EFFECT OF ENTREPRENEURIAL BEHAVIOUR ON FARM PERFORMANCE AMONG SMALL-SCALE COMMERCIAL-ORIENTED FARMERS: CASE OF NIONO ZONE, MALI

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Thesis Submitted to Graduate School in Partial Fulfilment of the Requirements for the Master of Science Degree in Agricultural Economics of Egerton University

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DEDICATION

This research work is dedicated to my dearly beloved mother, Gogo MANGARA, and late father, Soumaila Bambi KONTE.

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Above all, thanks and praise to the God who created humanity on His own image and endowed it with intelligence and reason. May His Name be ever glorified!

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ABSTRACT

The Agricultural Orientation Law (AOL) of 2006 gave Malian small-scale farmers incentives for commercial-orientation. However, they have not been fully embraced by farmers, and this may be due to their entrepreneurial behaviour (EB). Few studies have been conducted on farmers' EB in Mali. This study aimed towards fulfilling this knowledge gap. The general objective was to contribute towards improved livelihood through enhanced EB and farm performance among small-scale farmers in Niono zone, Mali. Specifically, the study aimed to determine: the level of EB of small-scale farmers, and the effect of their EB on both the uptake of AOL's business incentives and farm performance. Multistage sampling technique was used to select 236 farmers. Data was collected using semi-structured questionnaire. The Confirmatory Factor Analysis revealed relevancy of the selected EB while Cronbach's alpha of 0.82 was qualified acceptable. Descriptive statistics were used to determine farmers' EB while multivariate Probit and multivariate Tobit models were used to analyse the effect of farmers' EB on uptake of incentives and farm performance, respectively. Both models indicated good fitness to the data at 5% and 10% significance level respectively. The initiation, innovativeness risk-taking and self-efficiency of the respondents are ranged at second highest level. The previous-failure and proactiveness were scaled at second lowest level. The highest uptakes of incentives were fertilisers (84%) and credit (35%) while the lowest uptakes were funds (16%) and equipment (14%). The uptake was negatively influenced by the distance to extension services providers, household size and the proactiveness, initiation and previous failure. For farm performance, the indicators, sales, profitability and post-harvest losses (PHLs), were affected differently. Both sales and profitability were found to be affected by land size, farm asset values and access to a model farm. The PHLs increased with household size and average farm size in farmers' network, but decreased with household head's years of schooling, nature of business, average time of walking between network members, amount of credit in the counter-season and EB of initiation and innovativeness. To promote commercial-orientation, the study recommended that the government should develop farmers' EB, adapt equipment subsidy and agricultural funds to farmers' socio-economic realities. It should also smoothen the administrative procedures and consider positive factors that appeal and facilitate the emergence and achievement of EB. Further, consideration should be more inclined to farmer-to-farmer approaches since the network is important in terms of motivation, sensitization and sharing of knowledge and experiences.

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LIST OF ABBREVIATIONS AND ACRONYMS

AFI	Agriculture For Impact
AOL	Agricultural Orientation Law
CAFON	*Cooperative des Artisans Forgeron de l'Office du Niger* (Cooperative of Blacksmith of Office du Niger)
Cg	Credit guarantee
CtS	Creation subsidies
DBIS	Department of Business Innovation and Skills
EB	Entrepreneurial Behaviour
Fs	Fertilisers subsidy
IDRE	Institute for Digital Research and Education
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
MoA	Ministry of Agriculture
Mi	Market incentives
MVP	Multivariate Probit
MVT	Multivariate Tobit
ON	*Office du Niger*
PHLs	Post-Harvest Losses
Ti	Training incentives
USDC	United Stated Department of America Department Commerce
WBG	World Bank Group

CHAPTER ONE
INTRODUCTION

1.1.Background information

With an employment of 80% of the population, a contribution of 40 to 45% to the Gross Domestic Product and 30% to export earnings, the Malian economy is dependent on agriculture which is dominated by small scale farming (MoA, 2009; PNISA, 2010; GoM, 2014; MAAF, 2014). However, with an annual growth of 3.6%, the sector is performing below standard. Additionally, this sector is dominated by informal activities and faces many challenges that result in a fragile economy, food insecurity and poor livelihood conditions of stakeholders (John *et al.*, 2011; Stevenson, 2011). These challenges include the fast growing population, climate risks, vulnerable exploitations, illiterate stakeholders, inconsistent policies and rarity of finance systems (Konare, 2001; IFAD and Keita, 2011; John *et al.*, 2011).

Several policies and programmes have been developed since the independence of Mali in 1960 to tackle the challenges that agriculture is facing. Collectivist exploitation of the land in the 1960s was followed by the Structural Adjustment Program (SAP) that occurred in the 80s, terminating the monopoly of the State (Maiga *et al.*, 1995). These reforms led to disengagement of the State and the promotion of private sectors in agriculture and related areas (USDC, 2010; IMF, 2013). The decade of 1990-2000 was also the period of the devaluation of the domestic currency, Franc of Francophone Community of Africa (FCFA), establishment of common exterior tariff, adoption of Union Agricultural Policy and improved market system (Bourdet, 2004; USDC, 2015). On the backdrop of the global finance crisis, sporadic drought (1982-83, 1985-86, 1992-93, 1995-96, 2000-2001 and 2004-2005), and invasion of crickets in 2005-2006 season; the Agricultural Orientation Law (AOL) was established in 2006 as the federator of all legislatives and regulations in connection with agriculture and its related fields (MoA, 2013).

The domestic production as backbone of AOL gained new allure in government attention because of the global finance crisis of 2007-2011 and the food and nutritional crisis of 2007-2008 (GoM, 2010). According to GoM (2014), the domestic production was seen as a generator of stability and economic growth. It also considered the commercial-orientation of small-scale farmers as key factors of its implementation. The AOL and its sub sectorial policies of agriculture, the Agricultural Development Policy (ADP) and the National Program

for Investment in the Agricultural Sector (NPIAS) stipulates; putting better business environment through subsidies on creation, equipment and production factors for Small and Medium Enterprises (SMEs). Equally, the AOL focuses on smooth taxation and trade restrictions, improved skills and access to services, information, finance, markets, infrastructures and better institutions (GoM, 2006). These engagements are to provide key incentives for farming and its related businesses since it includes all supposed elements to boost national and international investments, thus promoting entrepreneurship in the country (IMF, 2015; US Department of States, 2015).

The transition of the small-scale farms to commercial-orientated production requires creation of new enterprises, efficiency of the current ones and their formalization (Diallo, 2012). The Entrepreneurial Behaviour (EB) is a showcase of skills, particular qualities and characteristics for both business initiation and successful management (Muhammad and Junaid, 2016). This level of entrepreneurship is conditioned by favourable policies as well as individuals' insight, willingness and achievement (Krueger and Brazeal, 1994). The EB is significantly important for the growth of any enterprise since it is the impulse to the performance of the latter (Gajanayake, 2010). Therefore, the entrepreneurial behaviour of smallholder farmers matters in policy decision-making (Albrizio *et al.*, 2014). Furthermore, EB matters in the country's economic growth due to the integration of small-scale farmers in several sectors of the economy (Chowdhury, 2013).

1.2.Statement of the problem

The Agricultural Orientation Law and its different strategies provides incentives that lead to reduced production costs and higher profits in the Malian agriculture. These opportunities are expressed in tax exoneration on creation of enterprises, input subsidy, national agricultural funds, smooth administration procedures in terms of time and filling, access to credit and market. Nevertheless, the AOL's business initiatives have not been embraced by all small-scale farmers. Among other socio-economic and institutional factors, this could be attributed to the entrepreneurial behaviour of the small-scale farmers. The entrepreneurial behaviour such as reluctance, initiation, risk-taking, innovativeness, self-efficiency, previous failure and proactiveness is important in agriculture as it may influence the transition from subsistence to market-oriented farming systems. This transition could be enhanced through farmers' ability to maximize on market opportunities, farm decisions, efficient use of resources and uptake of government initiatives embedded in AOL's business incentives. Despite the expressed opportunities, the effect of entrepreneurial behaviour that allows the uptake of these business

incentives by small-scale farmers has not been clear in literature. Moreover, the influence of this entrepreneurial behaviour on the farm performance has not been clearly evaluated. Hence, this study was geared towards filling these knowledge gaps and provides recommendations for better implementation of the AOL in Mali.

