang'a County, Kenya. Multinomial endogenous switching regression model was used for analysis. From the findings, the likelihood of using ASS is positively influenced by education level of household head, available household labour, experience in dairy farming, land tenure, and access to contract. However, ASS utilization was negatively influenced by age of household head, number of cows owned by the household, milk price, distance to veterinary clinic and distance to nearest output market. The result indicates that utilization of combination of ASS significantly increase milk productivity and income per year for smallholder dairy agripreneurs.

Key words: Agribusiness support services, Dairy agripreneurs, Income effects, Milk Productivity

10.1 Introduction

In the past decade, dairy production strategies have been focused on enhancing productivity and sustainable milk production of smallholder dairy farmers (Hernández-Castellano, 2019). However, a majority of these smallholder dairy farmers have low milk productivity and generate low income from their agrienterprises (Baur *et al*., 2017; Britt *et al.,* 2018; Kumar *et al.,* 2019; Ngeno, 2018). Some of the major causes include high cost of production, lack of market access, low uptake of credit and information asymmetry due to limited extension staff (Mwambi *et al.,* 2018; Wossen *et al.,* 2017). To address these challenges, public and private organizations have developed agribusiness support service programmes that are geared towards upgrading and empowering smallholder dairy agripreneurs (Maonga *et al.,* 2017). These support services ranges from provision of inputs such as animal feeds, animal health

services, credit services, business plan training to group marketing through dairy cooperatives (Oloo, 2016).

This paper focuses on the role of production, cooperative, financial, and business plan training services in influencing dairy farming productivity and income in Kenya. Production support service are related to utilization of improved agricultural technologies such as artificial insemination (AI), vaccination services and improved dairy breeds (Bardhan *et al.*, 2015). In addition, it includes utilization improved feeds such as hay and silage, improved animal health services and increased farm mechanization which may improve farm productivity (Kumar *et al.*, 2018).

Another well documented constraint limiting income of dairy agripreneurs is inefficient marketing system (Mwambi *et al.,* 2018). This has led to emergence of farmer-owned dairy cooperatives which have been initiated by private, public and smallholder dairy agripreneurs (Kumar *et al.,* 2018; Ngeno, 2018). Cooperatives are recognized as innovative collaborative business models that may help smallholder dairy agripreneurs overcome market access challenges and thereby increase farm productivity and income (Kumar *et al*., 2018; Ngeno, 2018; Twine *et al.*, 2018; Wossen *et al.*, 2017).

Dairy cooperatives may influence the productivity and income of smallholder agripreneurs through different pathways. First, cooperatives may offer credit linked inputs which are subsidized hence reduce the cost of production (Ngeno, 2018). Secondly, cooperatives reduce dairy agripreneurs' transaction costs and transportation costs by ensuring that they search for markets, negotiate with buyers, and offer logistic services for milk delivery (Kumar *et al.*, 2018; Mwambi *et al.,* 2018). Finally, cooperatives serve as avenue for smallholder dairy agripreneurs to pool different resources such as credit, equipment and information which could enable them to enjoy economies of scale in resource utilization (Molla *et al.,* 2020; Wossen *et al.,* 2017). Omondi *et al*. (2018), indicated that dairy cooperatives act as a one stop hub that offers farmers all necessary dairy services like vaccination, AI, deworming, improved feeds, credit linked inputs and community information centres.

Apart from the benefits attributed from membership to dairy cooperatives, majority of smallholder agripreneurs are receiving ASS such as access to credit and business plan training from private and public organizations (Wongtschowski *et al*., 2013). The objective of these

initiatives is to improve the productivity of smallholder farmers and hence their commercialization (Wortmann-Kolundžija, 2019). Utilization of credit support service may enhance milk productivity and income due to investment in new technologies such as purchase of improved breeds of cattle, use of AI, and purchase of machineries such as milking machine and chaff cutters (Wilkes *et al*., 2018).

While access to business plan training may improve the entrepreneurial behaviour of dairy agripreneurs, dairy farmers face many risks and uncertainties. Some of the risks include production, human resource, market risk and financial; while uncertainties are related to climate change, pests and diseases, fire and theft. Proper business planning could enable smallholder farmers to mitigate these challenges (Makropoulos *et al*., 2020). This is because a business plan acts as a map that smallholder farmers could refer to when making business decisions. Business planning may also enable agripreneurs to have strategic focus, set priorities, develop accountability and enhance financial management (Honig & Samuelsson, 2012).

Although utilization of ASS has positive payback, there is dearth of empirical evidence on the determinants of utilization and their impacts on productivity and income of smallholder dairy agripreneurs. To our knowledge, a study by Maonga *et al.* (2017), on the utilization decisions of ASS among maize farmers in Malawi is the first attempt to broadly examine the determinants of ASS utilization. The authors investigate the determinants and intensity of ASS utilization (extension, membership to a farmer club and access to loan facilities), but do not assess the effects of these services on yields or income of smallholder agripreneurs, which is one contribution of our study.

Similarly, Bardhan *et al*. (2015), Omondi *et al.* (2017) and Wane *et al.* (2019) assess the delivery of animal healthcare services among dairy farmers in India, Kenya and Mali without looking at its impact on productivity. Several studies have given an overview of the determinants of utilization of production (animal health, breeding and improved feeds), cooperative, credit and business plan training on separate basis (Anang *et al.,* 2015; Chagwiza *et al.,* 2016, Kumar *et al.,* 2019; Maonga *et al.,* 2017; Mwambi *et al.,* 2018; Oleksiy *et al.,* 2013; Wilkes *et al.,* 2018; Wossen *et al.,* 2017). However, despite the potential

complementarity of utilizing ASS, very limited studies have simultaneously analysed the determinants of utilization and impacts of these services on smallholder dairy farmers.

In addition, the influence of individual agribusiness support services on technology adoption, yield, productivity and income is well acknowledged in the existing literature. Wossen *et al.* (2017), observed a positive and significant effect of access to extension services and cooperative membership on technology adoption, asset ownership and poverty reduction among smallholder cassava farmers in Nigeria while Anang *et al*. (2019) reported positive impact of agricultural extension on farm income of rice farmers in Ghana. Ngeno (2018), and Kumar *et al.* (2018), reported that belonging to dairy cooperatives enhances smallholder welfare in Kenya and India. Wilkes *et al.* (2018), found that access to finance had a positive effect on dairy productivity in Kenya, and Oleksiy *et al.* (2013), reported positive impact of business planning on the income of small and medium enterprises involved in business coaching in USA and UK. These studies assess the effect of utilizing one ASS but do not analyse the effects of using a combination of these ASS on productivity and income of smallholder farmers. This study considers that dairy agripreneurs use different combinations of ASS and their impact could be different.

This study contributes to the developing body of literature on utilization of ASS by identifying the determinants that affect the decisions to utilize individual agribusiness support services such as production, financial, business plan training and cooperative as well as the combination of these services and their impact on productivity and income of dairy farmers in Murang'a County in Kenya. To achieve these objectives, we modelled the utilization of these services as multinomial selection process whereby it was assumed that the expected net returns of ASS accelerate the utilization decisions. Therefore, multinomial endogenous switching regression was used to test the impact of utilizing agribusiness support services on milk productivity and income of dairy farmers in Kenya.

The remainder of the paper is organized as follows. Section two present the survey design, data collection procedure and the econometric models used for estimation. Section three presents the estimation results and discussion. Finally, section four presents conclusions whereby policy implications are drawn from the findings of the study.

10.2 Methodology

10.2.1 Description of the study area and data collection

The study was conducted in Murang'a County in central Kenya. This county was selected owing to the fact that majority of the households are involved in mixed farming and dairy cattle is the most important livestock species in the area. The County represents a vibrant dairy sector with the county government initiating several interventions in relation to ASS. Some of the developmental needs that the county is engaged in include; increasing market access through dairy producer cooperatives, contract farming, business planning and upgrading markets and market infrastructures. The county is also involved in subsidized input provision programmes, bulk input purchases through producer and marketing cooperatives and link farmers to credit providers (Murang'a CIDP, 2018). The main aim of these initiatives is to empower smallholder farmers to improve the performance of their agrienterprises. Therefore, this study sought to determine the impact of agribusiness support services on productivity and income of dairy agripreneurs in Murang'a county.

This study adopts a quantitative research design based on cross-sectional farm household survey data collected among dairy agripreneurs involved in production and marketing of milk in Murang'a County, Kenya. We used the Cochran (1963), formula to determine the sample size that is a representative of dairy farmers in Kenya. Multistage sampling technique was employed to select the respondents. Based on information from the Sub-County Agricultural office, four of the main milk-producing sub-counties were purposively chosen. Within the four sub-counties, 12 wards were randomly selected and thereafter 682 dairy agripreneurs were randomly selected using proportionate to the number of households in the four sub-counties.

Before the start of data collection, a research permit was secured from the National Commission for Science Technology and Innovation (NACOSTI), which is the legal body mandated to regulate research activities in Kenya. The researcher also sought approval from County Government of Murang'a Ministry of Agriculture, Livestock & Fisheries to conduct interviews. Data collection took place from 4th January to 14th February, 2020. The respondents were informed of the objective of the study and informed consent was sought from the respondents. Once the dairy agripreneurs gave their consent, data was collected through personal interviews using semi-structured questionnaires. The survey collected information on

socio-economic and institutional characteristics of dairy farmers, utilization of ASS, and dairy production such as number of cows owned, input utilization, milk yield, sales and marketing channels.

In this study, we consider the utilization of four interrelated agribusiness support services: production (P), financial (F), business plan training (B) and cooperative (C) support services. Production support services are related to use of AI, deworming, vaccination, curative, pregnancy diagnosis and improved feeds (hay and silage). While business plan training is related to utilization of business capacity building programmes such as idea identification, marketing and management of agrienterprises. Cooperative support is related to membership and utilization of services from dairy cooperatives. Finally, financial support services are related to use of credit from formal non-formal financial institutions in running their dairy business. Use of these services was measured as a binary variable: 1 for utilization and 0 for non-utilization. Joint probability estimation was conducted to determine interrelationship across the four ASS which led to generation of 10 possible ASS packages. Table 10.1 presents the 10 alternative ASS packages. As indicated in Table 10.1, of the total sampled 682 dairy agripreneurs, about 1.61% of the farmers did not use any of the ASS ($P_0F_0B_0C_0$), whereas 17.45% of the farmers simultaneously used all of the four ASS ($P_1F_1B_1C_1$). Majority of the dairy agripreneurs (23.46%) were utilizing ASS package ($P_1F_1B_0C_0$).

Table 10.1. Alternative combinations of agribusiness support services (n=682 farmers)

Alternative (g)	Alternative package	Frequency	Percentage (%)
0	$P_0F_0B_0C_0$	11	1.61
1	$P_1F_0B_0C_0$	109	15.98
2	$P_0F_1B_0C_0$	19	2.79
3	$P_1F_1B_0C_0$	160	23.46
4	$P_1F_0B_1C_0$	31	4.55
5	$P_1F_0B_0C_1$	61	8.94
6	$P_1F_1B_1C_0$	35	5.13
7	$P_1F_1B_0C_1$	51	7.48
8	$P_1F_0B_1C_1$	86	12.61
9	$P_1F_1B_1C_1$	119	17.45

Note: ASS combination represents the 10 possible combination of production (P), financial (F), business plan training (B) and cooperative (C) support services.

10.2.2 Analytical estimation of determinants of dairy farmers' decisions on utilization of multiple ASS packages

The first objective of this study was to identify the determinants of ASS packages utilization among smallholder dairy farmers in the study area. As indicated in Table 10.1, the smallholder dairy agripreneurs were using a mix of ASS to deal with the existing production and marketing constraints. Utilization of these services is a robust strategy to enhance productivity and income of smallholder dairy agripreneurs. Therefore, understanding the factors that influence utilization of these packages will be a key priority for policy makers and the developmental partners. Whereas dairy agripreneur may utilize a combination of ASS, depending on the costs and benefits of the service, the decision to utilize a package of ASS, may be conditioned by the choice of other packages which could be due to complementarity or a substitutability. To model the choice of ASS package, multinomial discrete choice model was used. The dependent variables were the alternative packages of ASS. This model was suitable because the ASS packages were categorical, whereby individual dairy farmer was expected to be utilizing only one package. According to Singh (2018), multinomial logit is used when the dependent variables are categorical and they are more than one, whereby each category is compared with a reference category in our case the non-users of ASS were the reference package which was compared with other packages of ASS users. The multinomial logistic regression for the choice of ASS packages is summarised in Equation 1.

$$P(Yi = j) = e^{\beta' j} X_i / \sum_{k=0}^{2} e^{\beta' k} X_i \; j = 0,1,2\ldots. \text{ n=9}) \qquad 1$$

Where: Yi = the probability of dairy farmer utilizing a package of ASS; j = the indicator variable of ASS packages (0= $P_0F_0B_0C_0$, 1= $P_1F_0B_0C_0$, 2= $P_0F_1B_0C_0$ ……n=9); X_i= the vector of explanatory variables; and βs are the regression coefficients estimated by the maximum likelihood method. To interpret the coefficients in multinomial logit regression, marginal effects of the explanatory variables were conducted as follows:

$$\delta p(Y)/\delta X_i = \beta X_i * \exp[z]/[1 + \exp(z)]^2 \qquad 2$$

Equation 2 provides an estimate βs of the effect of the determinants X_i on the ASS package Y. Where z = the sum of coefficients multiplied by the means of the respective variables plus the constant term.

10.2.3 Analytical estimation of effect of agribusiness support services on milk productivity and income

10.2.3.1 Multinomial Endogenous Switching Regression Model (MESRM)

The second objective of this study is to determine the effect of agribusiness support services on milk productivity and income of smallholder dairy agripreneurs. Dairy agripreneurs' decision to use or not to use an ASS is determined by both observable and non-observable factors. A methodological challenge that may occur in this estimation is sample selection problem, since smallholder dairy agripreneurs may self-select themselves into utilization of ASS or have innate characteristics that correlate with productivity and income. To control for the possible bias resulting from non-observable characteristics, the study uses multinomial endogenous switching regression model (MESRM). This model corrects for both observable and non-observable biases that may result from non-random assignment of dairy agripreneurs into utilization of ASS, hence providing unbiased estimates of the impact of ASS on productivity and income. Productivity was measured as milk yield per litre divided by number of milking cows per year. While income was measured as milk sales per year which was total litres sold multiplied by milk price.

The multinomial endogenous switching regression model estimated the average treatment effect of utilizing ASS on the outcome variables (productivity and income). Thus, the model was used to compare the expected returns from users and non-users of agribusiness support services. We assumed that dairy agripreneurs aim to maximize their net productivity and income, π_h, by comparing expected returns from provided by, g, alternative agribusiness support services. The prerequisite for a dairy agripreneur, h, to select an agribusiness support service, g, over other alternative support services is that $\pi_{hg} >= \pi_{hk} k \neq g$. The expected net outcome, π^*_{hg}, derived from the support service, g, by a dairy agripreneur is a latent variable which is determined by observed features (X_h) and unobservable factors ($\in_{hg}$).

$$\pi^*_{hg} = X_h \beta_g + \in_{hg} \quad (3)$$

where X_h is a vector of observed exogenous variables. Let H be an index representing the agripreneur's choice of an agribusiness support service, such that:

$$H = \begin{cases} 1 \; if \; \pi_{h1}^{*} \rangle \max\left(\pi_{hk}^{*}\right) or \; \eta_{h1} \langle 0 \\ \qquad\qquad k \neq g \\ ... \qquad\qquad for \; all \; k \neq g \\ g \; if \; \pi_{hg}^{*} \rangle \max\left(\pi_{hk}^{*}\right) or \; \eta_{hg} \langle 0 \\ \qquad\qquad k \neq g \end{cases} \tag{4}$$

Where $\pi_{h1}^{*} = \max_{k\neq}\left(\pi_{hk}^{*} - \pi_{hg}^{*}\right) \langle \, 0$ implies that the h_{th} dairy agripreneur will select an agribusiness support service g to capitalize on the expected positive outcome if an agribusiness support service g provides a greater expected positive outcome than other support services $k \neq g$, that is, if $\eta_{hg} = \max_{k\neq g}\left(\pi_{hg} - \pi_{hk}\right) \rangle 0$ (Bourguignon *et al.*, 2007). Assuming that, $\in$ are independently and identically Gumbel distributed, the probability that an agripreneur, h, with characteristics X_h will choose an agribusiness support service g can be specified by use of a multinomial logit model according to McFadden, (1973):

$$P_{hg} = \Pr\left(\eta_{hg} \langle \, 0 \middle| X_h\right) = \frac{\exp\left(X_h \beta_g\right)}{\sum_{k=1}^{g} \exp\left(X_h \beta_k\right)} \tag{5}$$

To estimate the latent variable parameters, a maximum likelihood function was used. The link between the outcome variables (productivity and income) and a set of exogenous variables J were estimated for the selected agribusiness support service in the next step of the model. Two categories were formed where the first base category was "does not use any support service" represented as $g = 0$ and the other base category was in line with using at least one package of ASS by the dairy agripreneurs represented as $g = 1,2,3,4.....n = 9$. Hence the likely outcome equation for both categories is given as;

$$\begin{cases} Category\,1 : Q_{h1} = J_h \alpha_1 + \mu_{h1} \; if \; H = 1 \\ Category\,G : Q_{hg} = J_h \alpha_g + \mu_{hg} \; if \; H = G \end{cases} \tag{6}$$

where $Q_{hg}{}'s$ are outcome variables of the h_{th} agripreneur in category G and the error terms $u'S$ are spread with $E\left(u_{hg} \middle| X, Z\right) = \sigma_g^2 = 0$ and $\text{var}\left(u_{hg} \middle| X, Z\right) = \sigma_g^2$, Q_{hg} is the observed variable if the agribusiness support service g is used by an agripreneur, which occurs when $\pi_{hg} \rangle \max_{k\neq g}\left(\pi_{hk}\right)$

The multinomial endogenous switching model further assumes linearity assumption as shown in Equation 7:

$$E = \left(U_{hg} \left| \in_{h1} \ldots \in_{hg} \right.\right) = \sigma_g \sum_{k \neq g}^{g} rg\left(\in_{hk} - E\left(\in_{hk}\right)\right) \tag{7}$$

with $\sum g_k = 1 r_g 0$ meaning that the correlations between $u's\ and \in's$ sum to zero. Hence, following this assumption in equation 6 and 7 can be summarized as:

$$\begin{cases} Category\,1: Q_{h1} = J_h \alpha_1 + \sigma_h \lambda_1 + \omega_{h1}\ if\ H = 1 \\ Category\,2: Q_{hg} = J_h \alpha_g + \sigma_h \lambda_g + \omega_{hg}\ if\ H = G \end{cases} \tag{8}$$

Where $\omega's$ are error terms with zero expected values, α_g is the covariance between $u's\ and \in's$ and λ_g is the Inverse Mills Ratio (IMR) which was computed from the probabilities in equation 5 as:

$$\lambda_g = \sum_{k \neq g}^{g} \rho_g \left[\frac{\hat{P}_{hk}\ In\left(\hat{P}_{hk}\right)}{1 - \hat{P}_{hk}} + In\left(\hat{P}_{hg}\right) \right] \tag{9}$$

with *p* representing correlation coefficients of the $u's\ and \in's$. In the selection setting, there are $G-1$ choice outcomes, with one representing an agribusiness support service. Heteroskedasticity is further accounted for using the standard errors arising from the λ_g regressor.