1.3.Objectives

1.3.1. General objective

The general objective of this study was to contribute towards improved livelihood through enhanced entrepreneurial behaviour and farm performance among small-scale farmers in Niono, Mali.

1.3.2. Specific objectives

i. To determine the level of entrepreneurial behaviour of small-scale commercial-oriented farmers in Niono zone, Mali.
ii. To determine the effect of entrepreneurial behaviour in small-scale commercial-oriented farmers' uptake of incentives provided by Agricultural Orientation Law in Niono zone, Mali.
iii. To determine the effect of entrepreneurial behaviour on the farm performance of small-scale commercial-oriented farmers' production systems in Niono, Mali.

1.4.Research questions

i. What is the level of entrepreneurial behaviour of small-scale commercial-oriented farmers in Niono zone, Mali?
ii. To what extent does entrepreneurial behaviour affect small-scale commercial-oriented farmers' uptake of incentives provided by AOL in Niono zone, Mali?
iii. To what extent does entrepreneurial behaviour affect farm performance of small scale commercial-oriented farmers' production systems in Niono zone, Mali?

1.5.Justification of the study

Commercial-orientation of small-scale farmers is considered as the driving force behind growth, employment for both rural and urban areas, and the genesis of other socio-economic development, improved living conditions and better social status (Zhou *et al.*, 2013). The Agricultural Orientation Law as well as other reforms have resulted in better business climate to inspire desirability and feasibility of initiating business activities not only for small-scale farmers but also other types of enterprises in Mali (WBG, 2011). The promotion of small-

scale farming is in line with the country's objectives of poverty alleviation that focus on exploiting its comparative advantages to supply more goods and services to both national and international markets. Understanding entrepreneurial behaviour (EB) is one of the important things to be considered in any policy decisions and strategies that target promotion of business activities (Chidi *et al.*, 2015). Muhammad and Junaid (2016) found that EB leads to improvement of personality traits that are most essential conditions to efficient outcome of any socio-economic policy. The study acts as a guide to AOL and policy-makers on how to enhance commercial-orientation of small-scale agricultural faming systems. The farm performance will result in improvement of small-scale farmers' livelihoods, which is in line with five objectives of the Sustainable Development Goals of United Nation Development Program (Osborn *et al.,* 2015): ending poverty and hunger, sustainable agriculture, economic growth and well-being for all, and ensuring sustainable consumption and production patterns.

1.6.Scope and limitation of the study

This study focused on small-scale rice farmers particularly their characteristics, commercial-orientation, entrepreneurial behaviour and its influence on the uptake of business incentives as well as on the farm performance. Since record keeping and availability of data for many years with farmers can be a hurdle, the study used cross-sectional data and depended on recall by farmers. However, probing was done to ensure reliability of the collected data. The study was limited to Niono zone at *Office du Niger* irrigated perimeter which is the most favourable area for agriculture and related activities. Besides, the study was also limited to the commercial-oriented production systems that have been in existence for at least two years.

1.7.Outputs of the study

1. Article on "Effect of Entrepreneurial Behaviour on the uptake of business incentives among small-scale Rice farmers in Niono zone, Mali".
2. Article on "Determinant of Entrepreneurial Behaviour on Farm Performance among Small-scale Farmers: Case of Niono Zone at Office du Niger, Mali".
3. Policy brief on "Small-scale farmers' Entrepreneurial Behaviour towards commercial-orientation strategies of Agricultural Orientation Law in Niono Zone at Office du Niger, Mali".

1.8. Operational definition of terms

Fertiliser subsidy: it is a government decision to partially absorb the costs of fertilisers, particularly urea and di-amino-phosphate in order to reduce the costs for farmers and increase their access and use.

Creation subsidy: it is the government decision to disown some of its share administrative costs and gradual tax exemption (a pay of 25% in first year, 50% in second year, 75% third year and 100% from the fourth year) as incentives for business start-up.

Equipment subsidy: it is the government initiative to take in charge of collateral on equipment credit and up to 30% of the equipment cost through the National Bank of Agriculture (BNDA).

Credit guarantee: it is the government engagement to ensure partial or total guarantees to farmers' loans through banks, decentralized financial systems and other legal financial institutions in the country.

Entrepreneurial Behaviour: it is farmer's attitude, aptitude and ability towards discovering and exploiting opportunities for more benefits. It is measured by a 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree), and based on self-assessment method.

Commercial-oriented farmer: this is a farmer who is able to produce enough to cover the household consumption and put the output excess into market.

Farm Performance: it is the ability of running business activities with efficiency and effectiveness. It is measured by sales, profitability and post-harvest losses.

Household head: is the person responsible for decision-making about farm management

Small-scale farmer: this is a farmer whose land size is less than 5 hectares.

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CHAPTER TWO
LITERATURE REVIEW

2.1 Evolution of Malian agricultural policies

Colonialism has influenced African agricultural policies at different stages in history. As noted by Nyaguthii and Austin (2010), for Mali similar to any other African country, the different historical determinants in agricultural reforms can be divided into four main periods: colonialism, post-independence from 1960s to 1980s, Structural Adjustments in 1980s, and post-democracy from 1990s. In Mali, particularly the Office du Niger, colonialism developed cotton production to feed France metropolitan industries, but neglected the staple food production for the local population (Settles, 1996; Mbakwe, 2015). Although the climate and lack of farmers' freedom were a limitation to that system, the production of cotton outperformed other crops (Hoeffler, 2011; Green, 2013).

The pan-Africanist view of Kwame Nkuruma that dominated the independence decade focused on agricultural resources to support other economic sectors and state-owned processing companies (Botwe-Asamoah, 2005; Hoeffler, 2011). Later on, these companies collapsed due to the lack of competitive advantage, unsuccessful marketing and mishandling at different levels of processing activities and mismanagement (Dioné, 1991; Frank and John, 2015). The dynamic Rural Grouping promoted by the government in line with its vision experienced the same failure (ON, 2008). The withdrawal of the state from the sector by the establishment of Structural Adjustment Programs (SAPs) also led to missing or poor quality of services taken by the promoted private investors (Dollar and Svensson, 2000). This SAPs had unclear overall impacts on the growth, and its failure is due to its explicit inconsideration for household, top-down approach and the government unwillingness to follow it (Heffler, 2011; Heidhues and Obare, 2011).

The attainment of democracy in 1991 resulted in freedom of expression leading to multiplication of rural associations and supporting regional and international integrations (ON, 2008). The devaluation of the country currency (FCFA) by 50% affected exported products negatively, but combined with other recent reforms favoured some other production such as cotton up to 118%, rice to 40% and onion to 125% (Konare, 2001; Bourdet, 2004). The progress realized by these agricultural products could be better if the government price policies to satisfy urban big consumers were not established (Reardon *et al.*, 1997). I the 2 last decades, the liberalization in the region (ECOWAS countries) resulted in a disorganized

institutions and farming systems that reforms at country level alone could not correct (EAC, 2010). The Common Agricultural Policy of West African Economic and Monetary Union (ECOWAP), Comprehensive Africa Agriculture Development Program (CAADP) and West African Common Industrial Policy (WACIP) enhanced mobility freedom of people and agricultural goods, better macro-economic and related reforms, infrastructures and transfer of information. This integration is the unique successful way for Mali to face the turmoil of global economy. However, Robert (2004) reported that having many regional engagements is a source of duplicated duties and conflict in commitments, thus losses due to limited potentiality of the country member.