10.2.3.2 Estimation of Average Treatment Effects

The multinomial endogenous switching model was further used to examine the average treatment effect by comparing expected outcomes of each alternative packages of ASS. This model was used to compute the average treatment effects of the treated (ATT) whereby we compared the expected outcomes of different packages of ASS. To estimate the effect of using ASS, counterfactual effect which is the outcome that dairy agripreneur could have achieved if they used a different support service from the one they had used. According to Di Falco and Veronesi (2013), we compute the ATT in the actual and counterfactual scenarios as follows;

For actual users witnessed in the sample, the outcome estimation model is given as:

$$\begin{cases} E\left(Q_{h2} \left| H = 2\right.\right) = J_h \alpha_2 + \sigma_2 \lambda_2 & (10a) \\ E\left(Q_{hg} \left| H = 2\right.\right) = J_h \alpha_g + \sigma_g \lambda_g & (10b) \end{cases}$$

$$\begin{cases} E(Q_{h1}|H=1) = J_h\alpha_1 + \sigma_1\lambda_1 & (11a) \\ E(Q_{h3}|H=3) = J_h\alpha_3 + \sigma_3\lambda_3 & (11b) \end{cases}$$

If users of a given agribusiness support service had not chosen that package of agribusiness support service, counterfactual is modeled as:

$$\begin{cases} E(Q_{h1}|H=2) = J_h\alpha_1 + \sigma_1\lambda_2 & (12a) \\ E(Q_{h3}|H=G) = J_h\alpha_1 + \sigma_1\lambda_G & (12b) \end{cases}$$

$$\begin{cases} E(Q_{h2}|H=1) = J_2\alpha_2 + \sigma_2\lambda_1 & (13a) \\ E(Q_{hg}|H=3) = J_2\alpha_3 + \sigma_3\lambda_3 & (13b) \end{cases}$$

The above estimated values are useful in the derivation of unbiased estimates of the average treatment effects on treated (ATT) and untreated (ATU). ATT is the difference between equation 10a and 12a or equation 10b and 12b is given as:

$$ATT = E[Q_{h2}|H=2] - E(Q_{h1}|H=2) = J_h(\alpha_2 - \alpha_1) + \lambda_h(\alpha_2 - \alpha_1) \quad (14)$$

The expected change in the mean outcome for a dairy agripreneur who uses h support service is equal to the returns of a dairy farmer who does not use any support service is given by $J_h(\alpha_2 - \alpha_1) + \lambda_h(\alpha_2 - \alpha_1)$, λ_h is the choice term capturing all potential effects of the differences in unobserved variables.

On the other hand, ATU is given as the difference between Equation 11a and 13a or Equation 11b and 13b:

$$ATU = E[Q_{h1}|H=1] - E(Q_{h2}|H=1) = J_h(\alpha_2 - \alpha_2) + \lambda_2(\alpha_2 - \alpha_2) \quad (15)$$

10.4 Results and discussion

10.4.1 Description of the sample

Table 10.2 presents the socio-economic and institutional attributes of the respondents. With regards to utilization of ASS on average 95%, 56%, 47% and 40% of the dairy agripreneurs had used production, financial, cooperative and training on business planning respectively in the last 12 months. The result indicate majority of the dairy agripreneurs were receiving production support services possibly because of the many input providers who were promoting use of animal health, breeding technologies and improved feeds. Most of the respondents (70%) were male, and have an average age of 56 years and mean number of four adults in the households (Table 10.2). This result indicates that dairy farming in Kenya is dominated by

male-headed households who are elderly with an average dairy farming experience of 19 years (Machina & Lubungu, 2019).

Majority of the respondents had primary level of education indicating low literacy levels of smallholder farmers. This means dairy agripreneurs need more capacity building programmes to improve their skills and knowledge (Mwambi *et al.,* 2018). In relation to land tenure, 61% of the respondents owned land with title deeds with average size under dairy farming of 1.3 acres. This suggests the landholdings are very small which could be attributed to the population increase which is putting pressure on arable land for human settlements. With regards to livestock type kept by the dairy agripreneurs, 95% of the livestock kept was improved/exotic, with average number of 3 cows per household and mean milk yield of 15 liters/per day. This finding suggests that majority of dairy agripreneurs were smallholders, but interestingly they were keeping improved breeds of cattle which attributes to the averagely better milk yield (Ngeno, 2018).

Most dairy agripreneurs (66%) had access to contract and were receiving average milk price of KES 34 per litre. This price is low compared to the average market price of pasteurized milk of KES 110 per litre. This calls for innovative means of increasing farmers' milk price which could be through strengthening dairy cooperatives to process milk supplied by farmers before selling to consumers. This would enable them fetch a higher price which may boost income of smallholder dairy farmers. The mean distance to veterinary clinic and output market was 2.8 Km and 2.1 Km respectively with only 36% of the agripreneurs having access to tarmac road. Tarmac road is a proxy for market access since road infrastructures reduces transaction and transportation cost. The findings indicate, majority of these dairy agripreneurs had poor market access which may limit them from selling milk to lucrative markets hence opting for middlemen (Kumar *et al.,* 2019). In terms of trust buyers of milk and receiving of remittance, 65% and 40% respectively have high trust levels for buyers of milk and were receiving remittance from family members.

Table 10.2. Definition of variables and summary statistics

Variables	Description of variables	Mean	Std. dev
Production support services	Dummy = 1 if HH utilizes dairy production support services, 0 otherwise	0.95	0.22
Financial support	Dummy = 1 if HH utilizes financial support services, 0 otherwise	0.56	0.50
Business plan training support services	Dummy = 1 if HH Received training on dairy farm business planning, 0 otherwise	0.40	0.49
Cooperative support services	Dummy = 1 if HH Received cooperative support services, 0 otherwise	0.47	0.50
Sex	Dummy=1 if HH head male and 0 if female	0.70	13.682
Age	Age of HH head in years	55.55	1.007
Education level	Highest education level of household head	3.60	1.325
Household labour	Number of adult household members	3.43	12.974
Experience	Experience in dairy farming in years	18.82	0.488
Land tenure	Dummy = 1 if HH Owned land with title deed, 0 otherwise	0.61	1.214
Land size	Size of land under dairy farming in acres	1.29	0.208
Livestock type	Dummy = 1 if HH had improved/exotic, 0=otherwise)	0.95	1.806
Number of cows	Number of cows owned in the household	2.50	15.555
Milk yield	Average milk production per day in litres	14.29	0.474
Access to contracts	Dummy = 1 if HH had written contracts, 0 Otherwise	0.66	6.538
Milk price	Milk price per litre in KES	33.19	7.924

Distance veterinary clinic	Distance to a veterinary clinic in KM	2.79	19.358
Distance output market	Distance to the output market in KM	2.12	0.481
Type of road	Dummy = 1 if Tarmac, 0 otherwise	0.36	0.478
Trust buyers of milk	Dummy = 1 if HH had high trust, 0 otherwise	0.65	0.491
Remittance	Dummy = 1 if HH received remittance, 0 otherwise	0.40	0.215

The characteristics of the respondents according to use of different combinations of agribusiness support services are presented in Table 10.3. The results showed that mean values of sex of household head, education level, household labour, land tenure, land size. Livestock type owned, number of cows, milk yield, access to contract, milk price, distance to output market, type of road and level of buyer trust were significantly different across all the combinations of ASS. There were no statistical significant differences in the mean value of age, experience, distance to veterinary clinics and receive remittance among the different agripreneurs in relation to the different combinations of ASS.

Table 10.3. Summary statistics and choice of agribusiness support services by dairy agripreneurs, Kenya

Variables (Base category - $P_0F_0B_0C_0$)	**$P_0F_0B_0C_0$**	**$P_1F_0B_0C_0$**	**$P_0F_1B_0C_0$**	**$P_1F_1B_0C_0$**	**$P_1F_0B_1C_0$**	**$P_1F_0B_0C_1$**	**$P_1F_1B_1C_0$**	**$P_1F_1B_0C_1$**	**$P_1F_0B_1C_1$**	**$P_1F_1B_1C_1$**	**F-value**
Sample size (n)	11	109	19	160	31	61	35	51	86	119	
Sex (male=1)	0.64	0.72	0.42	0.73	0.74	0.74	0.74	0.59	0.63	0.78	2.01**
	(0.5045)	(0.4532)	(0.5073)	(0.4479)	(0.4448)	(0.4435)	(4434)	(0.4971)	(0.4862)	(0.4150)	
Age (years)	57.82	57.41	52.74	53.19	57.00	56.49	56.83	58.53	55.14	55.03	1.28
	(13.5412)	(14.7267)	(10.4501)	(13.1757)	(14.0475)	(15.9516)	(11.5720)	(13.7686)	(12.6567)	(13.5506)	
Education level	3.55	3.27	3.74	3.69	3.55	3.43	3.97	3.75	3.49	3.76	2.89***
	(1.1282)	(1.0332)	(1.2402)	(0.9713)	(0.8500)	(0.9909)	(0.8570)	(1.2624)	(0.9670)	(0.8922)	
Household labour (Number of adult members)	2.55	3.57	3.16	3.24	3.23	3.62	3.57	2.98	3.74	3.57	2.82***
	(0.9342)	(1.3902)	(1.3023)	(1.2614)	(1.3092)	(1.4510)	(1.2899)	(1.1746)	(1.3821)	(1.2526)	
Experience (years)	13.45	19.57	14.42	18.06	19.61	20.74	17.80	21.14	20.16	17.49	1.16
	(8.9035)	(12.3081)	(11.2858)	(12.7938)	(14.2517)	(15.1601)	(13.3434)	(14.6479)	(13.0608)	(11.7306)	
Farm characteristics											
Land tenure	0.45	0.69	0.74	0.52	0.55	0.54	0.77	0.63	0.62	0.64	1.89**
	(0.5222)	(0.4654)	(0.4524)	(0.5012)	(0.5059)	(0.5025)	(0.4260)	(0.4883)	(0.4891)	(0.4824)	
Land size	1.36	1.07	1.43	1.11	1.40	1.26	1.30	1.12	1.46	1.66	2.44***
	(0.7103)	(1.0551)	(0.7766)	(1.2222)	(1.3490)	(1.1785)	(1.0503)	(0.8841)	(1.3612)	(1.3867)	

Livestock type	1.00	0.97	0.79	0.91	0.90	1.00	0.97	0.96	0.99	0.98	3.61***
(1=improved/exotic,	(0.0000)	(0.1644)	(0.4189)	(0.2924)	(0.3005)	(0.0000)	(0.1690)	(0.1960)	(0.1078)	(0.1291)	
0=otherwise)											
Number of cows	2.45	2.12	2.32	2.09	1.97	2.31	2.34	3.14	2.99	3.10	4.98***
	(1.2933)	(1.0158)	(1.2043)	(1.2428)	(1.2776)	(1.6787)	(1.4741)	(2.3325)	(2.3288)	(2.3592)	
Milk yield	10.09	12.22	13.24	10.54	12.90	12.15	16.16	15.75	17.52	19.73	3.77***
	(4.3693)	(14.4199)	(11.4944)	(10.8900)	(13.3276)	(8.3822)	(18.3995)	(17.2599)	(19.7145)	(19.3082)	
Transaction cost characteristics											
Access to contract	0.27	0.39	0.53	0.36	0.65	0.97	0.74	0.78	0.98	0.92	33.79***
(yes=1)	(0.4671)	(0.4889)	(0.5130)	(0.4822)	(0.4864)	(0.1796)	(0.4434)	(0.4154)	(0.1516)	(0.2786)	
Milk price (KES)	33.82	35.23	37.74	35.39	32.58	31.70	33.74	30.37	31.30	30.92	8.92***
	(7.3187)	(8.0019)	(8.7803)	(7.3741)	(6.4796)	(3.9342)	(6.7838)	(4.7285)	(4.4539)	(4.0809)	
Distance to	4.05	2.85	3.21	2.38	2.42	2.24	2.20	2.59	2.02	4.30	0.72
veterinary clinics	(5.3360)	(3.0290)	(4.4762)	(1.9116)	(2.0307)	(2.2660)	(2.1173)	(1.9406)	(1.7484)	(18.2027)	
(Km)											
Distance to output	2.30	0.64	1.65	1.50	0.71	1.47	15.13	2.41	1.43	1.64	1.92**
market (Km)	(2.7964)	(1.9582)	(2.0192)	(4.9815)	(0.8606)	(1.5087)	(84.3821)	(5.6132)	(1.4848)	(1.5133)	
Type of road	0.00	0.34	0.21	0.23	0.48	0.36	0.40	0.25	0.49	0.53	5.32***
(1= Tarmac)	(0.0000)	(0.4757)	(0.4189)	(0.4230)	(0.5080)	(0.4842)	(0.4971)	(0.4401)	(0.5028)	(0.5012)	
Trust buyers	0.73	0.72	0.58	0.56	0.61	0.80	0.57	0.53	0.72	0.66	2.34***
(1=High)	(0.4671)	(0.4532)	(0.5073)	(0.4976)	(0.4951)	(0.4008)	(0.5021)	(0.5041)	(0.4512)	(0.4772)	
Access remittance	0.36	0.46	0.16	0.37	0.29	0.46	0.37	0.43	0.45	0.41	1.19
(yes=1)	(0.5045)	(0.5006)	(0.3746)	(0.4840)	(0.4614)	(0.5025)	(0.4902)	(0.5002)	(0.5008)	(0.4942)	

Note: Standard deviations are given in parentheses. *** 1% significance level; **5% significance level; *10% significance level.

10.4.2 Determinants of choice of specific ASS combinations

The results of the multinomial regression estimates with the corresponding marginal effects are presented in Table 10.4 and 10.5. The estimated coefficients differ significantly across alternative combinations of agribusiness support services. The age of the household head had a significant and negative effect on combination choices of production and financial ($P_1F_1B_0C_0$) and production and cooperative support services ($P_1F_0B_1C_1$). This results show that older dairy farmers are less likely to use a package of $P_1F_1B_0C_0$ and $P_1F_0B_1C_1$. A plausible explanation is that as the age of dairy farmer increases, so is the experience with utilization of agribusiness support services. During this period, they are exposed to success and failures of using different agribusiness support services. Therefore, as they grow older, they become more risk averse based on previous experience hence reluctant to use some combinations of agribusiness support services. In addition, older dairy agripreneurs are likely to be less educated, hence they would love to stick with the accumulated knowledge and skills learned overtime hence not willing to embrace new agribusiness support services such as business plan training and cooperative membership. The result is consistent with the findings of Maonga *et al.* (2017), in their study on determinants of smallholder farm household decision to access agricultural support services in Malawi.

Dairy agripreneurs who are educated are more likely to use a package of production, financial and business plan training support services ($P_1F_1B_1C_0$). This imply that, as household head education level increases, so does the likelihood of using a package of $P_1F_1B_1C_0$ increases. Educated agripreneurs have a better chance to acquire more information and skills leading to increase access of productions support services which are geared towards improving milk productivity. In addition, they are usually better informed on the availability of financial support services such as affordable loan facilities and benefits of business planning. Therefore, education increases the dairy agripreneurs knowledge and market opportunities which could enhance the utilization production, financial and business plan training support services. The result is consistent with the findings of Mwambi *et al*. (2018), in their study inclusiveness of farmers in producer organizations as well as Yannick *et al.* (2018), in their study on determinants of smallholder vegetable farmers credit access and demand in Cameroon.

The household labour had a positive effect on choice of $P_1F_0B_0C_0$, $P_1F_0B_0C_1$, $P_1F_1B_1C_{0.}$, $P_1F_0B_1C_1$ and $P_1F_1B_1C_1$. The positive effect indicates that an increase in number of adults in the household would increase the utilization of all the agribusiness support services. The plausible reason could be greater number of adults in the household implies greater family labor availability which is costless. This may prompt dairy agripreneurs to seek and invest in dairy support services with the mindset to optimize on the available labour for milk production. The result is consistent with the findings of Maonga *et al.* (2017), in their study on determinants of smallholder farm household decision to access agricultural support services in Malawi.

The dairy agripreneurs' experience in dairy farming was positive and statistically significant in the choice of $P_1F_0B_0C_0$, $P_1F_1B_0C_0$, $P_1F_0B_1C_0$, $P_1F_0B_0C_1$, $P_1F_1B_1C_0$, $P_1F_1B_0C_1$, $P_1F_0B_1C_1$ and $P_1F_1B_1C_1$. This imply as the number of years in dairy farming increases, it also increases the probability of using all the support services and almost all the combinations of agribusiness support services. This is probably due to the fact that the more the years a dairy agripreneur practices farming, the more he accumulates human capital in form of experience which makes him more conversant the merits and merits associated with different agribusiness support services. This is likely to influence their utilization of ASS by trying to diversify their risk of using one, two or three combinations of ASS with the objective of minimizing costs and capitalizing on returns. The result of the study agrees with Jitmun *et al.* (2020), in their study on factors influencing membership to dairy cooperatives in Thailand.

Land tenure positively affects utilization of production support services ($P_1F_0B_0C_0$), financial support services ($P_0F_1B_0C_0$) and combination of production, finance and business plan training support services ($P_1F_1B_1C_0$). Ownership as opposed to rental and other forms of access to land is expected to increase the long-run investment incentives in a dairy business. This is likely to motivate dairy agripreneurs to access and utilize production support services and increase their business skills through business plan training. Moreover, land can act as collateral hence motivate dairy agripreneurs to utilize financial support services in their agrienterprises. Maonga *et al*. (2017), obtained a similar in their study on determinants of smallholder farm household decision to access agricultural support services in Malawi.

In relation to the number of cows, dairy farmers with high number of cattle are less likely to use both production and business plan support services ($P_1F_0B_1C_0$). A plausible explanation is

that increased number of cows means increased cost of production which is a major issue among smallholder farmers. Therefore, they would opt to reduce utilization of production support services such as procurement of improved feeds and animal health services which are expensive to majority of farmers. Moreover, majority of dairy agripreneurs are still subsistence only selling the surplus milk. Therefore, they do not have the motivation of seeking business plan training to enable them commercialize. The results of this study are consistent with the findings of Ngeno (2018), in his study on impact of dairy hubs on smallholder welfare in Kenya.

With regard to access to contract, dairy agripreneurs who had contractual agreement were likely to utilize combinations of $P_1F_0B_0C_1$, $P_1F_1B_1C_0$, $P_1F_1B_0C_1$, $P_1F_0B_1C_1$ and $P_1F_1B_1C_1$ support services. Access to contract on sale of milk could increase market access. This is likely to motivate dairy agripreneurs to invest on human, financial, physical and information resources with anticipation to increase their productivity and profitability. Thus, through access to contract, dairy agripreneurs would seek different combinations of agribusiness support services with intention to maximize profit and minimize production costs. The result similar with Kiwanuka and Machethe (2016), on their study on determinants of smallholder farmers' participation in Zambian dairy sector's interlocked contractual arrangements.

Contrary to expectations, milk price was found to negatively influence dairy agripreneurs' decision to utilize of all the four support services ($P_1F_1B_1C_1$) and combinations of $P_1F_0B_0C_1$, $P_1F_1B_0C_1$ and $P_1F_0B_1C_1$. This means that if milk prices were to rise, the dairy agripreneurs' likelihood to utilize agribusiness support services would significantly reduce. This is probably because the factors of production such as land size and dairy cows stock size limits their expansion to take advantage of high milk prices as an incentive to produce more. Another reason would be because despite the increase in milk prices, the market enhancing factors such as roads and milk delivery points are still not improved. Therefore, when the price of milk increases, the farmers will be happy to receive higher income, however, they are likely to divert the use of this money to other activity instead of re-investment, coupled with their limited investment knowledge due to the average age of farmer and literacy levels as per the findings. Jitmun *et al.* (2020), in their study on factors influencing membership to dairy cooperatives in Thailand.

Distance to veterinary clinic was statistically and negatively significant in the choice of three agribusiness support services in combination ($P_1F_0B_1C_1$) at a significance level of 5%. This inferred that one kilometre increase in distance to veterinary clinic, the likelihood of utilizing production, business plan training and cooperative support services would decrease by 1.6%. proximity to the veterinary clinic has a significant influence in motivating dairy agripreneurs to use ASS. This is because of the closeness to veterinary officer who would offer advisory and animal health services. This may have a positive effect on utilizing production, business plan training and cooperative support services in their dairy business. The results of this study are consistent with the findings of Wossen *et al.* (2017), in their study on impacts of extension access and cooperative membership on technology adoption and household welfare in Nigeria.

Distance to the nearest output market had a negative and significant relationship with dairy agripreneurs' utilization of production support services ($P_1F_0B_0C_0$) and combination of production and business plan training support services ($P_1F_0B_1C_0$) at 1% and 5% significance level respectively. The result implies that, one kilometre increase to output market, lowered the likelihood of the dairy agripreneurs using $P_1F_0B_0C_0$ and $P_1F_0B_1C_0$ by 5.6% and 1.7% respectively. This is logical because, increased distance means increased transportation and transaction cost which reduces market participation thereby discouraging the demand for production and business plan training support services. This is because, the biggest production cost in dairy farming emanates from feeds and animal health services, if farmers are unable to sell their produce, they are likely to reduce investment in these costs. In addition, they lack adequate justification to improve their business skills due to market distance hence reducing utilization of business plan training support services. Maonga *et al.* (2017), obtained similar findings in their study on determinants of smallholder farm household decision to access agricultural support services in Malawi. The result is also consistent with the findings of Chagwiza *et al.* (2015), in their study Cooperative membership and dairy performance among smallholders in Ethiopia. However, the result is contrary to Moturi *et al.* (2015), in their study on milk marketing channels in Kenya as well as Jitmun *et al.* (2020), in their study on factors influencing membership to dairy cooperatives in Thailand.

Table 10.4. Parameter estimates of alternative agribusiness support services – using a multinomial logit selection model

Variables (Base category - $P_0F_0B_0C_0$)	$P_1F_0B_0C_0$	$P_0F_1B_0C_0$	$P_1F_1B_0C_0$	$P_1F_0B_1C_0$	$P_1F_0B_0C_1$	$P_1F_1B_1C_0$	$P_1F_1B_0C_1$	$P_1F_0B_1C_1$	$P_1F_1B_1C_1$
Sample size (n)	109	19	160	31	61	35	51	86	119
Sex (male=1)	-0.0828	-1.2289	0.0641	0.1173	0.3811	-0.3103	-0.5548	-0.3741	0.3129
	(0.8052)	(0.9381)	(0.7899)	(0.8932)	(0.8478)	(0.8847)	(0.8378)	(0.8279)	(0.8193)
Age (years)	-0.0551	-0.0683	-0.0683*	-0.0399	-0.0560	-0.0298	-0.0333	-0.0690*	-0.0613
	(0.0384)	(0.0464)	(0.0376)	(0.0422)	(0.0400)	(0.0416)	(0.0407)	(0.0396)	(0.0388)
Education level	-0.0176	0.3400	0.3693	0.3530	0.1263	0.7428*	0.6540	0.1131	0.3352
	(0.4034)	(0.4707)	(0.3953)	(0.4426)	(0.4173)	(0.4388)	(0.4226)	(0.4132)	(0.4068)
Household labour	0.7890**	0.5078	0.5291	0.5226	0.7525**	0.8092**	0.4572	0.8599***	0.6951**
(Number of adult	(0.3337)	(0.3967)	(0.3278)	(0.3596)	(0.3442)	(0.3566)	(0.3484)	(0.3413)	(0.3367)
members)									
Experience (years)	0.0875**	0.0717	0.0957***	0.0930**	0.0954**	0.0689*	0.0802**	0.0978***	0.0783**
	(0.0378)	(0.0462)	(0.0372)	(0.0415)	(0.0395)	(0.0409)	(0.0391)	(0.0390)	(0.0383)
Farm									
characteristics									
Land tenure	1.3647*	2.0212**	0.9563	0.6253	0.6277	1.8238**	0.8505	0.9622	1.0082
	(0.7924)	(0.9705)	(0.7753)	(0.8649)	(0.8195)	(0.8766)	(0.8266)	(0.8094)	(0.7973)
Land size	-0.3396	-0.1807	-0.2846	-0.1393	-0.1361	-0.4724	-0.5691	-0.0849	-0.0526
	(0.3309)	(0.3765)	(0.3214)	(0.3476)	(0.3403)	(0.3697)	(0.3601)	(0.3325)	(0.3274)
Livestock type	-15.0012	-17.5370	-16.1106	-16.1441	-1.1175	-14.9276	-15.1761	-13.8379	-14.3401
(1=improved/exotic,	(2153.33)	(2153.33)	(2153.33)	(2153.33)	(2242.958)	(2153.33)	(2153.33)	(2153.33)	(2153.33)
0=otherwise)									

Number of cows	-0.3693	-0.3115	-0.3614	-0.5898*	-0.1671	-0.4320	-0.0016	-0.0858	-0.0938
	(0.2832)	(0.3402)	(0.2797)	(0.3334)	(0.2910)	(0.3097)	(0.2823)	(0.2814)	(0.2788)
Milk yield	0.0739	0.0766	0.0558	0.0833	0.0449	0.0783	0.0647	0.0716	0.0699
	(0.0559)	(0.0582)	(0.0556)	(0.0576)	(0.0575)	(0.0565)	(0.0563)	(0.0558)	(0.0556)
Transaction cost characteristics									
Access to contract	0.1736	1.3644	0.2780	1.1873	4.1332***	1.6022*	2.0850***	4.1291***	2.8481***
(yes=1)	(0.7852)	(0.9216)	(0.7708)	(0.8488)	(1.0447)	(0.8557)	(0.8323)	(1.0435)	(0.8256)
Milk price (KES)	-0.0246	0.0661	-0.0003	-0.0701	-0.1306**	-0.0380	-	-	-
	(0.0506)	(0.0594)	(0.0494)	(0.0591)	0.0578)	(0.0571)	0.1575***	0.1412***	0.1471***
							(0.0597)	(0.0564)	(0.0549)
Distance to	-0.0238	-0.0293	-0.1386	-0.0394	-0.1595	-0.1636	-0.1255	-0.2744**	-0.0318
veterinary clinics	(0.0947)	(0.0986)	(0.0992)	(0.1007)	(0.1206)	(0.1331)	(0.1117)	(0.1202)	(0.0945)
(Km)									
Distance to output	-	-0.0593	-0.0377	-0.5377**	-0.0045	0.0033	-0.0034	-0.0061	-0.0220
market (Km)	0.5529***	(0.0978)	(0.0678)	(0.2409)	(0.0635)	(0.0609)	(0.0615)	(0.0622)	(0.0732)
	(0.1594)								
Type of road	14.9061	13.9216	14.2036	15.2303	14.5117	14.9308	14.3548	15.0424	15.2348
(1= Tarmac)	(455.9209)	(455.9211)	(455.9211)	(455.921)	(455.921)	(455.9211)	(455.9211)	(455.921)	(455.9209)
Trust buyers	0.2374	-0.6700	-0.5629	0.0987	1.1518	-0.5381	-0.4405	0.5213	0.2060
(1=High)	(0.8044)	(0.9533)	(0.7826)	(0.8685)	(0.8521)	(0.8570)	(0.8276)	(0.8252)	(0.8061)
Access remittance	0.6626	-0.6408	0.3263	-0.2451	0.7098	0.3448	0.5138	0.7410	0.8109
(yes=1)	(0.8256)	(1.0666)	(0.8130)	(0.9176)	(0.8731)	(0.8978)	(0.8632)	(0.8540)	(0.8395)
Constant	16.9930	14.9930	18.5875	17.2272	1.5721	12.0266	17.5888	15.4380	16.4097
	(2153.332)	(2153.333)	(2153.332)	(2153.333)	(2242.961)	(2153.333)	(2153.333)	(2153.333)	(2153.332)

Note: Robust standard errors are given in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. a Base dairy agripreneurs who are not utilizing agribusiness support services ($P_0F_0B_0C_0$).

Table 10.5. Marginal effect, estimates from multinomial logit model (dy/dx)

Variables (Base category - $P_0F_0B_0C_0$)	$P_1F_0B_0C_0$	$P_0F_1B_0C_0$	$P_1F_1B_0C_0$	$P_1F_0B_1C_0$	$P_1F_0B_0C_1$	$P_1F_1B_1C_0$	$P_1F_1B_0C_1$	$P_1F_0B_1C_1$	$P_1F_1B_1C_1$
Sample size (n)	109	19	160	31	61	35	51	86	119
Sex (male=1)	-0.0024	-0.0324	0.0374	0.0068	0.0171	-0.0192	-0.0485	-0.0312	0.0723
	(0.0655)	(0.0291)	(0.1921)	(0.0309)	(0.4506)	(0.0372)	(0.0339)	(0.0326)	(0.1805)
Age (years)	0.0003	-0.0002	-0.0033*	0.0007	0.0001	0.0021	0.0022	-0.0011*	-0.0008
	(0.0016)	(0.0006)	(0.0042)	(0.0013)	(0.0019)	(0.0030)	(0.0032)	(0.0017)	(0.0022)
Education level	-0.0438	0.0002	0.0116	0.0009	-0.0087	0.0308*	0.0289	-0.0207	0.0009
	(0.0855)	(0.0076)	(0.0666)	(0.0121)	(0.2264)	(0.0233)	(0.0191)	(0.0503)	(0.0551)
Household labour (Number of adult members)	0.0173**	-0.0030	-0.0370	-0.0051	0.0043**	0.0118**	-0.0173	0.0198***	0.0092**
	(0.0381)	(0.0050)	(0.0210)	(0.0064)	(0.1124)	(0.0258)	(0.0148)	(0.0370)	(0.0402)
Experience (years)	0.0001**	-0.0003	0.0026***	0.0002**	0.0003**	0.0014*	0.0006**	0.0010***	0.0019**
	(0.0019)	(0.0006)	(0.0066)	(0.0010)	(0.0091)	(0.0016)	(0.0013)	(0.0025)	(0.0021)
Farm characteristics									
Land tenure	0.0366*	0.0186**	-0.0318	-0.0181	-0.0191	0.0531**	-0.0191	-0.0094	-0.0109
	(0.0348)	(0.0174)	(0.2133)	(0.0497)	(0.4975)	(0.0390)	(0.0798)	(0.0685)	(0.1343)
Land size	-0.0113	0.0014	-0.0107	0.0044	0.0048	-0.0167	-0.0286	0.0156	0.0410
	(0.0136)	(0.0064)	(0.0363	(0.0123)	(0.1255)	(0.0167)	(0.0266)	(0.0333)	(0.0797)

Livestock type	0.0470	-0.1229	-0.2428	-0.0340	0.0773	0.0312	0.0231	0.0786	0.1424
(1=improved/exotic,	(0.0483)	(0.0878)	(0.1124)	(0478)	(0.0207)	(0.0470)	(0.0490)	(0.0285)	(0.0569)
0=otherwise)									
Number of cows	-0.0146	-0.0012	-0.0328	-0.0133*	0.0036	-0.0134	0.0225	0.0159	0.0332
	(0.0126)	(0.0045)	(0.0227)	(0.0144)	(0.0953)	(0.0135)	(0.0374)	(0.0301)	(0.0633)
Milk yield	0.0010	0.0002	-0.0031	0.0007	-0.0009	0.0009	-0.0001	0.0005	0.0008
	(0.0024)	(0.0005)	(0.0119)	(0.0007)	(0.0234)	(0.0013)	(0.0027)	(0.0020)	(0.0046)
Transaction cost characteristics									
Access to contract	-0.1655	-0.0008	-0.3570	-0.0076	0.0812***	0.0113*	0.0450***	0.1821***	0.2112***
(yes=1)	(0.1358)	(0.0402)	(0.3378)	(0.0699)	(2.1033)	(0.1546)	(0.2217)	(0.4827)	(0.6780)
Milk price (KES)	0.0058	0.0029	0.0215	0.0000	-0.0025**	0.0025	-0.0077***	-0.0067***	-0.0158***
	(0.0030)	(0.0023)	(0.0059)	(0.0031)	(0.0657)	(0.0032)	(0.0160)	(0.0151)	(0.0343)
Distance to veterinary	0.0108	0.0017	-0.0086	0.0028	-0.0021	-0.0040	-0.0014	-0.0156**	0.0163
clinics (Km)	(0.0069)	(0.0013)	(0.0307)	(0.0022)	(0.0546)	(0.0115)	(0.0092)	(0.0255)	(0.0094)
Distance to output	-0.0557***	0.0010	0.0216	-0.0170**	0.0044	0.0084	0.0094	0.0098	0.0181
market (Km)	(0.0524)	(0.0043)	(0.0649)	(0.0164)	(0.1153)	(0.0197)	(0.0229)	(0.0240)	(0.0487)
Type of road	0.0233	-0.0150	-0.1442	0.0213	-0.0084	0.0158	-0.0305	0.0312	0.1132
(1= Tarmac)	(0.0797)	(0.0303)	(0.3323)	(0.0312)	(0.2225)	(0.0514	(0.0890)	(0.0602)	(0.1426)
Trust buyers (1=High)	0.0418	-0.0123	-0.1408	0.0082	0.0465	-0.0325	-0.0293	0.0550	0.0635
	(0.2071)	(0.0214)	(0.2680)	(0.0613)	(1.2161)	(0.0727)	(0.0927)	(0.1838)	(0.3370)
Access remittance	0.0196	-0.0226	-0.0535	-0.0281	0.0087	-0.0118	0.0006	0.0225	0.0647
(yes=1)	(0.0633)	(0.0262)	(0.0530)	(0.0305)	(0.2264)	(0.0285)	(0.0364)	(0.0583)	(0.1401)

Note: Standard deviations are given in parentheses. *** 1% significance level; **5% significance level; *10% significance level.

10.4.3 Impacts of utilization of ASS combinations on milk income and productivity

The results of impact of utilization of agribusiness support services on dairy agripreneurs' milk productivity and income is presented in Table 10.6. The milk productivity and income variables were used as a measure of agrienterprise performance. The estimated milk productivity and income from the utilization of agribusiness support services were calculated from the MESR model for both ATT and ATU effects. The results in Table 10.6, were viewed as two scenarios: (1) dairy agripreneurs use a single agribusiness support service, that is production finance, business plan training or cooperative support; and dairy agripreneurs use more than one agribusiness support services, that is two, three or four services in combinations. The results indicate that the productivity of dairy farmers is gained when they utilize all the agribusiness support services ($P_1F_1B_1C_1$) by 7.9 units. This imply that utilization of production, financial, business plan training and cooperative support could increase the productivity of dairy agripreneurs by 10.7%. By using these services milk productivity would increase due to better animal health, access to high quality feeds as well as skills and knowledge that could be used to improve the welfare of cattle.

Utilization of $P_1F_0B_0C_0$, $P_0F_1B_0C_0$, $P_1F_0B_1C_1$ and $P_1F_1B_1C_1$ had a significant ATU value at 1% significance level (Table 10.6). The result indicates that dairy agripreneurs who did not use agribusiness support services would improve their productivity if they utilized these combinations of ASS by about 7.7, 144.3, 8.1 and 17.0 units, respectively. This implies that dairy agripreneurs could increase their productivity by 11.5%, 219.6%,12.2% and 27.1% respectively, if they used these combinations of agribusiness support services. In contrast, ASS combinations of $P_1F_0B_1C_0$ and $P_1F_0B_0C_1$ for non-users had a significant and negative contribution to milk productivity. The causal effect for these combinations were about 8.1 and 12.9 units. The result indicates that, use of these ASS packages would decrease milk productivity by 12.3% and 19.3% respectively for non-users, if they would have used these combinations of agribusiness support services. This could be related to cost implication of utilizing these support services. Therefore, due to their smallholding nature, they would be better off with their status quo of non-utilization.

In relation to milk income, the ATT and ATU effects are positive for dairy agripreneurs who were using combinations of $P_0F_1B_0C_0$ and $P_1F_1B_1C_0$ (Table 10.6). The results revealed that utilization of financial support services ($P_0F_1B_0C_0$) and combinations of production, finance

and business plan training support service ($P_1F_1B_1C_0$) would increase milk income dairy agripreneurs using ASS and also had the potential to increase milk income for non-users of ASS. Specifically, the causal effect of $P_0F_1B_0C_0$ and $P_1F_1B_1C_0$ for users is about KES 12,184.1 and KES 26,543.1 respectively. While for the non-users, the causal effect was KES 1,846.5 and KES 10,5150.8. The findings indicate that mutually inclusive multiple usage of ASS has significant impact on milk productivity and income compared to utilizing individual agribusiness support services.

Table 10.6. The average treatment effect of agribusiness support services choice on milk productivity and income: Multinomial Endogenous switching regression estimation

		Milk productivity			Milk income		
Agribusiness support services (ASS) combinations		**Associated with ASS**	**Not associated with any ASS**	**Treatment effect: ATT/ATU**	**Associated with ASS**	**Not associated with any ASS**	**Treatment effect: ATT/ATU**
$P_1F_0B_0C_0$	Associated	61.8	67.2	-5.4	85039.7	92963.5	-7923.8
	Not Associated	74.6	66.9	7.7***	105979.9	100231.3	5748.6
	Heterogeneity effect	-12.8	0.3	-13.1	-20940.2	-7267.8	-13672.4
$P_0F_1B_0C_0$	Associated	80.6	61.0	19.6	133794.3	121610.2	12184.1**
	Not Associated	210.0	65.7	144.3***	96771.9	94925.4	1846.5***
	Heterogeneity effect	-129.4	-4.7	-124.7	37022.4	26684.8	10337.6
$P_1F_1B_0C_0$	Associated	56.5	59.2	-2.7	70709.5	82195.0	-11485.5
	Not Associated	67.9	69.0	-1.1	94925.4	106107.9	-11182.5
	Heterogeneity effect	-11.4	-9.8	-1.6	-24215.9	-23912.9	-303.0
$P_1F_0B_1C_0$	Associated	69.9	65.9	4.0	75641.0	94235.2	-18594.2
	Not Associated	57.8	65.9	-8.1***	96658.9	99116.6	-2457.7
	Heterogeneity effect	12.1	-0.1	12.2	-21017.9	-4881.4	-16136.5
$P_1F_0B_0C_1$	Associated	64.5	63.2	1.2	100441.0	79900.6	20540.4
	Not Associated	54.1	67.0	-12.9***	96658.9	99116.6	-2457.7
	Heterogeneity effect	10.3	-3.8	14.1	3782.1	-19216.0	22998.1

$P_1F_1B_1C_0$	Associated	72.0	67.1	4.9	160962.3	134419.2	26543.1**
	Not Associated	63.9	65.8	-1.9	199537.4	94386.6	105150.8***
	Heterogeneity effect	8.1	1.3	6.8	-38575.1	40032.6	-78607.7
$P_1F_1B_0C_1$	Associated	63.8	64.1	-0.3	131867.3	95595.8	36271.5
	Not Associated	67.4	66.3	1.1	86062.6	95050.1	-8987.5
	Heterogeneity effect	-3.6	-2.2	-1.4	45804.7	545.7	45259.0
$P_1F_0B_1C_1$	Associated	64.7	71.6	-6.9	99926.9	109133.4	-9206.5
	Not Associated	74.4	66.3	8.1***	111808.2	97496.9	14311.3
	Heterogeneity effect	-9.7	5.3	-15.0	-11881.3	11636.5	-23517.8
$P_1F_1B_1C_1$	Associated	81.7	73.8	7.9*	112954.1	128348.1	-15394.0
	Not Associated	79.8	62.8	17.0***	98136.9	94600.9	3536.0
	Heterogeneity effect	1.9	11.0	-9.1	14817.2	33747.2	-18930.0

Note: Standard errors are in parenthesis. P=Production support, F=Financial support, B=Business plan training support, C= Cooperative support. *** 1% significance level; **5% significance level; *10% significance level.