The Agricultural Orientation Law (AOL), established in 2006, gained the engagements of all national and regional stakeholders and partners of agricultural development (MA, 2009). This policy with its different fulfilment frameworks, Agricultural Development Policy (ADP) and the National Program for Investment in the Agricultural Sector (NPIAS), aimed at promoting sustainable and modernized agriculture from subsistence to commercial-oriented production through establishment of good business environment (GoM, 2006). As strategies of agricultural modernization, they engaged in inputs subsidies, tax exoneration for strategic products (cotton, rice, fruits and legumes, cattle, meat, poultry, fishery production, oilseeds and cereals) and equipment subsidy for targeted agricultural areas and particular production zones. In the same line, National Funds for Agriculture Support (NAF) has been created to prevent and minimize the weather risks. The NAF partially or totally guaranteed loans to farmers, as well as the availability of national stock of improved seeds through local production. The NAF has three windows to implement its objectives, "Agricultural Development", "Risks and Calamities", and "Funds for Guarantee".

According to GoM (2006), in AOL strategies, the Fertilisers subsidy (Fs) is a blanket subsidy where every farmers can access. Nevertheless, it requires farmers to have a form that describes the amount of fertiliser required based on the farm size. Similarly, the Credit Guarantee (Cg) is accessible to all farmers and incentivizes mostly farmers who can hardly fulfil the requirement of financial institutions due to their small land size, lower asset values and income. The Agricultural Fund (Af) is a target subsidy, for farmers bringing about pertinent project or who experienced losses during the production process due to weather or diseases. In both cases, the inspection and the approval of the extension agent and hierarchy of *Office du Niger* ON is needed for farmers to benefit from the funds. In some extent, the project also needs the approval of other institutions such as Permanent Chambers Assembly

of Malian Agriculture (APCAM) to be executed. The equipment subsidy is also a target subsidy. It requires not only the approval of APCAM and National Bank for the Development of Agricultural (BNDA) but also farmers to cover the 30% costs of the equipment. The equipment is mainly tractors and accessories. Lastly, the market and incentives are expressed in organization of farmers' day, national expositions and involvement of farmers in building national stock of cereals. The latter involved government institutions of food security to buy directly from farmers and their organizations in order to offer better prices to farmers even at product pick seasons.

Goita and Coulibaly (2012) pointed out farmers' ignorance of policy objectives as restraint to the AOL's decisions resulting due to lack of information, illiteracy and disorganization. Further, they noticed that among the major impediments of this policy was government failure to provide services and transparency along its implementation process. In addition, the discontinuity of measures among different governments without drawing lessons from the previous policies is also seen as a limiting factor to the policy (ADP of 2013). Coulibaly and Oueleguem (2014) reported insignificant impacts of these policies on structural challenges such as vulnerability to the weather, demographic pressure on depleting resources, low level of processing products and rural poverty. It also stated that previous policies being lessons to new ones and periodic evaluations could favour the country in creating a coherent and sustainable policy by holistic consideration of obsessions and initiatives of society components (ADP of 2013).

2.2 Challenges of Malian Agriculture

Mali is a landlocked country where the agriculture is the economic activity that has the biggest contributor to the economy of the country. Rice production like the other cereal has both challenges and opportunities in the country. The irrigation systems though having its challenges have better advantages compared to rain-fed agriculture in the country. In irrigated system particularly the rice production, including the needs to face other challenges, Mali needs an extra land perimeter of 110 000 hectares in 2015 to cover the need of national demand and conquer the imports markets (Baris and Zaslavsky, 2005). According to economic projection of 2025, in order balance the demand and supply of rice the country needs an additional 185 000 hectares of new irrigated land. In late 1980s the average farm size at *Office du Niger* was estimated at 7 hectares while in the eve of the Agricultural Orientation in 2006 this average of land size was estimated to 3 ha, which is a reduction of more than 57% of farmers' exploitable land (Baris and Zaslavsky, 2005). This emanated from

the pressure on arable lands due to growing demography and allocation of agricultural lands to housing progress. At the event of AOL, the ON had made use of 82 000 ha which is not more than 10% of irrigation potentiality of the zone (ON, 2008).

At establishing of AOL in 2006, Ivory Cost and Mali were the biggest producers of rice in ECOWAS countries with 43% and 34% of the total rice produced in the region. According to Baris and Zaslavsky (2005), among ECOWAS countries Mali has the greatest potentiality in cereal production particularly the rice owed to its system of irrigation by gravity. The country disposes of 2.2 million hectares of irrigable land of which 960 000 ha is located at *Office du Niger*. From this big potential of irrigable land only 19% is cultivated (Diakité *et al.*, 2004). This is considered to be one of the best for the country to boost national production which has great impacts on country's macroeconomic balance, food security, poverty reduction and improving stakeholders' living conditions.

Nevertheless, the development of Malian agriculture is hindered by many and various challenges that result in making farming business more of subsistence than commercial-oriented. These challenges are summarised by Diallo (2012) as follows: Low production and productivity, insufficient resources, inappropriate market intelligence, high market concentration for final products, weak management, lack of anticipation, inadequate infrastructures and poor business skill of farmers are in general low in Mali. Climate factors also make farming business a risky activity hence negatively affecting small-scale farmers' resilience to weather and socio-economic shocks, disease, drought, hanger and extreme poverty (AFI, 2015). At the event of democracy in 1994 farmers' organisations split into smaller organisations offering the same services and goods, which later were subjected to mismanagement, lack of trust and conflicts (ON, 2008). This resulted in fragile organizations limiting farmers' accesses to credit, inputs and lower bargaining power among other stakeholders.

The availability of water at *Office du Niger* throughout the year makes it one the most hankered place for livestock keeping and transhumance among farmers and Fulani people. The untimely presence of animal in the zone is a source of competition between farmers and pastoralist. Consequently, devastation of farms by animals and sporadic conflicts between crop farmers and livestock farmers are frequent in the zone (Doumbia *et al.*, 2012). This can result in reduction of both production and productivity, thus affecting indirectly farmers' livelihood of actors of the two subsectors, crop farming and animal husbandry. Farming

business opportunities at Office du Niger got the attention of the government through investment strategies, improving infrastructures and legislations (MoA, 2009). His makes the arable land in Mali and irrigable one particularly in the zone of Office du Niger one the most attractive areas for farming business, thus making land more expensive and less affordable by small-scale farmers (Jean-Michel *et al.*, 2016). Additionally, the cost of establishing an irrigation system, land preparation, is relatively high and beyond the financial ability of the class of small-scale farmers.

To tackle the challenges that face agricultural development in Mali, many and various solutions have been proposed by stakeholders, government, development partners, farmers and other value chain actors. Among the myriad propositions, the strategies of modernizing Malian agriculture should include improved competitivity of the sector, increased yield and profitability, reduction in costs of value addition processes, efficient commercialization system, considering climate factors and improved negotiation of international trade (Diakité *et al.*, 2004; Baris and Zaslavsky, 2005;). Diallo (2012) focused on improving business skills, business environment, promotion of dynamic private sector and better interconnection of national and international markets.

2.3.Characteristics of entrepreneurial behaviour

In entrepreneurial behaviour (EB) research, different personality traits have been recognized as determinants of motive for entrepreneurship, but generalization remains questionable (Mueller and Thomas, 2001). In their study, a potential entrepreneur is defined as the person who reforms through novel exploitation of idea to create new products. As far as the process of opportunity discovery and initiation is concerned, the entrepreneurs can be individual "solo venture" or operating in a group "homophile" (Bula, 2012). On the other hand, EB characteristics such as risk-taking, desire for self-employment and reluctant entrepreneur have been pointed out as determining characteristics (Kautonen, 2014). Lau (2012) also found out factors such as innovativeness, change tendency and opportunism as important EB characteristics. Other personality traits like autonomy, self-reliant, self-efficiency, proactive, initiator and resourceful are counted for the value and behaviour of an entrepreneur (Mueller and Thomas, 2001).