10.5 Conclusion

The findings from this study suggest that the likelihood of utilizing agribusiness support services is positively influenced by education level of household head, available household labour, experience in dairy farming, land tenure, access to contract and negatively influenced by age of household head, number of cows owned by the household, milk price, distance to veterinary clinic and distance to nearest output market. The implication of these finding is that entrepreneurship capacity building in dairy farming is warranted for effective utilization of agribusiness support services. This may enable development of entrepreneurial mindset which could promote investment in ASS. In relation to the findings on causal effects of ASS on milk productivity and income, utilization of combination ASS generally yields higher productivity per year for users and non-users of ASS. The positive and significantly higher effect of ATU for utilization of financial support service indicate the positive impact of credit on dairy productivity.

To boost the use of financial support services, findings from this study suggest that proper training and awareness creation on financial literacy is imperative for smallholder dairy agripreneurs. Further, financial support should be customized to the needs and attributes of dairy agripreneurs. The results also indicate positive significant income effects of utilization of different combinations of ASS. Ensuring dairy agripreneurs have access to and are utilizing agribusiness support services is crucial in improving farm productivity and income of smallholder dairy agripreneurs in Kenya. Therefore, there is need to strengthen dairy cooperatives which have been documented to be one stop hub for access to ASS. In addition, agribusiness service providers should give special emphasis in the provision of these services in different combinations. This could mean cooperatives forming strategic alliances with input suppliers that could offer these services at more competitive rate than market rate. This will increase trust and accelerate provision of inputs and services that is actually needed by the dairy agripreneurs.

CHAPTER ELEVEN
GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

11.1 General discussions

The agripreneurial orientation (AO) construct has recently been given attention in agrienterprises development. This is due to its ability to transform agripreneurial opportunities into new or renewed growth trajectories among dairy agripreneurs. However, majority of smallholder dairy agripreneurs have low entrepreneurial orientations and limited resources which limits them from benefiting from their agrienterprises. This necessitates the need for agribusiness support services (ASS) such as production, finance, cooperative and business planning services. Interventions have been made by both private and public institutions to enhance agripreneurial behaviour through agribusiness support service provision. Utilization of these services could play a mediating role in building agripreneurial resilience of smallholder dairy farmers and thereby increased income from dairy farming. Therefore, this study sought to determine impact of agripreneurial orientations on resilience and performance of dairy agripreneurs in Murang'a County, Kenya: The mediating effect of agribusiness support services. The specific objectives of the study were:

i. To determine dairy agripreneurs' preferences for production, animal health and marketing support services in Murang'a County.

ii. To determine factors influencing the usage of agribusiness support services among smallholder agripreneurs in Murang'a County.

iii. To determine the effect of agripreneurial orientation mediated by agribusiness support services on smallholder dairy agripreneurs resilience in Murang'a County.

iv. To determine effect of agribusiness support services on performance of smallholder dairy agripreneurs in Murang'a County.

A multistage sampling method was used to select a sample of 682 dairy agripreneurs. Through a Cross-sectional survey, data were collected using a standardized questionnaire, discrete choice experiment (DCE) and analysed through mixed logit, multivariate probit, multinomial logit, structural equation analysis and multinomial endogenous switching regression model using the Statistical Package for Social Sciences (SPSS), STATA and Smart PLS version 3.

11.2 Implications of the study

11.2.1 Dairy agripreneurs' preference for production, animal health and marketing support services in Kenya.

Results in this study reported that smallholder dairy agripreneurs had higher preference for group marketing, curative services and artificial insemination whilst at the same time having a less preference for business plan training services. The respondents and literature review attribute these results to; group marketing offering farmers a steady market for their milk together with other benefits such as collective bargaining power for better milk prices (Ngeno, 2018) and access to subsidized production support services (Kumar *et al.,* 2018), majority of the small-scale farmers being poor hence will only pay for medication when the animal falls sick (Chawala *et al.,* 2019) and AI services' ability to increase dairy productivity, reduce calving intervals and improve herd fertility (Lukuyu *et al.*, 2019; Mazimpaka *et al.*, 2018; Mutenje *et al.,* 2020; Omondi *et al.,* 2017).

The low preference for business plan training services is explained majority of dairy farmers having been in the industry for decades hence their acquired experience makes them have a resistant attitude and mindset to change in terms of how to run their dairy enterprises (Korsgaard *et al.,* 2015). It was also established that dairy agripreneurs were more willing to pay for group marketing (KES 8797.91/month), artificial insemination (KES 2816.01/month) and curative services (KES 2577.62/month) and they were not willing to forego KES 2411.29 per month for business plan training services.

11.2.2 Factors influencing utilization of agribusiness support services among smallholder dairy farmers in Kenya

The results of the multivariate probit regression revealed that education level of household head, number of adults in the household, experience in dairy farming, land size, livestock type, number of cows owned, milk yield, price of milk, access to contract, type of road and level of buyer trust were the major factors that affect the likelihood of utilizing agribusiness support services among dairy farmers. Educated farmers are better placed to understand the terms and conditions of utilizing agricultural credit services (Sebatta *et al.,* 2014). Number of adults in the household was positively influenced utilization of production services. The plausible explanation could be because of the labour intensive nature of dairy farming hence by having

more adults which is a proxy for household labour. Thus, smallholder dairy agripreneurs are more incentivized to acquire production support services such as seeds for feeds because there exist people to work on them. However, at the same time, the enterprise will be more labor intensive rather than capital intensive hence the reduced likelihood of accessing financial services (Twine *et al.,* 2018).

Experience in years of practicing dairy farming positively influenced acquisition of production support services. Farming experience could help smallholder dairy farmers to know the economic importance of proper farm management especially the use of production support services such as artificial insemination, deworming, curative, preventive, deworming and use of hay and silage (Kumar *et al.,* 2018). Dairy farmers' choice of cooperative and business plan training support services depends on the land size. This could be due to availability of large space to invest on dairy farming such as growing of animal feeds, keeping large herd of cattle and infrastructural development such as animal structures. The result is consistent with Kumar *et al.* (2013), who found positive significant influence of land size on farmers' participation in cooperatives.

Other factors that influenced choice of cooperative support services included; livestock type as farmers with exotic cattle breeds join cooperatives in order to cushion themselves from the high costs associated with keeping exotic breeds and number of cows owned because joining cooperatives will enable farmers access a market for their large quantity of milk and access the expensive input requirement of a larger herd size. The results are similar to Ngeno (2018), who found herd size positively determined participation of dairy farmers in cooperatives. Milk yield displayed a positive relationship with utilization of business planning services since increase in milk yield makes farmers to be more market oriented due to increased marketable surplus which warrant them to seek for more knowledge in farm business planning.

Price of milk had a negative relationship with utilization of cooperative services and business training services. This is because if milk prices go high farmers will be less inclined to sell to cooperatives whose prices are fixed in the long run and their increased profits will make them see no use of accessing business training. Access to contract exhibited a positive relationship in influencing the decision to utilize cooperative and business planning support services. This is because by securing a contractual agreement on the sale of milk dairy farmers have a sure

market and therefore seek means by which to increase their production in order to capitalize on the available market channel. They will also seek business planning services to enable them increase their knowledge and skills in farm management thereby maximize their profit from the resources they have in order to benefit most from the available contract (Rademaker *et al.*, 2016).

Type of road positively influenced utilization of production and business planning support services since improved road quality is a proxy for the availability of markets and reduced transaction costs thus it incentivizes farmers to increase their production capacity and the reduced transaction cost and access to distant markets makes farmers more likely to seek business planning services as they desire to capitalize on the improved marketing and therefore want to learn how to improve the performance of their dairy enterprises. This result is consistent with the findings of Akudugu (2012), who found closeness to the output markets increased farmers' demand for extension services such production and business planning. Lastly, High level of trust of dairy farmers in milk buyers was positive factor in influencing the utilization of cooperative support services and negatively influenced utilization of financial support services. Dairy farmers would opt to utilize cooperative support services due to the group trust and because of accessing cooperative services and consequently, due to their high level of trust to the organization, they are less likely to seek financial services from other providers because they already receive the same services in the cooperatives.

11.2.3 Effect of agripreneurial orientation mediated by agribusiness support services on smallholder dairy agripreneurs resilience

Analysis of the data indicated that future orientation had a positive effect on agripreneurial resilience. This is because a future oriented agripreneurs is ambitious and optimistic for positive occurrence in the future and this keeps the farmers motivated despite the challenges they face in production and marketing. Risk taking orientation also had a positive impact on agripreneurial resilience (Yaseen *et al.*, 2018). This is because by being able to evaluate plausible risks and uncertainty to face the enterprise, a farmer is more likely to adopt preventive strategies to reduce the impact of the risks on the enterprise.

Market orientation was also found to have a positive influence of agripreneurial resilience and this is because dairy agripreneurs could become more market oriented by improving their

organization structure, personal competence in relation to handling and management of cows with objective of finding stable markets and prices for milk and these initiatives enhance their adaptive capability and resilience. However, social orientation was found to have a negative effect on entrepreneurial resilience and this is because if dairy agripreneurs depend so much on external support especially from family members and friends, they are likely to succumb to the shocks from the business environment. Agribusiness support services were found to have no mediating effect on the relationship between agripreneurial orientation and agripreneurial resilience. A plausible explanation to this is that in the Kenya dairy sector, agribusiness support services are supply driven by the government, NGOs and farmers' groups and they are accessible by all dairy agripreneurs hence their access cannot act as a differentiating factor in determining the agripreneurial resilience farmers since all farmers have access to them.

11.2.4 Impact of agribusiness support services on milk productivity and income

The results showed that the utilization of combination ASS (production support, financial support, business plan training support and cooperative support) generally yields higher productivity per year for users than non-users. Running a successful agrienterprise requires more than just paying attention to technical aspects of production. For profitability, attention also needs to be paid on marketing aspects and resource management. Hence, smallholder dairy farmers who sought for more than just production services were found to have a higher productivity. Utilization of financial support services had the highest impact on the non-users with ATU of 144.3 on milk productivity. The positive and significantly higher effect of ATU for utilization of financial support service indicate the positive impact of credit on dairy productivity.

11.3 Conclusion

The following are the key conclusions of the study according to the objectives.

i) Dairy agripreneurs had higher preference for group marketing, curative services and artificial insemination support services. The results further indicate that dairy agripreneurs have less preference for business plan training service. In relation to willingness to pay (WTP), dairy agripreneurs were more willing to pay for group marketing (KES 8797.91/month), artificial insemination (KES 2816.01/month) and curative services (KES 2577.62/month). Lastly, dairy agripreneurs were not willing to forgo KES 2411.29 per month for business plan training service.

ii) The findings revealed that education level of household head, number of adults in the household, experience in dairy farming, land size, livestock type, number of cows owned, milk yield, price of milk, access to contract, type of road and level of buyer trust were the major factors that affect the likelihood of utilising agribusiness support services among dairy agripreneurs in Murang'a County.

iii) Agripreneurial orientation was an antecedent to agripreneurial resilience. More explicitly, future orientation, risk-taking orientation and market orientation had a positive effect on agripreneurial resilience, while social orientation had a negative effect on agripreneurial resilience. It can be concluded that, market oriented, futuristic and risk-taking farmers are more resilient since they are more focused and are able to take calculated risk to improve on the quality of their products hence satisfying the needs of their customers. Moreover, agribusiness support services had no mediating effect on the relationship between agripreneurial orientation and agripreneurial resilience.

iv) Finally, utilization of different combination of ASS is positively influenced by education level of household head, available household labour, experience in dairy farming, land tenure, access to contract and negatively influenced by age of household head, number of cows owned by the household, milk price, distance to veterinary clinic and distance to nearest output market. In relation to the findings on causal effects of ASS on milk productivity and income, utilization of combination ASS generally yields higher productivity per year for users and non-users. Utilization of financial support services had the highest positive and significant effect on dairy productivity.

11.4 Recommendations

From the findings of the study, the following are some of the policy recommendations that can be derived;

i) Increasing linkage between agribusiness service providers and dairy cooperatives - The results of the study indicate the need for policy priority towards increasing the collaboration between agribusiness service providers such input suppliers, financial institutions, agribusiness consultants, extension agents and farmers' groups such as dairy cooperatives. This will improve input supply through access and availability of affordable agribusiness support services which are tailor made to the needs and preferences of smallholder dairy agripreneurs.

ii) *Tailor make agribusiness support services based on socio-economic and institutional characteristics of smallholder agripreneurs* - The policy makers should also advocate for practices and programs which gel with farmer socio-economic and institutional characteristics. Since majority of dairy agripreneurs are smallholders, there should be appropriate policy strategies targeting how to upgrade these farmers through increasing their chain governance and control of activities. This may be through access to contracts, stable markets, better milk prices and improved road infrastructures such as tarmac roads.

iii) *Entrepreneurship capacity building programmes for smallholder dairy agripreneurs* - In order to enhance the entrepreneurial mindset of dairy agripreneurs, the study recommends entrepreneurship capacity building programmes targeting smallholder farmers. A greater emphasis should be on farming as a business through business planning, financial literacy, change management and stress management to enhance their entrepreneurial orientations and resilience.

iv) *Awareness programme to promote utilization of different combinations of ASS* – there is need for sensitization and awareness programmes by both the public, private and NGOs to smallholder farmers on contribution of different combinations of ASS on milk productivity and income. Further, financial support should be customized to the needs and attributes of dairy agripreneurs.

11.5 Limitations and suggestions for further research

This study has some potential limitations. First and foremost, the sample was recruited from dairy agripreneurs from Kenya who have their own cultural attributes, which are different from other countries hence the generalizability may be limited to Kenya. In addition, the agripreneurial orientations and resilience of entrepreneurs could be affected by cultural characteristics. It would be useful to conduct a similar study in other developing countries to validate the findings of this study. Secondly, agripreneurial resilience is a multidimensional construct that could be affected by other factors such as socio-economic and institutional factors (age, gender, education, access to finance and government policies).

Future studies could consider incorporating socio-economic and institutional factors from the proposed model. Thirdly, the study used self-reporting to measure agripreneurial orientations and resilience which is also a limitation. This is because the emotional state of

agripreneur could have an effect on his resilience. For example, when one has positive emotional state, he would overestimate his orientations and resilience especially when things are working out well. Likewise, when an individual has negative emotional state, may underestimate their resilience. Due to this limitation, future studies should replicate these findings using other measures of orientations and resilience such as the resilience index measurement and analysis (RIMA) framework that has been suggested by food and agriculture organization in measuring resilience.

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APPENDICES

Appendix A. National Commission for Science Technology and Innovation (NACOSTI) clearance certificate

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **615337**

Date of Issue: **03/November/2020**

RESEARCH LICENSE

This is to Certify that Mr.. Dickson Otieno Okello of Egerton University, has been licensed to conduct research in Muranga on the topic: IMPACT OF AGRIPRENEURIAL ORIENTATIONS ON RESILIENCE AND PERFORMANCE OF DAIRY AGRIPRENEURS IN MURANG'A COUNTY: THE MEDIATING EFFECT AGRIBUSINESS SUPPORT SERVICES for the period ending : 03/November/2021.

License No: **BAHAMAS ABS/P/20/7403**

615337

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Appendix B. Questionnaire

EGERTON UNIVERSITY

DAIRY SUPPORT SERVICES, AGRIPRENEURIAL ORIENTATION AND RESILIENCE QUESTIONNAIRE

(This information is strictly confidential and is to be used for statistical and academic purposes only.)

SECTION A: HOUSEHOLD IDENTIFICATION

	CODE	NAME
1. QUESTIONNAIRE NUMBER	☐	…….
2. COUNTY	☐	…….
3. SUB-COUNTY	☐	…….
4. WARD	☐	…….
5. VILLAGE	☐	…….
6. NAME OF HOUSEHOLD HEAD		…….
7. NAME OF INTERVIEWER		…….
8. INTERVIEWER ID	☐	…….
9. DATE		…….
10. STARTING TIME		…….
11. FINISHING TIME		…….

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Introduction

This survey is aimed at determining the integrative effect of agripreneurial orientation moderated by agribusiness support services on resilience and performance of dairy agripreneurs in Murang'a County, Kenya. This questionnaire is meant for academic purposes only and information obtained therein will be treated with utmost confidentiality.

SECTION A: HOUSEHOLD MEMBER ROSTER

A1: **Provide the following details about the household head**

Sex: 1 = Male , 2 = Female	**Age** (years)	**Highest education level** (years) **(CODE A)**	**Main Occupation** for household head **(CODE B)**	**Secondary occupation of household head**

CODE A: Education Levels

1=No formal education 2= Adult education 3= Primary education 4= Secondary education 5= College education 6= University education

CODE B: Occupation

1 = Crop farming 2 = Dairy farming 3 = Other livestock farming

4 = Trading in agricultural Products (excluding livestock!) (Not own produce)

5 = Salaried employee (e.g. civil servant, domestic work) 6 = Business – trade / services (non-agric.)

7 = Not working / unemployed 8 =Old/Retired 9 = other (specify)……

A2: **Provide the following details about the household size**

Number of adults that usually live in the household	**Number of children in household**	**Total household size**	**Who is involved in… (1=Men, 2=Women, 3=Boys, 4=Girls, 5=Men & Boys, 6=Women & Girls**
Male...…Females……. Total=…….	Males……..Females…….	Total =……..	1. Milking morning 2. Milking evening 3. Cleaning barn 4. Grass cutting 5. Feeding 6. Watering 7. Fetching feeds

SECTION B: LIVESTOCK HUSBANDRY

B1. Experience in dairy farming ……. years

B2. Type of breed kept by the agripreneur……

1= Pure 2 = Cross 3 = Local

B3. Milk production parameters in the agrienterprises

Ownership		**Milk**							**Animal purchased**			**Animal sold**		
B3.1. Stock of livestock owned in the last 12 months?	B3.2. Type of livestock does this household currently own?	B3.3. How many cows were milked in the last 12 months?	B3.4. How many months on average, were the cows milked for?	B3.5. What was the average milk production per day per milked cow during this period?	B3.6. During this period, how many litres of liquid milk did you sell per day?	B3.7. During this period, how much of the milk produced was consumed by your household each day either in the form of liquid milk?	B3.8. Where did you sell most of the milk and processed dairy products?	B3.9. Do you have written contracts with your buyers?	B3.10. Have you purchased any livestock in the past 12 months?	B3.11. How many livestock have you purchased alive in the past 12 months?	B3.12. What was the total value of the livestock purchased in the last 12 months?	B3.13. Have you sold any livestock in the past 12 months?	B3.14. How many livestock have you sold in the past 12 months?	B3.15. What was the total value of sales?
1. Bulls= 2. Cows= 3. Steers= 4. Heifers= 5. Male calves= 6. Female calves=	1= Indigenous 2=Improved/Exotic	Number	Months	Litres	Litres/day	Litres/day	1=Cooperative 2=Middlemen 3=Retailers	1) Yes 0) No	1=Yes 0=No	Number	KES	1=Yes 0=No	Number	KES
CODES														

B4. Variable costs incurred (Labour, feeds and water)

B4.1. a) Did you hire any labor to help you with the livestock in the past 12 months? 1) Yes ☐ 0) No ☐ **[If no skip to B4.2]**

b) What was the total cost of this labor for livestock in the past 12 months? **KES**.....