Finez (2008) highlighted in a nutshell the "attitude", "aptitude" and "ability" as the most valuable factors that determine the individuals' EB with respect to their competences. The author distinguished two main cases in the relation to entrepreneur's competence and

business area. Firstly, business initiation is not profitably or successfully suitable even though the entrepreneur is talented and competent. Secondly, the business initiation is viable to make profit and succeed but the entrepreneur's competence is not sufficient to concrete the business idea. This gap between the business idea and the entrepreneurs' ability can be remedied by improving skills and information through learning process (Fayolle, 2006).

In Entrepreneurial Behaviour theory, the physical or human resources are embodied in the farmer's possession, finance, skills, information, power and any other things giving the farm a comparative advantage or allowing it to be more effective and efficient (Akio, 2005). In the behavioural sciences, risk-taking is the attitude of a person to devote disposable assets to a new business idea with possible unpleasant results while the reluctant entrepreneur is an individual who is venturing in a new business due to the lack of any other means of surviving (Miron and Hudson, 2014). Covin and Wales (2012) distinguished between the entrepreneurial proactiveness and innovativeness. The authors define proactiveness as an individual's capability to be forward-looking and anticipating the future with the aim of exploiting opportunities. Innovativeness, on the other hand, is the capability to bring about new products or services, technological process, operational methods and strategies of doing business as a way of experimenting and exploring. Self-efficiency in the behavioural theory is construed as an individual's judgment about their aptitude and ability to move towards perfect achievement of a given activity (Singh and DeNoble, 2003).

Ostergaard (2014) claimed that entrepreneurial personality, plus the discordant views, lacks detail when used due to its inability to measure the "unconsciousness in self-estimation" and high biasedness if only few traits are considered in the study. Welter (2011) found that the research on entrepreneurship tends to give more attention to intrinsic value of the entrepreneur over the external factors of his environment. The author specified that the context of entrepreneurship should be looked at as multifaceted and consider "cut across levels" of analysis. Naturally the boundaries between the personal traits considered in behaviourism study overlap, and neither internal factors nor external ones alone can lead to a conclusive research (Collins, 2004).

2.4.Factors influencing entrepreneurial behaviour

In behavioural science, behaviour refers to the personality traits and the person's specific way of doing things (Coon and Mitterer, 2011). This behaviour is qualified *overt* when the actions and responses are directly observable, otherwise it is qualified *covert.* Vitally, it is the

entrepreneurial behaviour that leads to identification of opportunities and making them concrete through a group or an individual (Boohene *et al.*, 2012). There are three main theories about factors influencing entrepreneurship: classical, neoclassical and behaviourism. As noticed by Simpeh (2011), the economic views about factors that underpin the venture decision are diverse and all are limited. The classical theory points out as the most important motivational elements for new venture are free trade, competition and specialization (Endres and Wood, 2003). According to the neoclassical theory (Marshallian analysis), the most important motivational factor for business start-up is related to the utility maximization process and market-clearing (Bula, 2012). On the other hand, the Austrian Market Process (AMP) complements the neoclassical theory by introducing the importance of time-scale and human intervention in discovering opportunities. Although relatively more complete, this theory ignores the process of discovering the opportunities (Endres and Wood, 2003).

The resource-based and opportunity-based theories supplemented the economic theory of entrepreneurship. The resource-based theory stipulates that the ability of creating an enterprise is mostly dependent on the advantage that a firm has in terms of tangible and intangible resources (Akio, 2005). In other words, a unit with more resources is more likely to venture and succeed compared to a less resourceful unit. In support of the opportunity-based theory, Patrick and Marvel (2007) considers opportunity as the right time and right place of doing things, which is the basic premise of any idea of initiation and running a business. According to the authors, the opportunity is a mix of personality and environment and although executed with determination and useful purpose, these opportunities are non-statics and they are difficult to forecast.

Behaviourist theory of entrepreneurship states that both creation and exploitation of opportunities are connected with some attitudes and abilities of the business initiator or runner (Endres and Wood, 2003). Although there are divergent views of scholars, the behaviour is seen as having factors that all can be involved in successful initiation and enterprises running. According Gleason (2003), culture gives the mentality patterns and values to motivated options, devotion, and norms that incentivize to business orientation. Spio *et al.* (2011) confirmed that any previous means such as facts, skills, information, education or experience from work, sharpens the capacity and motivation of a person towards entrepreneurship. Additionally, the EB is affected by many other social entities such as ethnicity, networking, gender, imitation and age. The latter in some types of entrepreneurship is reported to follow the inverse u-shape with a pick between the age 35 and 44 (Kautonen,

2014). Salaff *et al.* (2013) found that 16% of business starters receive ideas and guidance from their relatives while collectivism of this social capital can serve as a source of consumption and supply (Danes *et al.,* 2008). Akhter and Sumi (2014) noted that generally in the society, the women due to social burdens and limited freedom are less of entrepreneurs than men. The biological theory and physiological view of entrepreneurship admits that women are more risk averse than men, thus making them less probable to invest in new ventures than men (Bula, 2012). Further, the entrepreneurs in Least Developed Countries imitate more than they innovate.

2.5.Farm performance indicators

According to Chittithaworn *et al.* (2011), the indicators of farm performance are the central elements that help to find out farm improvement and its business opportunities. Moreover, the analysis of farm performance is complicated because it involves numerous factors and the specificity of Line of Business entities (LOB). Ted (2015) divided the Key Performance Indicators (KPI) into four main groups of metrics, "Financial Metrics", "Customer Metrics", "Process Metrics", and "People Metrics". However, in many recent empirical studies on enterprise performance, the most used indicators are of these three classes: financial perception, non-financial perception, and historical perception (Kraus *et al.*, 2012).

Farm performance is also influenced by factors that can be classified into internal and external (Harris *et al.*, 2012). An economic performance can be achieved by farmers' appraisal and reappraisal of their technical and managerial activities of farming (Franks and Collis, 2016). Ko kemuler (2016) posits that matching the ability of using internal factors, taking opportunities and considering the risks of external factors is the key to a performing farm. In the view of these authors, the internal factors are the ones related to farmer's characteristics and organizations, which are more or less under control. These factors can be farmer's motivation, devotion to the tasks, skills, information and networks. Morrison *et al.* (2004) found that the marital status also affected farm performance and that male-run enterprises performed better than female-run enterprises. In all the aforementioned studies, the external factors (out of the farmer's control) are legislation, political, technological, access to loans, norms and affordability of the product by consumers,

Sale of products is considered as the amount of outputs that are put into market, thus a farm which is unable to put any output into the market is considered as purely subsistence (Chirwa and Matita, 2012). It is the most common option for any commercial entity to remain in

business, and it is the indicator that is used by small commercial enterprises to assess their own farm performance and making decisions as well (Chen *et al.*, 2003). The authors imply that the sale indicator primes on the others since not only does it demand additional capital and labour, but also yields in increased profitability.

Franks and Collis (2016) in their analysis of farm benchmark stated that profit is the precondition for strength and advancement of any relationship between production and trade. Kahan (2013) considered the profitability being the indicator of survival, growth, success and a payback for farmer's time and efforts. A farm is said to be making profit at a given period if the total sale revenues are greater than the cost (Alda, 2008). The use of profitability as farm performance indicator can explain the previous farm performance but its reliability is limited where predictions are concerned. Kaplan and Norton (2005) dissuaded its use as an indicator by arguing that it is sensitive to many factors such as costs of production, customer taste, quality of product and even competitor' successful introduction of a products. Lesáková (2007) also recognized the weakness of using profitability as a farm performance indicator in terms of time, its ignorance of risks and market value.

Quality of products can also be used as an indicator of a farm's performance where, better quality positively influences the profit maximization of a farm (Freiesleben, 2005). A normal product is known by its chroma, shape and other organoleptic characteristics. A defective product is a product that has lost one of its natural qualities that depreciate it or make it unusable for its original purposes. Kays (1999) classified the defect factors into biological, entomological, physiological, cultural or environmental, mechanical damage, extraneous matters and aberration or variation due to genetics. Additionally, minimization of post-harvest losses can also be used as an indicator of enhanced quality and better performance. Post-harvest loss (PHL) is a defect in products (visible or invisible) that occurs between harvest and final consumption. The use of defects in products as an indicator is limited to an extent where the defect is not always visible and cannot be detected immediately (Rosselli, 2014).

2.6.Theoretical and conceptual frameworks

2.5.1. Theoretical framework

In this study the theory adopted was that entrepreneurial behaviour (EB) is based on the personality traits. The theory uses psychometric tools through self-assessment as an instrument of entrepreneurship measurements. It also takes into consideration profit

maximization conditions since small-scale farmers like any other entrepreneurs aim at high profit with respect to disposable resources. With the access to the different incentives provided by Agricultural Orientation Law (AOL), the decision by a small-scale farmer to uptake each of them is a dichotomous answer (yes or no). In the case of AOL, these different incentives are of blanket subsidies, thus the following situations: Small-scale farmers have two different choices, to go for incentives or not to go; each of these different choices of smallholder farmers is influenced by different socio-economic and institutional factors; and duality of choice is based on smallholder farmers' profit maximization objective including transaction costs. This is captured in the following equations:

$$\pi_i = TR_I - TC_i \quad \text{.....} \quad (1)$$

$$d\pi_i = MR_i - MC_i \quad \text{.....} \quad (2)$$

$$At Max\pi, MR_i = MC_i$$

Whereas π stands for profit; TR is total revenue; TC is total cost; $d\pi$ is derivative of profit; MC is marginal revenue; and MC represents marginal cost.

Equation 2 is the necessary and sufficient condition for profit maximization function. It is the one to be used by farmers for purchasing any goods or services, and determines their utility or satisfaction.

2.5.2. Conceptual framework

The adopted conceptual framework of the study was built on the link between the Entrepreneurial Behaviour (EB) and farm performance (Figure 1). Small-scale farmers' decision to uptake government incentives is influenced by both internal and external factors. The latter consists of institutional factors such distance to market, financial institution, extension services and social network. The internal factors, on the other hand, consist of farm and farmers' characteristics such as farm size, farmers' age, education level, household size, farming experience, nature of business and farm asset value. The uptake of these incentives that are provided by Agricultural Orientation Law, fertilisers subsidy, credit guarantee, creation subsidy, equipment subsidy, agricultural funds, training and market incentives, is an impulsion for farm performance of small-scale farmers. The performance should result in efficient use of resources, reduction of production costs, increased output, more output sold in markets, more value addition activities, more profitability and less post-harvest losses, hence

leading to change in farmers' livelihood. This improved livelihood of small-scale farmers which is a resultant of farm performance is essentially conditioned by shifting from subsistence farming to commercial-oriented one, and noticed through poverty reduction, increase in household income and improved food security.

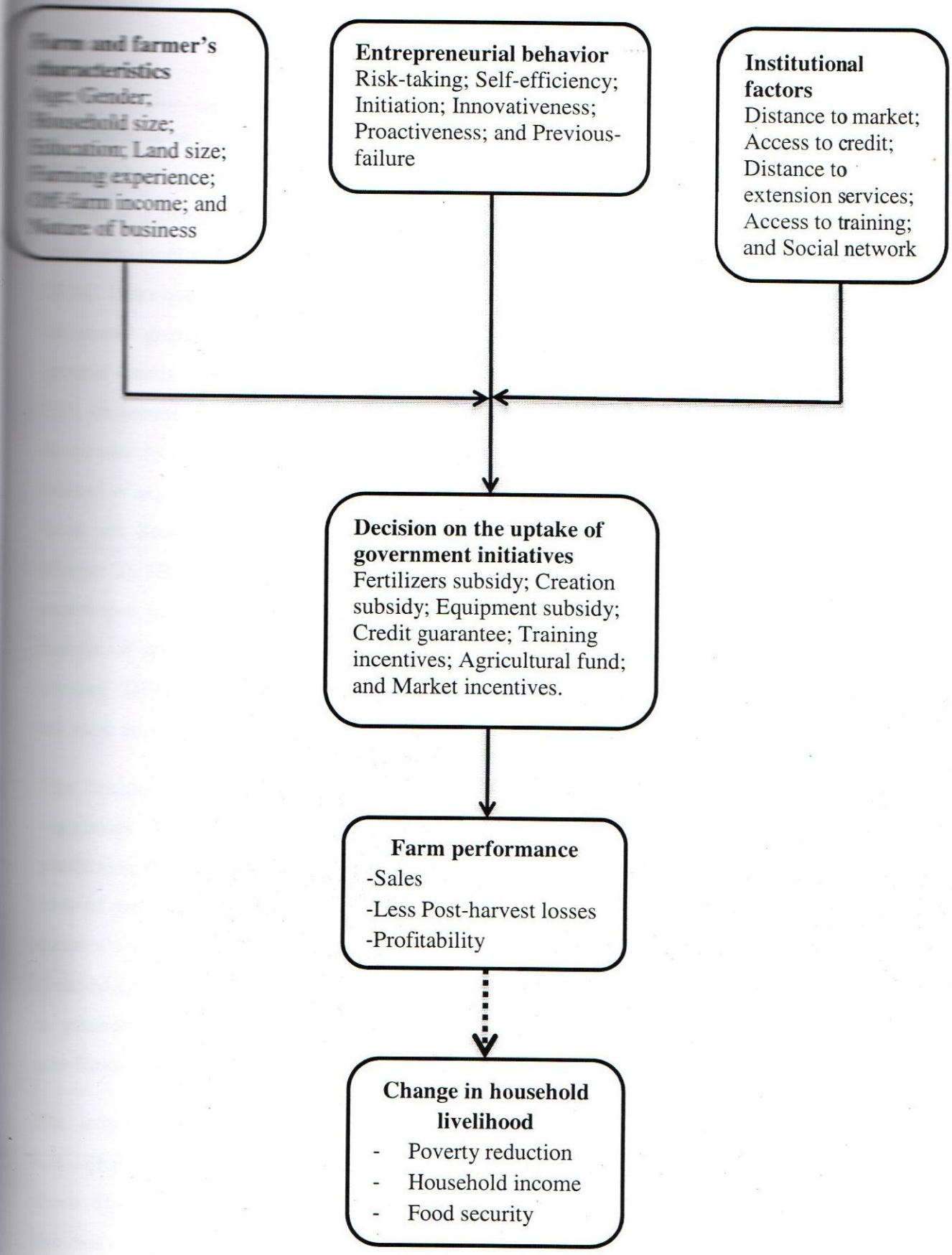

Figure 1. Conceptual framework

CHAPTER THREE
METHODOLOGY

3.1. Study area

This study was carried out in Niono zone at *Office du Niger* (ON) which is located at Segou region, at a distance of 235 km northeast of the capital city Bamako. Niono zone was the most important centre of French colonization and the second oldest zone of ON (Merieau, 2001). It has one of the highest population density in the country, estimated at 20.56/km^2 with an annual growth of 6.54 between 1976 and 2009 (Jean-Michel *et al.*, 2016). In the last general census of population and household held in 2009, Niono zone had a population of 91 550, an annual growth of 4.5%, 59 080 agricultural exploitation units, and economic sector dominated by agriculture at 85%, fishery at 3%, handcraft added to trade (RGPH, 2009; Jean-Michel *et al.*, 2016). The zone is an agglomeration point of diverse tribes living together and these are Bambara, Minianka, Mosi, Bozo, Fulani, Malinke, Soninke, Dogon, and Moor (Figure 2). The potential of irrigation by gravity, land availability and more than half century experience in irrigated agriculture has made farmers in Niono zone not only to have the benefit of relative technology advancement but also to have better farming skills in the country (GEDURU, 2009). Additionally, agricultural organizations and product markets in the zone are comparatively some of the best structured in the country (Afrique Verte, 2014).

The dominant crop in Niono as well as at ON is rice followed by onion, tomato and vegetables. The ON covers 45% of national rice production and more than half of onion production (MCI, 2015). Niono represents around 23% of ON's total crop production and 16% of cattle with 60-70% of cattle owned by native farmers. The ON represents 7% of the country's farmers and also the most attractive area for investment in irrigated agriculture (Jean-Michel *et al.*, 2016). Gardening, mostly practiced by youth and women, represents 40% of generated revenue in the area, while the main industrial units are located in Segou town and Niono city (Oden, 2011).