B4.2. a) Did you purchase any feed / fodder for your livestock in the past 12 months? 1) Yes ☐ 0) No ☐ **[If no skip to B4.3]**

b) How much has this household paid to feed the livestock in the past 12 months? **KES**…….

B4.3. a) Has this household ever paid to water in the livestock in the past 12 months? 1) Yes ☐ 0) No ☐ **[If no skip to B4.2]**
b) How much has this household paid to access the main water sources for the livestock in the past 12 months **KES**……...

SECTION C: PROPERTY RIGHTS ANDTRANSACTION COST INFORMATION

C1: Property rights (land size and tenure system)

a) What is the land size under dairy production…… acres?
b) Type of land tenure: ……1=Owned with title deed 2=Owned without title deed 3= Rented 4=Owned by parents 5=Communal/ government/ cooperative

C2: Transaction cost information

a) Distances for and time in accessing dairy support services
   i) Veterinary clinic (Km)…….…… (Mins)…….....
   ii) Milk output market (Km)……. (Mins)……..……...
   iii) Time taken to negotiate with buyer……..…(Mins)……..…
b) What is the state of the road to the milk market?
   1= Tarmac 0= Murrum
c) What is the level of trust for your milk buyers?
   1) Low 2. Moderate 3) High
d) Did you receive remittance in the past 12 months?
   1) Yes ☐ 0) No ☐ **[If no skip to D1]**
e) Who was the source of remittance?.....

CODES for e

1. Spouse	2. Parent	3. Daughter	4. Son
5. Sister	6. Brother	7. Other relative	8. Business associate
9. Friend	10. Other, specify.....		

SECTION D: MARKET ORIENTATION OF DAIRY AGRIPRENEURS

D1: In your opinion, state your level of agreement or disagreement to the following statements regarding market orientation? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
Customer orientation (based on Narver and Slater, 1990)					
1. I continuously try to discover additional customer needs which they are not aware of yet.					
2. I anticipate what customer might need and suggest new products and services which I could supply to them					
3. I always try to innovate the current dairy cattle business to meet customer needs even I recognize the possibility of risk					
4. I usually think about the benefit that customers receive from my products and services benefit					
5. I contact closely with lead customers and try to recognize their needs months or even years before the majority of market may notice them					
Competitor orientation (based on Narver and Slater, 1990)					
1. I always collect and concern about competitor's activities					
2. I diagnose competitor's goals					
3. I always track the business performance of key competitors					
4. I identify the area where our key competitors have succeeded or failed					
5. I evaluate the strength and weakness of competitors					
6. I target customers where my business has an opportunity for competitive advantage					
Inter-functional coordination (based on Narver and Slater,1990					
1. I regularly visit my current and prospective customers					
2. I freely discuss my successful and unsuccessful customer experiences with my partners					
3. Actors in the dairy value chain understand how everyone can contribute to creating customer value					
4. I always share resources with other actors in the dairy marketing chain					

E. ACCESS TO AND QUALITY OF DAIRY PRODUCTION SUPPORT SERVICES

E1: Access to production support services

a) Did you have access to dairy production support services in the last 12 months? **[If no skip to E2]**

1) Yes ☐ 0) No ☐

b) If yes, what was the frequency of utilizing the following production support services?

		Number of times the farmer received the services in past 12 months	Cost of services in past 12 months	Service providers [Code A]	Quality of service? [Code B]
	Productive services				
i.	Curative treatment				
ii.	Artificial insemination				
iii.	Pregnancy diagnosis				
iv.	Deworming				
v.	Vaccination				
vi.	Supply of feeds				

Code A (Service providers)

1=Private vet clinic 2=District vet clinic 3=Ngo/project 4=Other, specify…….

Code B

1=Accessible 2=Effective 3=Efficient 4=Equitable 5=Affordable
6=Available 7=Drug available 8=Staff competent

e) In your opinion, state your level of agreement or disagreement to the following statements regarding how utilization of **production support services** has improved your agrienterprise operations? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
1. I have been able to achieve and maintain quality of my milk.					
2. I have been able to achieve high milk productivity and efficiency					
3. I have improved optimum cow health and reproduction					
4. I have improved on my milk profitability					
5. I have improved my compliance to milk safety standards					

E2. Access to financial support services

a) Do you have access to credit facilities? **[If no skip to F]**

1) Yes ☐ 0) No ☐

b) Have you ever borrowed money to use in the dairy production last 12 months?

1) Yes ☐ 0) No ☐

c) If yes, who was the source of the credit?

Source of credit……

Source of credit

1= Loan from family/friends/neighbor 2= Loan from a SACCO 3=Mobile loan such as Mshwari, KCB Mpesa
4=Loan from a microfinance 5=Loan from an informal moneylender 6= Commercial Banks
7=Loan from a government institution such Agricultural Finance Corporation (AFC) 8=Loan/credits from buyer of your agricultural products
9=Loan from an informal moneylender 10= Others (please specify) …….

d) Which activities did this household perform with credit?

AC1……AC2……
……AC3……

(Example of practices to note: Purchase improved breed heifer, Cultivation of Napier grass, Hay production (Rhodes grass), Purchase chaff cutter, Construct zero grazing unit, Purchase of milking machine)

e) In your opinion, state your level of agreement or disagreement to the following statements regarding how utilization of financial support services has improved your farm operations? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
Encourage standards adoption and compliance.					
Provide producer support especially access to inputs					
Encourage working in groups/aggregation					
Has promoted mechanization in the farm					

f) Which are the constraints that limit you from accessing credit

1) Insufficient collateral ☐
2) Income fluctuations impact on ability to repay ☐
3) Lack of knowledge ☐
4) Others (Please specify) ……

E3. Access to business plan support services

a) Have you received any training on dairy farm business planning in the last 12 months? **[If no skip to E4]**

1) Yes ☐ 0) No ☐

b) How many times in the in the last 12 months have you received training in business planning?

Number of times in a year……. ……..

c) Who is the Main service provider who offered you the trainings?

1=Government extension agents 2=Private consultants 3=NGOs/Developmental agencies

4=Universities through projects 5=Others (please specify) ……

d) Did you pay for the business plan training services? **[If no skip to f]**

1) Yes ☐ 0) No ☐

e) If 'Yes', how much did you spend for the service?.....

f) In your opinion, state your level of agreement or disagreement to the following statements regarding how you used the knowledge in business planning? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
1. I used the knowledge in farm planning					
2. It helped in record keeping					
3. The business plan skills gained helped me discovering consumer needs					
4. It helped me in securing loan from financial institutions					
5. It has helped me in making budgets on expenses and revenues					

E4. Cooperative support services

E4.1. Membership to Dairy Cooperatives

a) Are you a member of dairy cooperative? **[If no skip to F1]**

1) Yes ☐ 0) No ☐

b) If '**Yes'**, Fill the table below.

Name of the cooperative	Main cooperative activities (At least 3) 1=Producer cooperative 2=Marketing cooperative 3= Producer and Marketing cooperative	Number of years been a member (YEAR)	Who originally formed the cooperative 1=county government 2=NGO 3=area sub-chief/chief 4=community members 5=farmers	Why did you decide to join the cooperative (reasons)? See the codes below: 1=to receive better prices for milk 2=to get free inputs 3=to facilitate access to credit 4=other (specify)	Number of active members	Meeting frequency 1=Weekly 2=Monthly 3= Annually

	4. SACCO 5=Others					
Name	**Act**	**GrpExp**	**GrpOrigin**	**Reason**	**GPSIZE**	**Meetfreq**

E4.2. Cooperative homogeneity index

Cooperative Name **ENUME: Refer to the cooperatives recorded in Section C4 (a) and probe about each.**	**Are the members in this cooperative from the same…… as me?** **1=All 2=Most of them 3=Some of them**								
	Neighbourhood	**Village**	**Age**	**Gender**	**Religion**	**Profession**	**Educ. Level**	**Economic status**	**Political affiliation**

E4.3. Cooperative trust

In your opinion, state your level of agreement to the following statements regarding cooperative trust? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	**1**	**2**	**3**	**4**	**5**
1. Most members in this cooperative can be trusted					
2. In this cooperative, one has to be alert or someone is likely to take advantage of you.					
3. The cooperative leaders can be trusted					
4. In this cooperative, members do not trust each other in matters of lending and borrowing money					
5. Other cooperatives can be trusted.					
6. Milk buyer contractors can be trusted.					
7. Milk cooperative support NGOs can be trusted					
8. Extension workers can be trusted.					

E4.4. Cooperative membership density:

a) Apart from membership to farmer cooperatives, are you a member of any other cooperatives?

Type of cooperative	Number of members	Is membership to this cooperative influenced your decision to invest more in dairy farming [1. Yes, 0. N0]	Explain
1.			
2.			
3.			

E4.5 Group marketing support services

a) Have you received any group marketing support services in the last 12 months?

1) Yes ☐ 0) No ☐

b) If 'Yes', in your opinion, state your level of agreement or disagreement to the following statements regarding how group marketing in dairy cooperative has helped your dairy business? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
1. Credit linked input supply services					
2. Transporting of harvested milk					
3. Bulk and Storage of milk					
4. Adding value through processing					
5. Provision of market information					
6. Enhancing access to markets					
7. Training in best agricultural practices					

E4.6. Frequency of utilizing agribusiness support services

a) What is the frequency of utilization of the following agribusiness support services in the last 12 months?

Agribusiness support services	Always	Often	Sometimes	Rarely	Never
1. Productive support services					
2. Financial support services					
3. Cooperative support services					
4. Business plan support services					

SECTION F. SOCIAL ORIENTATION

F1. In your opinion, state your level of agreement or disagreement to the following statements regarding social capital/linkages? (1=Very rarely, 2=Rarely, 3=Sometimes 4=Often, 5=Very often)

Statement	Very often	Often	Sometimes	Rarely	Very rarely
1. I have difficulties in obtaining loans from bankers.					
2. My relatives/friends talk to me when they have to take an important decision					
3. I develop my ideas by gathering information from friends and neighbours.					
4. My friends/relatives are available to me whenever I need to talk to them					
5. My friends/family help me to get market for my milk					
6. My friends/relatives help me in making important business decision					

SECTION G: RISK TAKING ORIENTATION OF DAIRY AGRIPRENEURS

E1: In your opinion, state your level of agreement or disagreement to the following statements regarding **risk taking orientation**? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
1. I would keep my current breeds of cow in the farm, rather than substituting them with others that I do not know					
2. I prefer avoiding doing an investment in my farm, if I do not know the benefits that I will get					
3. I do not want to enlarge my farm, because I do not want to incur more costs					
4. If someone suggests me to include more high-yielding breeds in my farm, I will do it and I take the risk (chances for very high profits)					
5. I don‘t mind working under conditions of uncertainty as long as there is a reasonable probability of gains from it for me.					
6. I don‘t care if the profit is small so long as it is assured and constant.					

SECTION H: FUTURE ORIENTATION OF DAIRY AGRIPRENEURS

H1. In your opinion, state your level of agreement or disagreement to the following statements regarding **future orientation**? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	1	2	3	4	5
1. I am optimistic regarding my dairy agrienterprise's survival					
2. My dairy agrienterprise's profitability will improve in the future					
3. I am optimistic regarding my dairy agrienterprise's income level					
4. The dairy agrienterprise will provide a decent standard of living for me and my family in the future					
5. I will become a successful dairy producer					
6. I cannot see the future as bright and promising.					
7. My decision-making is driven by my vision for my agrienterprise (+)					

SECTION I: DAIRY AGRIPRENEURIAL RESILIENCE ATTRIBUTES

I1. In your opinion, state your level of agreement or disagreement to the following statements regarding **agripreneurial resilience**? (0=Not true at all, 1=rarely true, 2=sometimes true, 3=often true, 4=true nearly all the time)

Statement	0	1	2	3	4
1. I am able to adapt to change					
2. I can deal with whatever comes my way					
3. Tries to see the humorous side of things					
4. Coping with stress strengthens me					
5. I tend to bounce back after a hardship or illness					
6. I can achieve my goals despite obstacles					
7. Can stay focused under pressure					
8. I am not easily discouraged by failure					
9. I think of myself as a strong person					
10. I can handle unpleasant feelings					

I2. In your opinion, state your level of agreement or disagreement to the following statements regarding **financial performance of your agrienterprise**? (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Statement	**1**	**2**	**3**	**4**	**5**
1. I am very satisfied with the overall performance of the farm last year.					
2. The return on production investments met expectations last year.					
3. The return on marketing investments met expectations last year.					
4. The price I receive for milk covers production costs					
5. The overall performance of the farm last year exceeded that of previous years.					

TIME FINISHED:

SECTION J: AGRIPRENEURS PREFERENCE FOR INTEGRATED AGRIBUSINESS SUPPORT SERVICES (CHOICE EXPERIMENT)

In the questions that appear in the next section you will be presented with two imaginary "scenarios". Each scenario describes attributes of agribusiness support services for dairy agripreneurs. The objective is to make you think about each scenario as if you were making a decision between them in the real world. Then, the respondents will be asked to choose which scenario A, B or C that they most prefer. You can state that you do not prefer either scenario by choosing 'None' (I would not need agribusiness support services). If you choose None as your preferred option then the researcher will further want the respondent to indicate whether scenario A, B and C would be the most preferable to them (for example, the least bad) if utilization of agribusiness support services was mandatory.

Each scenario is made up of 5 different attributes:

Attributes	**Definition**	**Levels**
Group marketing	Dairy agripreneurs engaging in collective marketing of milk.	1. Yes 2. No
Animal health	Access to preventive services (vaccination and deworming) and curative (drugs to cure diseases).	1. Preventive 2. Curative
Business plan training	Training in management of resources in agrienterprises.	1. Yes 2. No
Production support	Access to services that improve productivity of cows such as improved breeds through AI or improved feeds such as silage and hay	1. AI 2. Improved feeds
Monthly fee (KES)	Amount of money paid in Kenya shillings for utilizing the bundle of ASS	1. 500 2. 1000 3. 1500 4. 2000

Appendix C. Results of mixed logit regression analysis on dairy agripreneurs' preference for production and animal health support services

```
. mixlogit choice monthlyfee , group( obsid ) rand( grpmkt bplan anhecur prdai ) id(hhid)
nrep(500)
Mixed logit model                               Number of obs     =      6,138
                                                LR chi2(4)        =     280.40
Log likelihood = -757.60194                     Prob > chi2       =     0.0000

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Mean         |
  monthlyfee |   .0018088   .0004507     4.01   0.000     .0009254    .0026921
      grpmkt |   15.91331   3.226729     4.93   0.000     9.589038    22.23758
       bplan |  -4.361449   1.022125    -4.27   0.000    -6.364778   -2.358121
     anhecur |   4.662303   1.017767     4.58   0.000     2.667517    6.657088
       prdai |   5.093482   1.175633     4.33   0.000     2.789284     7.39768
-------------+----------------------------------------------------------------
SD           |
      grpmkt |   9.921237   2.056768     4.82   0.000     5.890045    13.95243
       bplan |   5.588335    1.17649     4.75   0.000     3.282456    7.894214
     anhecur |   3.441593   .8113891     4.24   0.000     1.851299    5.031886
       prdai |  -3.047017   .7195206    -4.23   0.000    -4.457252   -1.636783
------------------------------------------------------------------------------
The sign of the estimated standard deviations is irrelevant: interpret them as
being positive
```

Willingness to pay for attributes using Hole's wtp command (delta method-nlcom command)

```
. nlcom (_b[grpmkt])/- (_b[monthlyfee])

       _nl_1:  (_b[grpmkt])/- (_b[monthlyfee])

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -8797.912   1465.448    -6.00   0.000    -11670.14   -5925.687
------------------------------------------------------------------------------

. nlcom (_b[bplan])/- (_b[monthlyfee])

       _nl_1:  (_b[bplan])/- (_b[monthlyfee])

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
       _nl_1 |   2411.293   441.3259     5.46   0.000      1546.31    3276.275
------------------------------------------------------------------------------

. nlcom (_b[ anhecur ])/- (_b[monthlyfee])

       _nl_1:  (_b[ anhecur ])/- (_b[monthlyfee])

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -2577.624   456.6457    -5.64   0.000    -3472.633   -1682.615
------------------------------------------------------------------------------

. nlcom (_b[ prdai ])/- (_b[monthlyfee])

       _nl_1:  (_b[ prdai ])/- (_b[monthlyfee])

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -2816.008   480.5297    -5.86   0.000    -3757.829   -1874.187
------------------------------------------------------------------------------
```