The irrigated areas in Niono zone called "*casier*" cover 14,898 ha, and are divided into GRUBER, ARPON and RETAIL, taking the name of funder or the projects that realized them. There is also an extra area of production created by natural expansion or floods during the rainy season called "hors-casiers". The latter is the least productive and only practical during the rainy season. Niono counts 3 Tons of Villages (TVs), 23 Association of Village (AVs), 53 Grouping for Economic Interest (GEIs), 45 Women Grouping for Economic

Interest (WGEIs), and a growing number of 216 OMTC1s. In a study done by Office du Niger (2008), it is reported that only 45% of these farmers' organizations are considered to be functional, 33% relatively functional and 22% non-functional.

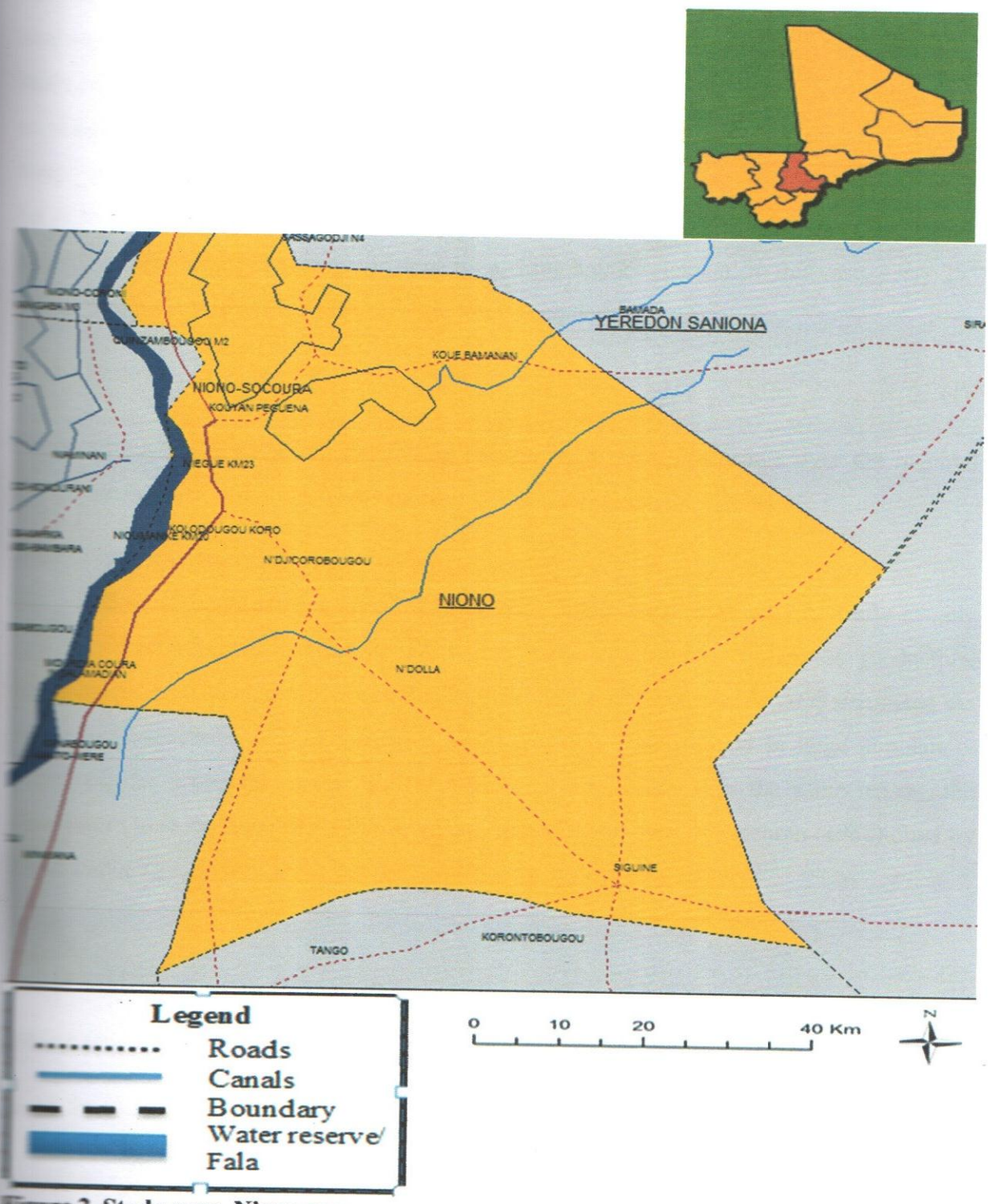

Figure 2. Study area, Niono zone

Source: Office du Niger and UNICEF (2016)

3.2.2 Sampling procedure

The study used a multistage sampling technique. First, the zone of Niono at Office du Niger was purposively selected due to the reason that it is a reference in both production and commercialization of agricultural products in Mali. At the second stage, rice farmers with land size less or equal to 5 ha were selected. Consequently, the population of interest in this study represented 81% of the total inhabitants of the zone (excluding farmers called non-resident farmers due to their inaccessibility and producing only for self-consumption). Lastly, linear systematic sampling method was used to select farmers of interest from the available list of farmers in ON using famers' code. A random number called d is chosen between 1 and k, and the selection of the sample is done by picking any k^{th} element. In this case, every 25th farmer was picked. Therefore, the selected items included;

$$d, d+k, d+2k, ..., d+(n-1)k. \quad \text{..... (1)}$$

The k, which is the sampling interval, is chosen by dividing the frame over the required number of samples and it is a whole number or the closest smaller number.

3.3 Sample size determination

The sampling combined three types of production perimeters in the area of study namely ARPON, RETAIL and GRUBER, since they had homogenous system of production, arrangement, management and technologies. The last general census in 2009 estimated the number of household in Niono zone at 59 313, which is considered as large population. Therefore, the acceptable error term was 5% (Raosoft, 2016). For the same reason, the sample size is determined using the following formula proposed by Cochran **(1963)** cited by Polonia (2013):

$$n = \frac{pqz^2}{e^2} \quad \text{..... (2)}$$

Where: n = sample size,

$p = 0.81$ (Population of interest)

$q = 1 - p$,

Z= confidence level ($\alpha = 0.05$),

e = acceptable error.

Hence replacing the value into the formula gave:

$$n = \frac{0.81*(1-0.81)*(1.96)^2}{(0.05)^2} = 236.4888$$

Consequently, the sample size was 236.

3.4. Data collection and analysis

The study used both primary and secondary data. The primary data was collected through face-to-face interviews using a semi-structured questionnaire that was administered by trained enumerators. The questionnaire was pretested for its reliability. This pre-test was a pilot study to confirm or contest the understanding of the adopted instrument among the respondents, thus measuring the data collection instrument reliability (Sitzia, 1999). The content of data included information on smallholder farmers' socio-economic characteristics such as farm size, age, education, years of experience, output, amount of output sold, price of selling, and agricultural assets. It also included information about institutional factors such as, financial access, group membership, networks and extension services. The secondary data was obtained from *Office du Niger*, *Secretariat Permanent de la Law d'Orientation Agricultural*, *Observatoire du Marche Agricole*, *Institut d'Economic Rural*, *Cellule de Planification et Statistiques du Sector Agricole*, local NGOs and written literature.

3.5. Analytical framework

3.5.1. Objective one: To determine the level of entrepreneurial behaviour of small-scale commercial-oriented farmers in Niono Zone, Mali.

The models used in the measurements of entrepreneurial behaviour (EB) according to the causality direction can be formative or reflective. In both cases (formative and reflective) the choice of indicators differs from one study to another (Covin and Wales, 2012). The two authors defined the formative model (contrary to the reflective model) as the case where the causality flows from the measures to construct factors. They also advised its use mainly when determining the importance of indicators. As stated by Østergaard (2014), since the entrepreneurial behaviour studies are based on psychometric indicators, having several indicators is always more conclusive than few ones. In this case, the following indicators are considered as effective in entrepreneurial behaviour: risk-taking, reluctance, self-efficiency, initiation, innovativeness, proactiveness and previous failure. Each indicator was rated on a 5-point Likert- scale since the method was found to be the simplest and more accurate. The 5-

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point Likert- scales were: "strongly disagree", "disagree", "neutral", "agree" and "strongly agree".

The instrument to measure the EB was constructed based on modification of early instruments used in various studies such as Lumpkin and Dess (2001), Liñán and Chen (2006), Wu (2009) and Covin and Wales (2011). In the present study, a total of 29 self-estimation items were used to rate the perception of small-scale farmers about their EB. These self-estimation items are displayed in Table 1. A Confirmatory Factor Analysis (CFA) as a method of Principal Component Analysis (PCA) was used as a variable reduction procedure since the same construct is measured using different variables and there was possibility of correlation among these selected variables. In the CFA method, numerous items are always preferred to few ones, and it is conducted on latent variables for the purpose of ensuring internal consistency, convergence and construct validity (Olsen *et al.*, 2017). Additionally, each factor was subjected to the Relevancy Weightage (RW) using the following formula (Achilleas, 2013):

$$EBRW=\sum_{i}^{n}\frac{FScore_i * item_i}{TScore} \quad \ldots\ldots\ldots\

Table 1. Description of variables for factors influencing the uptake of incentives

Variables	Description	Measurement	Expected sign
Dependent variable			
Fertilisers subsidy	Household head's uptake of subsidized fertilisers	1=Yes, 0=No	
Creation subsidy	Household head access to subsidy for business start-up	1=Yes, 0=No	
Agricultural fund	Household head's uptake of agricultural fund	1=Yes, 0=No	
Credit guarantee	Household head's uptake of credit guarantee	1=Yes, 0=No	
Training incentive	Household head's attendance of training	1=Yes, 0=No	
Market incentive	Household head's uptake of market incentive	1=Yes, 0=No	
Equipment subsidy	Household head's uptake of equipment subsidy	1=Yes, 0=No	
Independent variables			
Entrepreneurial behaviour	Entrepreneurial behaviour of household head		
	Risk-taking	5-point Likert-scale	+
	Reluctance	5-point Likert-scale	+
	Self-efficiency	5-point Likert-scale	+
	Proactiveness	5-point Likert-scale	+
	Initiation	5-point Likert-scale	+
	Innovativeness	5-point Likert-scale	+
	Previous failure	5-point Likert-scale	-
Age	Age of household head	Years	-
Gender	Gender of household head	1=Male, 0=Female	-
Origin	If household head is native or migrant	1=Native, 0=Migrant	+
Household size	Number of household members	Number	+
Education	Education level of household head	Years of schooling	+
Farm size	Land under rice owned household head	Hectare	+
Farm assets values	Monetary value of farm properties	Currency	+

Table 1. Description of variables for factors influencing the uptake of incentives (continued)

Variables	Description	Measurement	Expected sign
Business experience	Business experience of household head	Years	+
Farm ownership	Ownership of farm business land by household head	1=titled, 0=rent	+
Nature of business	Ownership of business share	1=Alone, 0=group	+
Distance to market	Distance from business entity to the output market	Kilometre	-
Off-farm income	Income from non-farming activities	Currency (FCFA)	+
Number of business training	Household head's attendance of business trainings	Number	+
Social network			
Average age in the network	Average age of household head's network members	Number	-
Average distance in the network	Time taken from household head's place to network members' ones	Minutes	-
Average frequency of meeting in the network	Days of meeting per month in household head's network	Days per month	+
Access to model farm	Household head's access to model farm	1=Yes, 0=No	+

In the study of entrepreneurial behaviour using the 5-point Likert scale, the sample size should reach a minimum of a hundred or 5 times the number of variables that are observed in the study (Fabrigar *et al.*, 1999; IDRE, 2016). Moreover, the underlying assumptions of this procedure are identical measurement scales for all variables, the linear relationship among variables, and lastly a case of random sampling and normal distribution. It is preferred to other methods in this objective due its ability of giving more information about a subject's score and its consideration of all variances, individual variance, common variance and error

variance. The maximization of variance used by the PCA makes it sensitive to metric change (scales, people, numbers or proportion). Therefore, the study used the correlation method instead of covariance method since this study's data was not uniform (Katchova, 2013). Additionally, descriptive statistics was used, that is, the mean, standard deviation, percentages and frequency tables were used to present the results.

3.5.2. **Objective two**: To determine the effect of entrepreneurial behaviour in small-scale commercial-oriented farmers' uptake of incentives provided by Agricultural Orientation Law in Niono Zone, Mali.

Multivariate Probit Model (MVP) was used to determine the determinants of the role of small-scale farmers' EB on the uptake of different incentives provided by AOL. In the case of AOL's business incentives considered in this study, farmers' uptake of an incentive does not affect the probability of the uptake of any other incentives. According to Teklewold *et al.* (2013), the MVP model in a simultaneous way, shows the effects of a series of independent variables (Entrepreneurial Behaviour) on the dependent variables (different AOL's incentives). Additionally, the model takes into account the many underlying factors while admitting possibility of the relationships among farmers' socio-economic characteristics as well as the potential correlation among disturbance terms. In such a case, the use of individual univariate analyses results in insufficiency regarding the interrelation of factors and even in mutual contradiction (Nagler, 1994). The positive correlation signifies complementarity between the different factors while negative correlations indicate substitutability. The MVP has the two following assumptions (Nagler, 1994). First, it assumes a response S-shaped curve will show swift response of the dependent variable to changes in the independent variables in the middle of the response curve and slow response in the two tails of the curve. Secondly, while only observing the binary value of Y, there is unobserved variable or latent variable (Y*) which is continuous and determines the value of Y. The unobserved or latent variable in its turn is determined by the independent variables, and the greater its values, the greater the trend towards the likelihood of dependent variables which is the uptake of the incentives provided by AOL.

The possible outcome is the i^{th} farmer $(i = 1,2,..., n)$ facing a situation on whether or not to uptake the incentives provided by AOL. These incentives are fertilisers subsidy, equipment subsidy, creation subsidy, credit guarantee, training incentive, market incentive, and funds for farming business. Assume U_0 the utility of farm before the AOL's incentives and U_s its

utility after establishment of S^{th} incentives by AOL denoting fertilisers subsidy (Fs), equipment subsidy (Es), credit guarantee (Cg), creation subsidy (CtS), agricultural fund (Af), and training incentives (Ti), and market incentives (Mi). The farmer opts for subsidies if $Y_{is}^{*} = U_{is} - U_0 > 0$, in another word $U_{is} > U_0$. The Ys^{*} which is the net benefit of farm is a latent variable determined by both observed and unobserved factors:

$$y(s = Fs, Cg, CtS, Af, Es, Ti, Mi) \quad \ldots\ldots\ldots\

3.5.3. **Objective three**: To determine the effect of entrepreneurial behaviour on the farm performance of small-scale commercial-oriented farmers production systems in Niono zone, Mali.

The farm performance indicators that are considered in this study are sales, profitability and post-harvest losses. These indicators were considered to be the main incentives towards making investment decisions at farm level (Table 2).