Appendix D. Results of MVP on factors influencing utilization of agribusiness support services

```
. mvprobit(MemberCoop= SexHH AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows MilkYield
Contract MilkPrice DistVetClin DistOutputMkt Typeroad trustlev Remittance)(AccessProdSer= SexHH
AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows MilkYield Contract MilkPrice
DistVetClin DistOutputMkt Typeroad trustlev Remittance)(AccessCredit= SexHH AgeHH EducHH hhsz
exper LandOwnTen Landsz Livetype NoCows MilkYield Contract MilkPrice DistVetClin DistOutputMkt
Typeroad trustlev Remittance)(ReceiveBusinessTrain= SexHH AgeHH EducHH hhsz exper LandOwnTen
Landsz Livetype NoCows MilkYield Contract MilkPrice DistVetClin DistOutputMkt Typeroad trustlev
Remittance), nolog

Multivariate probit (SML, # draws = 5)           Number of obs   =        682
                                                 Wald chi2(68)   =     366.27
Log likelihood = -1221.6465                      Prob > chi2     =     0.0000

------------------------------------------------------------------------------
                     |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------+--------------------------------------------------------------
MemberCoop           |
               SexHH |    .056328   .1311935     0.43   0.668    -.2008064    .3134625
               AgeHH |  -.0056589    .006315    -0.90   0.370    -.0180361    .0067183
              EducHH |   .0359013   .0632426     0.57   0.570    -.0880518    .1598545
                hhsz |   .0053467   .0471412     0.11   0.910    -.0870484    .0977418
               exper |   .0049748   .0060039     0.83   0.407    -.0067926    .0167422
          LandOwnTen |  -.1675438   .1252239    -1.34   0.181    -.4129781    .0778905
              Landsz |    .085268   .0500486     1.70   0.088    -.0128254    .1833615
            Livetype |    .574435   .3065673     1.87   0.061    -.0264258    1.175296
              NoCows |   .1587736   .0446316     3.56   0.000     .0712974    .2462499
            MilkYield |  -.0002751   .0051645    -0.05   0.958    -.0103972     .009847
             Contract |   1.444778   .1366814    10.57   0.000     1.176887    1.712668
            MilkPrice |    -.06966   .0109905    -6.34   0.000    -.0912011    -.048119
          DistVetClin |    .000965   .0083399     0.12   0.908     -.015381     .017311
       DistOutputMkt |  -.0032808   .0031013    -1.06   0.290    -.0093592    .0027977
            Typeroad |   .1609972   .1204742     1.34   0.181    -.0751279    .3971224
             trustlev |   .3834926   .1207256     3.18   0.001     .1468748    .6201104
           Remittance |   .1741971   .1305497     1.33   0.182    -.0816757    .4300698
                _cons |  -.1100793   .6100947    -0.18   0.857    -1.305843    1.085684
---------------------+--------------------------------------------------------------
AccessProdSer        |
               SexHH |   .2856235   .2020582     1.41   0.157    -.1104034    .6816504
               AgeHH |  -.0044753   .0104565    -0.43   0.669    -.0249697    .0160191
              EducHH |  -.0700671    .105942    -0.66   0.508    -.2777096    .1375754
                hhsz |    .242131   .0854999     2.83   0.005     .0745543    .4097077
               exper |   .0231405    .010522     2.20   0.028     .0025178    .0437631
          LandOwnTen |   .1264126   .2089184     0.61   0.545      -.28306    .5358852
              Landsz |   -.094312   .0777385    -1.21   0.225    -.2466767    .0580527
            Livetype |   .4636337   .3429651     1.35   0.176    -.2085656    1.135833
```

```
              NoCows |   .0223067   .0751626     0.30   0.767    -.1250093    .1696227
           MilkYield |   .0006626   .0094771     0.07   0.944    -.0179122    .0192375
            Contract |   .2826967   .1925259     1.47   0.142    -.0946472    .6600405
           MilkPrice |  -.0188084     .01351    -1.39   0.164    -.0452875    .0076707
         DistVetClin |  -.0015387   .0124339    -0.12   0.902    -.0259086    .0228313
       DistOutputMkt |    .001428   .0117771     0.12   0.903    -.0216547    .0245107
            Typeroad |   .6754633   .2586535     2.61   0.009     .1685117    1.182415
            trustlev |  -.1235289   .2093941    -0.59   0.555    -.5339337     .286876
          Remittance |   .3795059   .2388681     1.59   0.112    -.0886669    .8476788
               _cons |    .692063   .8928023     0.78   0.438    -1.057797    2.441923
---------------------+------------------------------------------------------------------
AccessCredit         |
              SexHH |   .0563221   .1158092     0.49   0.627    -.1706597     .283304
              AgeHH |  -.0018046   .0056061    -0.32   0.748    -.0127925    .0091832
             EducHH |   .2145648   .0570295     3.76   0.000     .1027891    .3263405
               hhsz |   -.103866   .0424755    -2.45   0.014    -.1871164   -.0206156
              exper |  -.0036191   .0053175    -0.68   0.496    -.0140412    .0068031
         LandOwnTen |  -.0053662   .1118184    -0.05   0.962    -.2245262    .2137938
             Landsz |   -.019541   .0440224    -0.44   0.657    -.1058232    .0667413
           Livetype |  -.4752558   .2642647    -1.80   0.072     -.993205    .0426935
              NoCows |   .0255002   .0357071     0.71   0.475    -.0444845    .0954849
           MilkYield |   .0006774   .0042022     0.16   0.872    -.0075588    .0089137
            Contract |   -.118718   .1134278    -1.05   0.295    -.3410324    .1035964
           MilkPrice |   .0033092   .0079779     0.41   0.678    -.0123271    .0189455
         DistVetClin |   .0044804   .0085055     0.53   0.598    -.0121901    .0211509
       DistOutputMkt |   .0440286   .0296816     1.48   0.138    -.0141463    .1022036
            Typeroad |  -.1336859    .106039    -1.26   0.207    -.3415185    .0741467
            trustlev |  -.3831212   .1095924    -3.50   0.000    -.5979183   -.1683241
          Remittance |  -.0704803   .1167441    -0.60   0.546    -.2992945     .158334
               _cons |   .5105239   .5375662     0.95   0.342    -.5430865    1.564134
---------------------+------------------------------------------------------------------
ReceiveBusinessTrain |
              SexHH |  -.0054993   .1236387    -0.04   0.965    -.2478267    .2368282
              AgeHH |  -.0017236   .0059427    -0.29   0.772    -.0133712    .0099239
             EducHH |   .0211395   .0597757     0.35   0.724    -.0960187    .1382976
               hhsz |   .0649744   .0443804     1.46   0.143    -.0220096    .1519584
              exper |  -.0016596   .0056942    -0.29   0.771    -.0128201    .0095009
         LandOwnTen |   .0840955   .1180689     0.71   0.476    -.1473153    .3155063
             Landsz |   .1062799   .0456017     2.33   0.020     .0169021    .1956576
           Livetype |   .2816057   .2902029     0.97   0.332    -.2871816     .850393
              NoCows |   .0206437   .0358149     0.58   0.564    -.0495522    .0908397
           MilkYield |   .0076786   .0042148     1.82   0.068    -.0005823    .0159395
            Contract |   .9166564   .1258246     7.29   0.000     .6700447    1.163268
           MilkPrice |  -.0371424   .0094234    -3.94   0.000     -.055612   -.0186728
         DistVetClin |   .0018544   .0073354     0.25   0.800    -.0125226    .0162314
       DistOutputMkt |   .0015889   .0038906     0.41   0.683    -.0060364    .0092143
            Typeroad |   .4925344    .110358     4.46   0.000     .2762366    .7088321
            trustlev |   .0718834   .1142062     0.63   0.529    -.1519567    .2957235
```

```
          Remittance |   .0362472   .1231548     0.29   0.769    -.2051317    .2776261
               _cons |  -.7433509   .5686123    -1.31   0.191     -1.85781    .3711086
---------------------+------------------------------------------------------------------
    /atrho21 |   .1580163   .1306576     1.21   0.227     -.098068    .4141006
-------------+----------------------------------------------------------------
    /atrho31 |   .0346574   .0686356     0.50   0.614     -.099866    .1691807
-------------+----------------------------------------------------------------
    /atrho41 |   .5537186   .0750387     7.38   0.000     .4066454    .7007918
-------------+----------------------------------------------------------------
    /atrho32 |   .0864626   .0862184     1.00   0.316    -.0825224    .2554476
-------------+----------------------------------------------------------------
    /atrho42 |   .0561305   .1054848     0.53   0.595     -.150616     .262877
-------------+----------------------------------------------------------------
    /atrho43 |   .1447633   .0652197     2.22   0.026     .0169349    .2725916
-------------+----------------------------------------------------------------
       rho21 |   .1567141   .1274488     1.23   0.219    -.0977548    .3919489
-------------+----------------------------------------------------------------
       rho31 |   .0346435   .0685532     0.51   0.613    -.0995353    .1675849
-------------+----------------------------------------------------------------
       rho41 |   .5033021   .0560304     8.98   0.000     .3856207    .6048701
-------------+----------------------------------------------------------------
       rho32 |   .0862478   .0855771     1.01   0.314    -.0823356    .2500326
-------------+----------------------------------------------------------------
       rho42 |   .0560716   .1051532     0.53   0.594    -.1494873    .2569845
-------------+----------------------------------------------------------------
       rho43 |   .1437604   .0638718     2.25   0.024     .0169333    .2660347
------------------------------------------------------------------------------
Likelihood ratio test of  rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0:
             chi2(6) =  65.9094   Prob > chi2 = 0.0000

Probit regression                               Number of obs     =        682
                                                LR chi2(17)       =     281.33
                                                Prob > chi2       =     0.0000
Log likelihood = -331.00151                     Pseudo R2         =     0.2982

------------------------------------------------------------------------------
   MemberCoop |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
        SexHH |   .0464056    .130744     0.35   0.723    -.2098479    .3026591
        AgeHH |  -.0053299   .0063501    -0.84   0.401    -.0177758     .007116
       EducHH |   .0346886    .063624     0.55   0.586    -.0900121    .1593893
         hhsz |   .0102331   .0470482     0.22   0.828    -.0819796    .1024457
        exper |    .003546   .0060729     0.58   0.559    -.0083568    .0154487
   LandOwnTen |  -.1668884   .1256418    -1.33   0.184    -.4131419    .0793651
       Landsz |   .0926303   .0498445     1.86   0.063     -.005063    .1903237
     Livetype |   .5829476   .3120609     1.87   0.062    -.0286805    1.194576
       NoCows |   .1607476   .0443323     3.63   0.000      .073858    .2476373
    MilkYield |  -.0009142   .0050626    -0.18   0.857    -.0108366    .0090083
```

```
     Contract |   1.442352   .1367339    10.55   0.000     1.174358    1.710345
    MilkPrice |  -.0697917     .01102    -6.33   0.000    -.0913904   -.0481929
  DistVetClin |   .0009876   .0076807     0.13   0.898    -.0140663    .0160415
DistOutputMkt |  -.0033661   .0032155    -1.05   0.295    -.0096683    .0029362
     Typeroad |   .1524531    .120562     1.26   0.206    -.0838441    .3887503
     trustlev |   .3704572   .1210086     3.06   0.002     .1332847    .6076296
   Remittance |   .2032259   .1309612     1.55   0.121    -.0534535    .4599052
        _cons |  -.1092531   .6163206    -0.18   0.859    -1.317219    1.098713
------------------------------------------------------------------------------
```

```
. probit AccessProdSer SexHH AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows MilkYield
Contra> ct MilkPrice DistVetClin DistOutputMkt Typeroad trustlev Remittance

Probit regression                                 Number of obs     =        682
                                                  LR chi2(17)       =      47.20
                                                  Prob > chi2       =     0.0001
Log likelihood = -108.52858                       Pseudo R2         =     0.1786

------------------------------------------------------------------------------
AccessProdSer |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
        SexHH |   .2792507   .2026046     1.38   0.168    -.1178471    .6763484
        AgeHH |   -.005631   .0104052    -0.54   0.588    -.0260249    .0147629
       EducHH |  -.0547187   .1055322    -0.52   0.604     -.261558    .1521207
         hhsz |   .2501742   .0858989     2.91   0.004     .0818154    .4185329
        exper |   .0237656   .0105036     2.26   0.024     .0031789    .0443523
   LandOwnTen |   .1277417   .2095765     0.61   0.542    -.2830208    .5385041
       Landsz |   -.097999   .0787039    -1.25   0.213    -.2522558    .0562578
     Livetype |   .4567336   .3466396     1.32   0.188    -.2226676    1.136135
       NoCows |   .0201143   .0751874     0.27   0.789    -.1272503    .1674789
    MilkYield |   .0008077   .0096084     0.08   0.933    -.0180245    .0196398
     Contract |   .2866234   .1926731     1.49   0.137     -.091009    .6642557
    MilkPrice |  -.0203311   .0135637    -1.50   0.134    -.0469154    .0062532
  DistVetClin |  -.0017349   .0118233    -0.15   0.883    -.0249081    .0214383
DistOutputMkt |   .0016322   .0128436     0.13   0.899    -.0235408    .0268053
     Typeroad |   .7022655   .2627327     2.67   0.008     .1873189    1.217212
     trustlev |  -.1216124   .2100652    -0.58   0.563    -.5333325    .2901078
   Remittance |   .4041971   .2390098     1.69   0.091    -.0642534    .8726477
        _cons |   .7179729   .8930228     0.80   0.421     -1.03232    2.468265
------------------------------------------------------------------------------
```

```
. probit AccessCredit SexHH AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows MilkYield
Contrac> t MilkPrice DistVetClin DistOutputMkt Typeroad trustlev Remittance
Probit regression                                 Number of obs     =        682
                                                  LR chi2(17)       =      59.48
                                                  Prob > chi2       =     0.0000
Log likelihood = -438.04284                       Pseudo R2         =     0.0636
```

```
------------------------------------------------------------------------------
 AccessCredit |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
        SexHH |   .0560812   .1161194     0.48   0.629    -.1715087    .2836711
        AgeHH |  -.0016193   .0055949    -0.29   0.772     -.012585    .0093464
       EducHH |   .2167167   .0569878     3.80   0.000     .1050227    .3284106
         hhsz |  -.1023574   .0424371    -2.41   0.016    -.1855326   -.0191821
        exper |  -.0039931   .0053068    -0.75   0.452    -.0143943    .0064081
   LandOwnTen |   .0018295   .1117584     0.02   0.987    -.2172131     .220872
       Landsz |  -.0218418   .0441296    -0.49   0.621    -.1083343    .0646507
     Livetype |  -.4749233   .2654706    -1.79   0.074     -.995236    .0453895
       NoCows |   .0258192   .0356375     0.72   0.469     -.044029    .0956673
    MilkYield |   .0006104   .0041875     0.15   0.884    -.0075969    .0088177
     Contract |  -.1156241   .1134305    -1.02   0.308    -.3379437    .1066956
    MilkPrice |   .0034417   .0079888     0.43   0.667    -.0122162    .0190996
  DistVetClin |   .0040022   .0081571     0.49   0.624    -.0119855    .0199899
DistOutputMkt |   .0459088    .029422     1.56   0.119    -.0117574    .1035749
     Typeroad |  -.1328963   .1060102    -1.25   0.210    -.3406725    .0748799
     trustlev |  -.3846002   .1097412    -3.50   0.000     -.599689   -.1695114
   Remittance |  -.0634449   .1164993    -0.54   0.586    -.2917793    .1648894
        _cons |   .4841897   .5361558     0.90   0.366    -.5666564    1.535036
------------------------------------------------------------------------------
Note: 0 failures and 1 success completely determined.

. probit ReceiveBusinessTrain SexHH AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows
MilkYield>  Contract MilkPrice DistVetClin DistOutputMkt Typeroad trustlev Remittance
Probit regression                                 Number of obs     =        682
                                                  LR chi2(17)       =     161.61
                                                  Prob > chi2       =     0.0000
Log likelihood =  -377.0283                       Pseudo R2         =     0.1765
------------------------------------------------------------------------------
ReceiveBusinessTrain |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------+--------------------------------------------------------------
               SexHH |  -.0038387   .1242653    -0.03   0.975    -.2473942    .2397168
               AgeHH |  -.0013413   .0059427    -0.23   0.821    -.0129888    .0103063
              EducHH |   .0273417   .0600303     0.46   0.649    -.0903156     .144999
                hhsz |   .0678045   .0443746     1.53   0.127    -.0191682    .1547772
               exper |  -.0026127   .0057036    -0.46   0.647    -.0137916    .0085663
          LandOwnTen |    .080487   .1182598     0.68   0.496    -.1512979    .3122719
              Landsz |   .1022467   .0460903     2.22   0.027     .0119114     .192582
            Livetype |   .3124112   .2970405     1.05   0.293    -.2697775    .8945998
              NoCows |   .0273494   .0365106     0.75   0.454    -.0442101    .0989089
           MilkYield |   .0063798   .0043117     1.48   0.139     -.002071    .0148306
            Contract |   .9243243   .1264311     7.31   0.000     .6765239    1.172125
           MilkPrice |  -.0350163   .0094823    -3.69   0.000    -.0536012   -.0164314
         DistVetClin |   .0023047   .0071345     0.32   0.747    -.0116787    .0162881
       DistOutputMkt |   .0031081    .005993     0.52   0.604     -.008638    .0148542
            Typeroad |   .4496744   .1110242     4.05   0.000     .2320709     .667278
```

```
            trustlev |   .0920422    .115703     0.80   0.426    -.1347316    .3188159
          Remittance |   .0742042   .1240991     0.60   0.550    -.1690256    .3174341
               _cons |  -.8982272   .5758238    -1.56   0.119    -2.026821    .2303667
------------------------------------------------------------------------------
```

Appendix E. Results of Multinomial logit regression on effect of ASS on choice of dairy cooperative market channel in Kenya

```
Multinomial logistic regression                 Number of obs     =        649
                                                LR chi2(27)       =     807.62
                                                Prob > chi2       =     0.0000
Log likelihood = -350.95717                     Pseudo R2         =     0.5350

------------------------------------------------------------------------------
           MktChoice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------+--------------------------------------------------------------
Cooperative          |  (base outcome)
---------------------+--------------------------------------------------------------
Middlemen            |
         AccessCredit |   .1044123   .4847351     0.22   0.829     -.845651    1.054476
 ReceiveBusinessTrain |  -.9969816   .5025854    -1.98   0.047    -1.982031   -.0119323
           MemberCoop |  -8.547369    1.10558    -7.73   0.000    -10.71427   -6.380471
          Curative__1 |  -.5194086   .4837471    -1.07   0.283    -1.467536    .4287183
                AI__2 |  -.4236221   .6202569    -0.68   0.495    -1.639303    .7920591
         Pregnancy__3 |  -1.257863   .7955943    -1.58   0.114      -2.8172    .3014727
         Deworming__4 |  -1.004611   .5872941    -1.71   0.087    -2.155686    .1464643
       vaccination__5 |  -.3249032   .4755766    -0.68   0.494    -1.257016    .6072098
       SupplyFeeds__6 |   2.196951   .5779155     3.80   0.000     1.064258    3.329645
                _cons |   3.236033   .8454717     3.83   0.000     1.578939    4.893127
---------------------+--------------------------------------------------------------
Retailers            |
         AccessCredit |   .4811359   .5095892     0.94   0.345    -.5176407    1.479912
 ReceiveBusinessTrain |  -1.747667   .5673717    -3.08   0.002    -2.859695   -.6356388
           MemberCoop |  -6.531236   .8334735    -7.84   0.000    -8.164814   -4.897658
          Curative__1 |  -.6948067   .5066569    -1.37   0.170    -1.687836    .2982225
                AI__2 |  -.6493032   .6474158    -1.00   0.316    -1.918215    .6196085
         Pregnancy__3 |  -2.841149   1.266162    -2.24   0.025     -5.32278   -.3595184
         Deworming__4 |   .8777696    .657651     1.33   0.182    -.4112027    2.166742
       vaccination__5 |    .852419   .5075222     1.68   0.093    -.1423063    1.847144
       SupplyFeeds__6 |   1.016053   .5954778     1.71   0.088    -.1510623    2.183168
                _cons |   1.037039   .9186853     1.13   0.259    -.7635508    2.837629
---------------------+--------------------------------------------------------------
Consumers__Neighbors_ |
         AccessCredit |   .2463167    .545581     0.45   0.652    -.8230024    1.315636
 ReceiveBusinessTrain |  -1.285921   .6086887    -2.11   0.035    -2.478929   -.0929133
           MemberCoop |  -6.712834   1.092858    -6.14   0.000    -8.854796   -4.570871
          Curative__1 |  -.5874422   .5393104    -1.09   0.276    -1.644471    .4695867
                AI__2 |   -.268743   .6929556    -0.39   0.698    -1.626911    1.089425
         Pregnancy__3 |  -.5085683   .9072614    -0.56   0.575    -2.286768    1.269631
         Deworming__4 |  -1.102203   .6336202    -1.74   0.082    -2.344075    .1396701
       vaccination__5 |  -.3956681   .5339859    -0.74   0.459    -1.442261    .6509251
       SupplyFeeds__6 |   .9525061   .6492049     1.47   0.142     -.319912    2.224924
                _cons |   2.328191   .9261626     2.51   0.012     .5129459    4.143436
------------------------------------------------------------------------------
```

Appendix F. Results of Multinomial endogenous switching regression on determinants of agribusiness support services combinations utilization

```
. mlogit ASS_COMB SexHH AgeHH EducHH hhsz exper LandOwnTen Landsz Livetype NoCows MilkYield
Contract Mi> lkPrice DistVetClin DistOutputMkt Typeroad trustlev Remittance, baseoutcome(1)

Multinomial logistic regression                 Number of obs     =        682
                                                LR chi2(153)      =     583.88
                                                Prob > chi2       =     0.0000
Log likelihood = -1118.4556                     Pseudo R2         =     0.2070

------------------------------------------------------------------------------
     ASS_COMB |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
1             |  (base outcome)
--------------+---------------------------------------------------------------
2             |
        SexHH |   -.082819    .805223    -0.10   0.918    -1.661027    1.495389
        AgeHH |  -.0550815   .0383974    -1.43   0.151    -.1303391     .020176
       EducHH |  -.0176008   .4034336    -0.04   0.965     -.808316    .7731145
         hhsz |   .7890059   .3337351     2.36   0.018      .134897    1.443115
        exper |   .0875044   .0378254     2.31   0.021     .0133679    .1616408
   LandOwnTen |   1.364732   .7924423     1.72   0.085    -.1884268     2.91789
       Landsz |  -.3395627   .3309182    -1.03   0.305    -.9881504    .3090249
     Livetype |   -15.0012    2153.33    -0.01   0.994     -4235.45    4205.448
       NoCows |  -.3693007   .2831942    -1.30   0.192    -.9243511    .1857497
    MilkYield |    .073908   .0558761     1.32   0.186    -.0356072    .1834233
     Contract |    .173608   .7852182     0.22   0.825    -1.365391    1.712607
    MilkPrice |  -.0245717    .050574    -0.49   0.627     -.123695    .0745515
  DistVetClin |  -.0238313   .0946772    -0.25   0.801    -.2093953    .1617326
DistOutputMkt |  -.5529224   .1594361    -3.47   0.001    -.8654113   -.2404335
     Typeroad |   14.90609   455.9209     0.03   0.974    -878.6824    908.4946
     trustlev |   .2373549   .8044123     0.30   0.768    -1.339264    1.813974
   Remittance |   .6625994   .8255526     0.80   0.422    -.9554539    2.280653
        _cons |   16.99303   2153.332     0.01   0.994    -4203.461    4237.447
--------------+---------------------------------------------------------------
3             |
        SexHH |  -1.228895   .9381312    -1.31   0.190    -3.067598    .6098085
        AgeHH |  -.0682602   .0464336    -1.47   0.142    -.1592683     .022748
       EducHH |   .3400171   .4706806     0.72   0.470    -.5824999    1.262534
         hhsz |   .5078211   .3966671     1.28   0.200    -.2696321    1.285274
        exper |   .0716819   .0461637     1.55   0.120    -.0187972     .162161
   LandOwnTen |   2.021179   .9705182     2.08   0.037     .1189985     3.92336
       Landsz |   -.180673   .3764584    -0.48   0.631    -.9185179    .5571718
     Livetype |  -17.53697    2153.33    -0.01   0.994    -4237.986    4202.912
       NoCows |  -.3115467   .3402204    -0.92   0.360    -.9783665    .3552731
    MilkYield |   .0765793   .0582158     1.32   0.188    -.0375215    .1906801
     Contract |   1.364432   .9215672     1.48   0.139    -.4418062    3.170671
    MilkPrice |   .0661299   .0593673     1.11   0.265     -.050228    .1824877
  DistVetClin |  -.0293151   .0986496    -0.30   0.766    -.2226648    .1640346
DistOutputMkt |  -.0592828   .0978294    -0.61   0.545    -.2510249    .1324593
     Typeroad |   13.92161   455.9211     0.03   0.976    -879.6674    907.5106
     trustlev |  -.6699653    .953269    -0.70   0.482    -2.538338    1.198408
   Remittance |  -.6408279   1.066574    -0.60   0.548    -2.731275    1.449619
        _cons |   14.99299   2153.333     0.01   0.994    -4205.463    4235.449
--------------+---------------------------------------------------------------
5             |
        SexHH |   .0641334   .7899255     0.08   0.935    -1.484092    1.612359
        AgeHH |   -.068295   .0375645    -1.82   0.069    -.1419201    .0053301
       EducHH |   .3692661   .3952547     0.93   0.350    -.4054188    1.143951
         hhsz |   .5290858   .3278463     1.61   0.107    -.1134812    1.171653
        exper |   .0957444   .0372247     2.57   0.010     .0227854    .1687034
   LandOwnTen |   .9563424   .7752954     1.23   0.217    -.5632087    2.475893
       Landsz |  -.2846399   .3213518    -0.89   0.376    -.9144778    .3451979
     Livetype |  -16.11062    2153.33    -0.01   0.994    -4236.559    4204.338
       NoCows |  -.3613717   .2796561    -1.29   0.196    -.9094876    .1867443
    MilkYield |    .055835    .055604     1.00   0.315     -.053147    .1648169
     Contract |   .2780152   .7707691     0.36   0.718    -1.232664    1.788695
    MilkPrice |  -.0002817   .0494193    -0.01   0.995    -.0971418    .0965783
  DistVetClin |  -.1385611   .0991572    -1.40   0.162    -.3329056    .0557834
DistOutputMkt |  -.0376807   .0677865    -0.56   0.578    -.1705398    .0951783
```

```
     Typeroad |   14.20355   455.9211     0.03   0.975    -879.3854    907.7925
     trustlev |   -.562899   .7825744    -0.72   0.472    -2.096717    .9709187
   Remittance |   .3262935   .8129799     0.40   0.688    -1.267118    1.919705
        _cons |   18.58752   2153.332     0.01   0.993    -4201.866    4239.041
--------------+------------------------------------------------------------------
6             |
        SexHH |   .1172596   .8932385     0.13   0.896    -1.633456    1.867975
        AgeHH |  -.0399144   .0421692    -0.95   0.344    -.1225645    .0427358
       EducHH |   .3529988   .4425956     0.80   0.425    -.5144727     1.22047
         hhsz |   .5225958   .3595619     1.45   0.146    -.1821325    1.227324
        exper |   .0930185   .0414713     2.24   0.025     .0117364    .1743007
   LandOwnTen |   .6252704    .864852     0.72   0.470    -1.069808    2.320349
       Landsz |  -.1392967   .3476148    -0.40   0.689    -.8206091    .5420158
     Livetype |  -16.14409    2153.33    -0.01   0.994    -4236.593    4204.305
       NoCows |  -.5898089   .3333796    -1.77   0.077    -1.243221    .0636031
    MilkYield |   .0833292   .0575898     1.45   0.148    -.0295447     .196203
     Contract |   1.187251   .8487635     1.40   0.162    -.4762953    2.850796
    MilkPrice |  -.0701455   .0591318    -1.19   0.236    -.1860417    .0457507
  DistVetClin |  -.0394424   .1006958    -0.39   0.695    -.2368026    .1579178
DistOutputMkt |  -.5376839   .2409249    -2.23   0.026    -1.009888   -.0654797
     Typeroad |   15.23031    455.921     0.03   0.973    -878.3585    908.8191
     trustlev |   .0987276   .8685058     0.11   0.909    -1.603513    1.800968
   Remittance |  -.2450648   .9176345    -0.27   0.789    -2.043595    1.553466
        _cons |   17.22723   2153.333     0.01   0.994    -4203.227    4237.682
--------------+------------------------------------------------------------------
7             |
        SexHH |   .3811136   .8478086     0.45   0.653    -1.280561    2.042788
        AgeHH |  -.0559806   .0400079    -1.40   0.162    -.1343946    .0224335
       EducHH |   .1263376   .4172966     0.30   0.762    -.6915488     .944224
         hhsz |   .7525467   .3442378     2.19   0.029      .077853     1.42724
        exper |   .0954447   .0395235     2.41   0.016     .0179802    .1729093
   LandOwnTen |   .6276591   .8194659     0.77   0.444    -.9784644    2.233783
       Landsz |  -.1360761   .3403466    -0.40   0.689    -.8031432    .5309909
     Livetype |  -1.117514   2242.958    -0.00   1.000    -4397.234    4394.999
       NoCows |  -.1670998   .2909906    -0.57   0.566    -.7374309    .4032312
    MilkYield |   .0449158   .0574981     0.78   0.435    -.0677785      .15761
     Contract |   4.133191   1.044739     3.96   0.000     2.085541    6.180841
    MilkPrice |  -.1305617   .0577581    -2.26   0.024    -.2437656   -.0173579
  DistVetClin |  -.1594616   .1206438    -1.32   0.186    -.3959191    .0769958
DistOutputMkt |  -.0045107   .0635189    -0.07   0.943    -.1290053     .119984
     Typeroad |   14.51171    455.921     0.03   0.975    -879.0771    908.1005
     trustlev |   1.151847   .8521483     1.35   0.176    -.5183331    2.822027
   Remittance |   .7098432   .8731373     0.81   0.416    -1.001474    2.421161
        _cons |   1.572113   2242.961     0.00   0.999     -4394.55    4397.694
--------------+------------------------------------------------------------------
8             |
        SexHH |  -.3103368   .8847264    -0.35   0.726    -2.044369    1.423695
        AgeHH |    -.02982   .0415562    -0.72   0.473    -.1112687    .0516288
       EducHH |   .7428344    .438757     1.69   0.090    -.1171136    1.602782
         hhsz |   .8091908   .3565686     2.27   0.023     .1103291    1.508052
        exper |   .0689469   .0409385     1.68   0.092     -.011291    .1491848
   LandOwnTen |   1.823834   .8765708     2.08   0.037     .1057871    3.541882
       Landsz |   -.472374   .3697447    -1.28   0.201     -1.19706    .2523123
     Livetype |  -14.92763    2153.33    -0.01   0.994    -4235.377    4205.522
       NoCows |  -.4319958   .3096578    -1.40   0.163    -1.038914    .1749224
    MilkYield |    .078264   .0565478     1.38   0.166    -.0325676    .1890957
     Contract |   1.602244   .8556816     1.87   0.061    -.0748616    3.279349
    MilkPrice |  -.0380379   .0571358    -0.67   0.506     -.150022    .0739461
  DistVetClin |   -.163616   .1331412    -1.23   0.219     -.424568    .0973359
DistOutputMkt |   .0032886   .0609434     0.05   0.957    -.1161583    .1227356
     Typeroad |    14.9308   455.9211     0.03   0.974    -878.6581    908.5197
     trustlev |  -.5381375   .8569953    -0.63   0.530    -2.217817    1.141542
   Remittance |   .3447698   .8978299     0.38   0.701    -1.414944    2.104484
        _cons |    12.0266   2153.333     0.01   0.996    -4208.428    4232.482
--------------+------------------------------------------------------------------
9             |
        SexHH |  -.5547607   .8377772    -0.66   0.508    -2.196774    1.087253
        AgeHH |  -.0333233   .0406529    -0.82   0.412    -.1130016    .0463549
       EducHH |   .6540111   .4225959     1.55   0.122    -.1742616    1.482284
         hhsz |   .4572148   .3483784     1.31   0.189    -.2255943    1.140024
        exper |   .0802192   .0390966     2.05   0.040     .0035913    .1568472
   LandOwnTen |   .8505333   .8265711     1.03   0.303    -.7695163    2.470583
```

```
       Landsz |  -.5691279   .3600879    -1.58   0.114    -1.274887    .1366313
     Livetype |  -15.17614    2153.33    -0.01   0.994    -4235.625    4205.273
       NoCows |  -.0015531   .2823116    -0.01   0.996    -.5548738    .5517675
    MilkYield |   .0647169   .0562594     1.15   0.250    -.0455496    .1749834
     Contract |   2.085046   .8322914     2.51   0.012     .4537846    3.716307
    MilkPrice |  -.1574534   .0596599    -2.64   0.008    -.2743847   -.0405222
  DistVetClin |  -.1254745   .1117397    -1.12   0.261    -.3444802    .0935312
DistOutputMkt |  -.0033646   .0614875    -0.05   0.956    -.1238778    .1171486
     Typeroad |   14.35483   455.9211     0.03   0.975    -879.2341    907.9437
     trustlev |  -.4404754   .8276352    -0.53   0.595     -2.06261     1.18166
   Remittance |   .5138378   .8631833     0.60   0.552     -1.17797    2.205646
        _cons |   17.58883   2153.333     0.01   0.993    -4202.865    4238.043
--------------+-----------------------------------------------------------------
10            |
        SexHH |  -.3740893   .8279405    -0.45   0.651    -1.996823    1.248644
        AgeHH |  -.0689557   .0395829    -1.74   0.081    -.1465367    .0086253
       EducHH |    .113108   .4131963     0.27   0.784    -.6967418    .9229579
         hhsz |   .8598511   .3412541     2.52   0.012     .1910053    1.528697
        exper |    .097842   .0390172     2.51   0.012     .0213697    .1743142
   LandOwnTen |   .9622275   .8094325     1.19   0.235    -.6242311    2.548686
       Landsz |  -.0848736   .3324682    -0.26   0.799    -.7364993    .5667521
     Livetype |  -13.83791    2153.33    -0.01   0.995    -4234.287    4206.611
       NoCows |  -.0858119   .2814294    -0.30   0.760    -.6374034    .4657796
    MilkYield |   .0716162   .0558146     1.28   0.199    -.0377784    .1810109
     Contract |   4.129094   1.043516     3.96   0.000      2.08384    6.174349
    MilkPrice |  -.1411743   .0563518    -2.51   0.012    -.2516217   -.0307268
  DistVetClin |  -.2744328   .1202168    -2.28   0.022    -.5100535   -.0388121
DistOutputMkt |  -.0060996   .0622042    -0.10   0.922    -.1280175    .1158183
     Typeroad |    15.0424    455.921     0.03   0.974    -878.5464    908.6312
     trustlev |   .5213303   .8252048     0.63   0.528    -1.096041    2.138702
   Remittance |   .7409665   .8540455     0.87   0.386    -.9329319    2.414865
        _cons |   15.43798   2153.333     0.01   0.994    -4205.016    4235.892
--------------+-----------------------------------------------------------------
11            |
        SexHH |   .3128947   .8192626     0.38   0.703     -1.29283     1.91862
        AgeHH |  -.0612867   .0387885    -1.58   0.114    -.1373108    .0147374
       EducHH |   .3352096   .4068294     0.82   0.410    -.4621613    1.132581
         hhsz |   .6950523   .3366758     2.06   0.039     .0351799    1.354925
        exper |     .07833   .0383164     2.04   0.041     .0032313    .1534288
   LandOwnTen |   1.008221   .7972949     1.26   0.206    -.5544486     2.57089
       Landsz |  -.0525688    .327428    -0.16   0.872    -.6943159    .5891783
     Livetype |  -14.34011    2153.33    -0.01   0.995    -4234.789    4206.109
       NoCows |   -.093827   .2788184    -0.34   0.736     -.640301     .452647
    MilkYield |   .0698824   .0556302     1.26   0.209    -.0391508    .1789156
     Contract |   2.848092   .8255955     3.45   0.001     1.229955    4.466229
    MilkPrice |  -.1471294   .0549259    -2.68   0.007    -.2547823   -.0394765
  DistVetClin |  -.0317627   .0944607    -0.34   0.737    -.2169023    .1533769
DistOutputMkt |  -.0219757   .0732424    -0.30   0.764    -.1655282    .1215768
     Typeroad |   15.23477   455.9209     0.03   0.973    -878.3537    908.8233
     trustlev |   .2059992   .8061301     0.26   0.798    -1.373987    1.785985
   Remittance |   .8108885   .8394549     0.97   0.334    -.8344128     2.45619
        _cons |   16.40973   2153.332     0.01   0.994    -4204.044    4236.864
------------------------------------------------------------------------------


MFX---MARGINAL EFFECTS
. mfx compute, predict (outcome(1))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==1) (predict, outcome(1))
         =  .00003285
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
   SexHH*|   2.04e-06      .00039    0.01   0.996  -.000768  .000772   .703812
   AgeHH |   1.89e-06      .00036    0.01   0.996   -.00071  .000714   55.5469
  EducHH |  -.0000109      .00209   -0.01   0.996  -.004104  .004082   3.59677
    hhsz |  -.0000214      .00411   -0.01   0.996  -.008067  .008024   3.43109
   exper |  -2.87e-06      .00055   -0.01   0.996  -.001081  .001076   18.8182
LandOw~n*|  -.0000405      .00777   -0.01   0.996  -.015279  .015198   .608504
  Landsz |   8.20e-06      .00157    0.01   0.996  -.003075  .003092   1.29456
Livetype*|   .0000631      .01042    0.01   0.995  -.020369  .020495   .954545
```

```
  NoCows |   8.32e-06       .0016    0.01   0.996  -.003122  .003139   2.50293
MilkYi~d |  -2.17e-06      .00042   -0.01   0.996  -.000819  .000814   14.2903
Contract*|  -.0000517      .00993   -0.01   0.996  -.019514   .01941    .66129
MilkPr~e |   2.34e-06      .00045    0.01   0.996  -.000877  .000881   33.1906
DistVe~n |   3.62e-06      .00069    0.01   0.996  -.001358  .001365   2.79084
DistOu~t |   3.58e-06      .00069    0.01   0.996  -.001342  .001349    2.1234
Typeroad*|  -.0066184      .64358   -0.01   0.992  -1.26802  1.25478    .36217
trustlev*|   3.81e-06      .00073    0.01   0.996  -.001432  .001439   .648094
Remitt~e*|  -.0000159      .00305   -0.01   0.996  -.005989  .005958   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(2))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==2) (predict, outcome(2))
         =  .12553002
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|  -.0023791      .06553   -0.04   0.971  -.130822  .126063   .703812
   AgeHH |   .0003139       .0016    0.20   0.844   -.00282  .003448   55.5469
  EducHH |  -.0437757      .08546   -0.51   0.608  -.211276  .123725   3.59677
    hhsz |   .0173289      .03807    0.46   0.649  -.057279  .091937   3.43109
   exper |   .0000308      .00188    0.02   0.987  -.003655  .003716   18.8182
LandOw~n*|   .0366209      .03478    1.05   0.292  -.031555  .104797   .608504
  Landsz |  -.0113123      .01355   -0.83   0.404  -.037879  .015255   1.29456
Livetype*|   .0469651      .04826    0.97   0.330  -.047626  .141556   .954545
  NoCows |  -.0145654      .01256   -1.16   0.246  -.039177  .010046   2.50293
MilkYi~d |   .0009847      .00238    0.41   0.679  -.003673  .005643   14.2903
Contract*|  -.1654712      .13575   -1.22   0.223  -.431527  .100585    .66129
MilkPr~e |   .0058415      .00303    1.93   0.054  -.000089  .011772   33.1906
DistVe~n |   .0108378      .00687    1.58   0.115  -.002622  .024298   2.79084
DistOu~t |  -.0557465      .05244   -1.06   0.288  -.158529  .047036    2.1234
Typeroad*|   .0232564      .07968    0.29   0.770  -.132904  .179417    .36217
trustlev*|   .0417848       .2071    0.20   0.840  -.364131    .4477   .648094
Remitt~e*|   .0196029      .06327    0.31   0.757    -.1044  .143606   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(3))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==3) (predict, outcome(3))
         =  .02098286
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|  -.0324004      .02908   -1.11   0.265  -.089404  .024603   .703812
   AgeHH |  -.0002241      .00064   -0.35   0.726  -.001479  .001031   55.5469
  EducHH |   .0001866      .00757    0.02   0.980  -.014652  .015025   3.59677
    hhsz |  -.0030035        .005   -0.60   0.548   -.01281  .006803   3.43109
   exper |  -.0003268      .00063   -0.51   0.607  -.001571  .000917   18.8182
LandOw~n*|   .0186466      .01735    1.07   0.283  -.015363  .052656   .608504
  Landsz |   .0014431      .00639    0.23   0.821  -.011084   .01397   1.29456
Livetype*|  -.1229206       .0878   -1.40   0.162  -.295006  .049164   .954545
  NoCows |  -.0012228      .00446   -0.27   0.784  -.009971  .007525   2.50293
MilkYi~d |   .0002206       .0005    0.44   0.658  -.000755  .001197   14.2903
Contract*|  -.0008322      .04015   -0.02   0.983  -.079516  .077851    .66129
MilkPr~e |   .0028796      .00225    1.28   0.201  -.001536  .007296   33.1906
DistVe~n |   .0016965      .00132    1.29   0.197  -.000881  .004274   2.79084
DistOu~t |   .0010397      .00425    0.24   0.807  -.007288  .009368    2.1234
Typeroad*|  -.0150309      .03025   -0.50   0.619  -.074312  .044251    .36217
trustlev*|  -.0123283       .0214   -0.58   0.565  -.054269  .029612   .648094
Remitt~e*|  -.0225548      .02619   -0.86   0.389  -.073882  .028772   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(4))
```

```
Marginal effects after mlogit
      y  = Pr(ASS_COMB==5) (predict, outcome(5))
         =   .3037885
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|   .0374207      .19209    0.19   0.846  -.339076  .413917   .703812
   AgeHH |  -.0032544      .00424   -0.77   0.443  -.011574  .005065   55.5469
  EducHH |   .0115864      .06663    0.17   0.862  -.119012  .142185   3.59677
    hhsz |  -.0370239      .02099   -1.76   0.078   -.07816  .004112   3.43109
   exper |   .0025779       .0066    0.39   0.696   -.01035  .015506   18.8182
LandOw~n*|   -.031786      .21325   -0.15   0.882  -.449757  .386185   .608504
  Landsz |  -.0106914      .03633   -0.29   0.769  -.081897  .060514   1.29456
Livetype*|  -.2428011      .11239   -2.16   0.031  -.463086 -.022516   .954545
  NoCows |  -.0328402      .02268   -1.45   0.148  -.077289  .011608   2.50293
MilkYi~d |  -.0031075      .01185   -0.26   0.793  -.026325   .02011   14.2903
Contract*|   -.356958      .33784   -1.06   0.291  -1.01911  .305198    .66129
MilkPr~e |   .0215158      .00589    3.65   0.000   .009975  .033057   33.1906
DistVe~n |  -.0086256      .03065   -0.28   0.778  -.068697  .051445   2.79084
DistOu~t |   .0216153      .06488    0.33   0.739  -.105555  .148786    2.1234
Typeroad*|   -.144216      .33225   -0.43   0.664  -.795408  .506976    .36217
trustlev*|  -.1407979        .268   -0.53   0.599  -.666058  .384463   .648094
Remitt~e*|  -.0535224        .053   -1.01   0.313  -.157403  .050358   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(5))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==6) (predict, outcome(6))
         =  .03966658
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|   .0068467      .03086    0.22   0.824  -.053637  .067331   .703812
   AgeHH |   .0007008      .00125    0.56   0.574  -.001745  .003146   55.5469
  EducHH |   .0008676      .01213    0.07   0.943  -.022909  .024644   3.59677
    hhsz |  -.0050918      .00638   -0.80   0.425  -.017593   .00741   3.43109
   exper |   .0002285      .00103    0.22   0.824  -.001786  .002243   18.8182
LandOw~n*|  -.0180542      .04974   -0.36   0.717  -.115534  .079426   .608504
  Landsz |   .0043693      .01226    0.36   0.722   -.01967  .028408   1.29456
Livetype*|  -.0339775      .04776   -0.71   0.477  -.127576  .059621   .954545
  NoCows |  -.0133494      .01444   -0.92   0.355  -.041652  .014953   2.50293
MilkYi~d |   .0006848      .00071    0.97   0.333  -.000703  .002072   14.2903
Contract*|   -.007596      .06988   -0.11   0.913  -.144555  .129363    .66129
MilkPr~e |   .0000381       .0031    0.01   0.990   -.00603  .006106   33.1906
DistVe~n |   .0028054       .0022    1.28   0.202  -.001507  .007118   2.79084
DistOu~t |   -.017011      .01643   -1.04   0.300  -.049207  .015185    2.1234
Typeroad*|   .0213447      .03117    0.68   0.494  -.039756  .082445    .36217
trustlev*|   .0082359      .06131    0.13   0.893  -.111925  .128397   .648094
Remitt~e*|  -.0281322      .03051   -0.92   0.356  -.087929  .031664   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(6))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==7) (predict, outcome(7))
         =  .04231162
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|   .0171284      .45063    0.04   0.970  -.866095  .900351   .703812
   AgeHH |   .0000678      .00189    0.04   0.971  -.003631  .003766   55.5469
  EducHH |  -.0086649       .2264   -0.04   0.969  -.452406  .435076   3.59677
    hhsz |   .0042983      .11239    0.04   0.969  -.215984  .224581   3.43109
   exper |   .0003464      .00907    0.04   0.970   -.01743  .018123   18.8182
LandOw~n*|  -.0191458      .49746   -0.04   0.969  -.994153  .955861   .608504
  Landsz |   .0047969      .12547    0.04   0.970  -.241122  .250716   1.29456
```

```
Livetype*|   .0772831      .02071    3.73   0.000   .036695  .117872   .954545
  NoCows |    .003646      .09532    0.04   0.969  -.183169  .190461   2.50293
MilkYi~d |  -.0008948       .0234   -0.04   0.969   -.04675  .044961   14.2903
Contract*|   .0812463     2.10333    0.04   0.969  -4.04121   4.2037    .66129
MilkPr~e |  -.0025156      .06571   -0.04   0.969  -.131314  .126283   33.1906
DistVe~n |  -.0020857      .05456   -0.04   0.970  -.109023  .104852   2.79084
DistOu~t |   .0044141       .1153    0.04   0.969  -.221569  .230398    2.1234
Typeroad*|  -.0083982       .2225   -0.04   0.970  -.444489  .427693    .36217
trustlev*|   .0464528     1.21605    0.04   0.970  -2.33695  2.42986   .648094
Remitt~e*|   .0086615      .22643    0.04   0.969   -.43514  .452463   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(7))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==8) (predict, outcome(8))
         =  .07472408
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|  -.0191992      .03715   -0.52   0.605  -.092009  .053611   .703812
   AgeHH |   .0020745      .00299    0.69   0.488  -.003783  .007933   55.5469
  EducHH |   .0307645      .02328    1.32   0.186  -.014867  .076396   3.59677
    hhsz |   .0118237      .02579    0.46   0.647  -.038715  .062362   3.43109
   exper |  -.0013683      .00162   -0.85   0.398   -.00454  .001803   18.8182
LandOw~n*|   .0531499      .03899    1.36   0.173  -.023276  .129576   .608504
  Landsz |   -.016658      .01665   -1.00   0.317  -.049284  .015968   1.29456
Livetype*|   .0312286      .04697    0.66   0.506  -.060826  .123284   .954545
  NoCows |  -.0133552      .01349   -0.99   0.322  -.039789  .013079   2.50293
MilkYi~d |   .0009116      .00125    0.73   0.464  -.001529  .003352   14.2903
Contract*|   .0112617      .15461    0.07   0.942  -.291769  .314292    .66129
MilkPr~e |    .002471      .00322    0.77   0.442  -.003835  .008777   33.1906
DistVe~n |  -.0039939      .01147   -0.35   0.728  -.026471  .018484   2.79084
DistOu~t |   .0083782      .01968    0.43   0.670  -.030204   .04696    2.1234
Typeroad*|   .0157516      .05139    0.31   0.759  -.084974  .116477    .36217
trustlev*|  -.0325437      .07269   -0.45   0.654  -.175022  .109934   .648094
Remitt~e*|  -.0118385       .0285   -0.42   0.678  -.067705  .044028   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(8))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==9) (predict, outcome(9))
         =  .08953859
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   SexHH*|  -.0485079      .03388   -1.43   0.152  -.114906   .01789   .703812
   AgeHH |   .0021721      .00317    0.68   0.494  -.004048  .008392   55.5469
  EducHH |   .0289106      .01905    1.52   0.129  -.008433  .066254   3.59677
    hhsz |  -.0173477      .01484   -1.17   0.243  -.046441  .011746   3.43109
   exper |  -.0006303      .00128   -0.49   0.623  -.003147  .001886   18.8182
LandOw~n*|  -.0190904      .07984   -0.24   0.811  -.175574  .137393   .608504
  Landsz |  -.0286238      .02658   -1.08   0.281  -.080711  .023463   1.29456
Livetype*|   .0230854      .04898    0.47   0.637  -.072921  .119092   .954545
  NoCows |   .0225383      .03744    0.60   0.547  -.050846  .095922   2.50293
MilkYi~d |  -.0001206      .00265   -0.05   0.964  -.005319  .005078   14.2903
Contract*|   .0450259      .22165    0.20   0.839  -.389407  .479458    .66129
MilkPr~e |  -.0077314      .01597   -0.48   0.628  -.039039  .023577   33.1906
DistVe~n |  -.0013706      .00919   -0.15   0.881   -.01939  .016649   2.79084
DistOu~t |   .0094435      .02287    0.41   0.680  -.035373   .05426    2.1234
Typeroad*|  -.0305431        .089   -0.34   0.731  -.204984  .143898    .36217
trustlev*|  -.0293498       .0927   -0.32   0.752  -.211037  .152337   .648094
Remitt~e*|   .0005858      .03642    0.02   0.987  -.070797  .071969   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
```

```
. mfx compute, predict (outcome(9))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==10) (predict, outcome(10))
         =  .09501586
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
   SexHH*|  -.0311715      .03264   -0.96   0.340  -.095139  .032796   .703812
   AgeHH |  -.0010806       .0017   -0.63   0.525  -.004416  .002255   55.5469
  EducHH |  -.0207152      .05026   -0.41   0.680   -.11923  .077799   3.59677
    hhsz |    .019848      .03704    0.54   0.592  -.052745  .092441   3.43109
   exper |   .0010056      .00248    0.41   0.685  -.003852  .005863   18.8182
LandOw~n*|  -.0093758      .06848   -0.14   0.891  -.143588  .124837   .608504
  Landsz |    .015637      .03329    0.47   0.639   -.04961  .080884   1.29456
Livetype*|   .0786392      .02847    2.76   0.006   .022848   .13443   .954545
  NoCows |   .0159111      .03012    0.53   0.597  -.043127  .074949   2.50293
MilkYi~d |   .0005275      .00198    0.27   0.790  -.003354  .004409   14.2903
Contract*|   .1821426      .48266    0.38   0.706  -.763853  1.12814    .66129
MilkPr~e |  -.0066575      .01507   -0.44   0.659  -.036186  .022871   33.1906
DistVe~n |  -.0156078      .02547   -0.61   0.540  -.065522  .034306   2.79084
DistOu~t |   .0097613        .024    0.41   0.684  -.037276  .056798    2.1234
Typeroad*|   .0312363      .06019    0.52   0.604  -.086726  .149199    .36217
trustlev*|   .0550026      .18375    0.30   0.765  -.305131  .415136   .648094
Remitt~e*|   .0225177      .05826    0.39   0.699  -.091666  .136702   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

.
. mfx compute, predict (outcome(10))

Marginal effects after mlogit
      y  = Pr(ASS_COMB==11) (predict, outcome(11))
         =  .20840902
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]       X
---------+--------------------------------------------------------------------
   SexHH*|   .0722602      .18047    0.40   0.689   -.28145  .425971   .703812
   AgeHH |   -.000772      .00222   -0.35   0.728  -.005115  .003571   55.5469
  EducHH |    .000851      .05508    0.02   0.988  -.107099  .108801   3.59677
    hhsz |   .0091893      .04021    0.23   0.819  -.069622  .088001   3.43109
   exper |  -.0018608       .0021   -0.89   0.376  -.005977  .002255   18.8182
LandOw~n*|  -.0109247      .13428   -0.08   0.935  -.274106  .252257   .608504
  Landsz |   .0410311      .07966    0.52   0.607  -.115103  .197165   1.29456
Livetype*|   .1424346      .05686    2.51   0.012   .030999   .25387   .954545
  NoCows |   .0332292      .06325    0.53   0.599  -.090747  .157206   2.50293
MilkYi~d |   .0007958      .00463    0.17   0.864  -.008284  .009875   14.2903
Contract*|   .2112327      .67802    0.31   0.755  -1.11766  1.54012    .66129
MilkPr~e |  -.0158438      .03432   -0.46   0.644  -.083101  .051413   33.1906
DistVe~n |   .0163403      .00938    1.74   0.082   -.00205  .034731   2.79084
DistOu~t |   .0181019      .04873    0.37   0.710  -.077409  .113613    2.1234
Typeroad*|   .1132176      .14255    0.79   0.427  -.166172  .392608    .36217
trustlev*|   .0635397      .33698    0.19   0.850  -.596939  .724018   .648094
Remitt~e*|   .0646959      .14012    0.46   0.644   -.20994  .339331   .404692
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
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Appendix G. Publications and presentations

Publications

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EFFECT OF AGRIBUSINESS SUPPORT SERVICES ON CHOICE OF DAIRY COOPERATIVE MARKET CHANNELS IN KENYA

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ABSTRACT

Kenya is witnessing an immense increase in number of smallholder dairy agripreneurs sourcing income from the dairy sub-sector. Smallholder dairy agripreneurs who dominate the production sector are forced to sell milk to informal buyers such as middlemen/women, who exploit them by paying less than the market price. As a result of this, the Kenyan Government has made significant efforts to upgrade dairy cooperatives to link the dairy agripreneurs with consumers. In spite of this, milk marketing is still dominated by traditional informal outlets. This study sought to determine the effect of provision of agribusiness support services on choice of dairy cooperative market channel. Data were collected from a cross-sectional survey of 682 respondents from Muranga County in Kenya, using a semi-structured questionnaire. Results revealed that provision of business plan training, group marketing, pregnancy diagnosis and deworming support services had significant and positive effects on the choice of cooperative market channel. In contrast, access to vaccination services and supply of feeds had negative effectson the choice of cooperative market channel. This study recommends strong coordination among the agribusiness support service providers and the dairy cooperatives in order to increase adoption of the cooperative marketing channel. In addition, dairy cooperatives need to redesign their business models to ensure that their members not only receive agribusiness support services, but also get better prices and prompt payments to increase supply of milk to cooperatives by dairy agripreneurs.

Key Words: Agribusiness support, cooperatives, dairy agripreneurs

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cogent food & agriculture

FOOD SCIENCE & TECHNOLOGY | RESEARCH ARTICLE

Effect of ICT tools attributes in accessing technical, market and financial information among youth dairy agripreneurs in Tanzania

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Additional information is available at the end of the article

Abstract: The purpose of this article is to determine the effect of Information and communications technology (ICT) tools' attributes in accessing technical, market and financial information among youthful dairy agripreneurs in Arumeru District, Tanzania. Data were collected through a standardized questionnaire from 347 farming households. Descriptive statistics and multivariate probit regression were used to analyze the data. The results of the study show that utilization of the various ICT tools (mobile phone, television (TV) and radio) is interrelated, whereas several factors, including extension contacts, installation of electricity, level of buyer trust, availability of market information and receiving of remittances, are found to affect the probability of ICT use. Findings also reveal that complementarity, accessibility, relevance and timeliness had a positive effect on ICT use, while the feedback attribute had a negative influence on ICT use. This finding underscores the need to consider ICT tools' attributes when designing a sustainable ICT-based information delivery model for dairy youth agripreneurs. An understanding of actual users' preference for ICT attributes can provide a blueprint for the ongoing ICT-based public- and private-sector initiatives that target youth-users more effectively.

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PUBLIC INTEREST STATEMENT

Tanzania is witnessing a gradual increase in adoption of innovative technologies in dairy agrienterprises. As part of the journey towards improving youth employment through agripreneurship. The government and the private sector are making immense efforts in the promotion of ICT use among youthful agripreneurs. This is through access to agricultural information and financial transaction. Despite such initiatives, demand-side issues of usage of these ICT tools are still low. We argue in the paper that uptake and use of ICT tools is a function of socioeconomic, institutional and technological attributes, which have not been previously studied. Unless we explore the role of ICT attributes on uptake and use of ICT tools, larger policy level initiatives on dissemination of information using technologies will not be successful. The empirical findings emphasize the importance of considering such factors when designing a sustainable ICT-based information delivery model.

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FOOD SCIENCE & TECHNOLOGY | RESEARCH ARTICLE

Gender effect of entrepreneurial orientation on dairy farming career resilience in Kenya

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Abstract: This study sought to examine gender effect of entrepreneurial orientation on dairy farming career resilience in Kenya. Specifically, the study examined the moderating role of gender on the relationship between future orientation (FO), market orientation (MO), risk-taking orientation (RO), social orientation (SO) and entrepreneurial resilience of dairy agripreneurs in Kenya. We surveyed 682 respondents; 480 males and 202 female dairy agripreneurs in Murang'a County, Kenya using a cross-sectional study design. Data was collected using semi-structured questionnaire using personal interview. Data were analysed using partial least square-structural equation modelling PLS-SEM and multi-group analysis (MGA). Results show significant gender differences across the agripreneurial orientations. The direct effects relationships indicate that future, market and risk-taking orientation of female agripreneurs had a positive and significant impact on agripreneurial resilience (AR). While, for male agripreneurs, future and market orientation had a positive and significant impact on AR; but social orientation had a negative impact on AR. Gender moderates the entrepreneurial orientation-agripreneurial career resilience relationship whereby female agripreneurs had statistically significant higher risk-taking propensity of ($\beta = 0.189$, $p = 0.06$) compared to their male counterparts ($\beta = 0.054$, $p = 0.06$).

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PUBLIC INTEREST STATEMENT

This paper examines the extent to which gender influences entrepreneurial behaviour (EB) on dairy farming career resilience of smallholder farmers in Kenya. Despite the key role women play in the dairy sector, there is a missing link on how gender provides different perspectives of EB practices on dairy farming career resilience. The results show that EB positively influences dairy farming career resilience especially for female agripreneurs. The main implication of this study presents the unique contribution of women entrepreneurial behaviour in Kenya dairy sector. It was found that future, market and risk-taking orientation of female agripreneurs enhanced their dairy farming career resilience. In addition, female agripreneurs had higher risk-taking propensity compared to their male counterparts. While, for male agripreneurs, future and market orientation improved their dairy farming career resilience; but social orientation had a negative impact on dairy farming career resilience. This paper would help to strengthen the body of knowledge on Entrepreneurship in agriculture.

Policy Brief

Desirable attributes that promote access of agricultural information and services through ICT: Lessons from youth dairy farmers in Tanzania

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Executive Summary

The use of information communication and technology (ICT) holds considerable potential to attract youth engagement in agribusiness. Globally, the benefits of ICTs such as mobile phone, radio and television in Agri-enterprises include access to agricultural information and financial services. However, there is low use of ICT among majority of smallholder farmers in sub-Saharan African countries. This study assessed the effect of youth agripreneurs' perceived ICT tools attributes in accessing technical, market and financial information on dairy production in Arumeru District, Tanzania. Data was collected through a questionnaire from 347 youth dairy agripreneurs. The results indicated that complementarity, accessibility, relevance, and timeliness had a positive effect on ICT use while the feedback attribute had a negative influence on ICT use. This finding suggests the need to consider ICT tools attributes when designing a sustainable ICT-based information delivery model for dairy youth agripreneurs. An understanding of actual users' preference for ICT-attributes can provide a blueprint for the ongoing ICT-based public and private-sector initiatives that target youth-users more effectively. The results also indicated that socio-economic and institutional characteristics including; access to extension services, access to electricity, level of trust in milk buyers, access to market information and receiving of remittance all have important implications for interventions aiming to progress dairy youth agripreneurs participation in agribusiness through ICT use. Therefore, these factors should be considered during planning of ICT based agricultural programmes.