Table 2. Description of variables influencing farm performance

Variables	Description	Measurement	Expected sign
Dependent variable			
Farm performance	Farm's ability to sale more and make more profit with minimum losses of products	Currency (FCFA)	
Sales	Total output sold	Currency (FCFA)	
Post-harvest losses	Total defective products over total production (ratio)	Currency (FCFA)	
Profitability	Gross margin	Currency (FCFA)	
Independent variables			
Entrepreneurial behaviour	Entrepreneurial behaviour of household head		
	Risk-taking	5-point Likert-scale	+
	Self-efficiency	5-point Likert-scale	+
	Reluctance	5-point Likert-scale	+
	Proactive	5-point Likert-scale	+
	Initiation	5-point Likert-scale	+
	Innovativeness	5-point Likert-scale	+
	Previous failure	5-point Likert-scale	-
	Innovativeness	5-point Likert-scale	+
Age	Age of household head	Years	-
Gender	Gender of household head	1=Male, 0=Female	-
Origin	If household head is native or migrant	1=Native, 0=Migrant	+
Household size	Number of household members	Number	+
Education	Education level of household head	Years of schooling	+
Farm size	Land under rice owned by household head	Hectare	+
Farm asset value	Monetary value of farm properties	Currency (FCFA)	+
Business experience	Business experience of household head	Years	+

Table 2. Description of variables influencing farm performance (continued)

Variables	Description	Measurement	Expected sign
Farm ownership	Ownership of farm business land by household head	1=titled, 0=rent	+
Business ownership	Ownership of business share	1=Alone, 0=group	+
Distance to market	Distance from business entity to the output market	Kilometre	-
Off-farm income	Income from non-farming activities	Currency (FCFA)	+
Number of business training	Household head's attendance of business trainings	Number	+
Social network			
Average age in the network	Average age of household head's network members	Number	-
Average distance in the network	Time taken from household head's place to network members'	Minutes	+
Average frequency of meeting in the network	Days of meeting per month in the network	Days per month	+
Access to model farm	Household head's access to model farm	1=Yes, 0=No	+

CHAPTER FOUR
RESULTS AND DISCUSSION

This chapter presents descriptive statistics and regression model results of the study. The chapter is structured into three main sections. The first section presents results on descriptive statistics and the level of entrepreneurial behaviour of small-scale rice farmers. Results and discussion of multivariate Probit model used to analyse the determinants of farmers' uptake of the different business incentives provided by AOL are in the second section. The final section presents findings and discussion of multivariate Tobit model, which was used to determine the role entrepreneurial behaviour on farm performance using three indicators, sales, profitability and post-harvest losses.

4.1. Descriptive statistics

The entrepreneurial behaviour being a psychometric tool (unobserved or latent variables) necessitates using numerous indicators in order to be conclusive (Ostergaad, 2014). Confirmatory factor analysis (CFA) was conducted on latent variables for validity of the instruments, internal consistency or convergence and discriminant validity (Olsen *et al.*, 2017). Bartlett's sphericity, Kaiser-Meyer-Olkin (KMO) and Cronbach's coefficient alpha tests were done to determine the fitness of CFA to the data, sampling adequacy and construct reliability and validity. The results of this analysis are presented in Table 3.

Table 3. Results of factor analysis for entrepreneurial behaviour

Variables	Items	Factor loadings	Uniqueness	AIC	RC
Self-efficiency (Lumkin and Dess, 2001 Liñán and Chen, 2006)	Shifting to commercial-oriented farming would be simple for me	0.641	0.589		
	Running a commercial-oriented farm would simple for me	0.774	0.401		
	I have necessary skills to start commercial-oriented farming	0.708	0.499		
	My farm assets allows me to become commercial-oriented farmer	0.683	0.533		
	Starting commercial-oriented farming, I have a high likelihood to succeed	0.667	0.555	0.458	0.729
Initiation (Liñán and Chen, 2006; and Covin and Whales, 2011)	I have tried to become commercial-oriented farmer	0.654	0.572		
	I am willing to make anything to become commercial-oriented farmer	0.846	0.285		
	My professional intention is to become commercial-oriented farmer	0.806	0.351		
	I have strong thought of shifting commercial-oriented farming in the	0.817	0.332	0.426	0.800
Risk-taking (Lumkin and Dess, 2001; Liñán and Chen, 2006; Wu, 2009; and Covin and Whales, 2011)	I like devote my assets and my time to farming business of high profitability	0.517	0.733		
	I prefer activities with less risky outcomes	0.689	0.525		
	I don't like to newly venture if there is uncertainty about outcome	0.729	0.469		
	If a business is highly risky and high profitable, I would go for profit but with insight into the risk	0.609	0.629	0.333	0.517
Innovativeness (Liñán and Chen, 2006; Covin and Whales, 2011)	I tried once to bring new ideas and plans in my business	0.737	0.457		
	I prefer doing my business as other people do, without any change	0.785	0.384		
	If I gain what to feed my family and me, I don't struggle myself with any new way of doing farming	0.811	0.342		
	I always want to distinguish myself from other farmers by bringing ideas, techniques and technology that are new for them	0.695	0.517	0.703	0.750

Table 3. Results of factor analysis for entrepreneurial behaviour (continued)

Variables	Items	Factor loadings	Uniqueness	AIC	RC
Proactiveness	I work hard and ever try to improve my business competiveness and growth	-0.232	0.298		
(Lumkin and Dess, 2001; and Covin and Whales, 2011)	My attitude, aptitude and ability make me ready to commercial-oriented farmer in the nearest future	0.006	0.361		
	I always look for opportunities and exploit them before other farmers	0.097	0.357		
	Farming is the most important for me, I should be ahead of others in modernizing it	0.132	0.310		
	I now am satisfied with my business and fulfilling all my needs and wants, there is no need for more venturing	0.984	0.033	0.304	0.607
Previous-failure	My previous failure in farming business is scaring me to engage in commercial-oriented farming	0.689	0.526		
(Lumkin and Dess, 2001; Liñán and Chen, 2006; Wu, 2009; Covin and Whales, 2011)	If my business idea fails, I neither correct it nor improve it and I will not	0.856	0.267		
	If business fails once, I would not try the same business even if a new environment seems to make it more profitable	0.869	0.246		
	If a new venture fails, I do not dare trying any other similar business activities to that new venture	0.755	0.431	1.060	0.806

Note: Chi-squared = 3251.87; DF = 406; $p = 0.000$; AIC: average inter-items covariance; RC: reliability coefficient.

Bartlett's test of sphericity indicated that the application of confirmatory factor analysis was suitable for the data $[\chi^2 = 3237.45, DF = 406, \rho = 0.000]$(Glen, 2016). The factor loadings on the instruments were all significant $[\chi^2 = 3251.87, \rho = 0.00]$. This means that the data fit the CFA. The reliability coefficient ranged from 0.52 to 0.80, which is termed good according to Boohene *et al.* (2012). The Kaiser-Meyer-Olkin test for sampling adequacy was adequate $[KMO = 0.90]$. In fact, the KMO is qualified "marvellous" (Glen, 2016). These results indicated both the reliability and validity of the constructs, and the suitability of CFA results for further analysis. The factor loadings of CFA were used in determining the relevancy weightage (RW) of entrepreneurial behaviour. The results of mean RW of EB or scores are presented in Table 4.

Table 4. Mean scores of entrepreneurial behaviour among small-scale farmers

Variables	Mean	Std. Err.
Risk-taking	3.957	0.054
Self-efficiency	3.881	0.052
Proactiveness	3.292	0.109
Initiation	4.190	0.048
Previous failure	2.941	0.082
Innovativeness	4.117	0.070

According to Moralista *et al.* (2014), the EB characteristics based on the Weighted Mean (WM) can be scaled as "Not Strong" (NS) for mean range of 1.00-1.80; "Somewhat Strong" (SS) for 1.81-2.60; "Strong" (S) for 2.61-3.40; "Very Strong" (VS) for 3.41-4.20; and "Extremely Strong" (ES) for a mean score of 4.21-5.00. The results of the analyses showed that among the entrepreneurial behaviour rated by farmers, initiation was rated higher with MW of 4.190, followed by innovativeness behaviour with MW of 4.117, (Table 4). The respondents' scale vis-á-vis the previous-failure and proactiveness had the lowest ratings with MWs of 2.941 and 3.292, respectively. In other words, the EB of initiation, innovativeness, risk-taking and self-efficiency are rated "Very Strong" (second highest level). Previous-failure and proactiveness were rated "Somewhat Strong" (second lowest level).

The high level of initiation recorded among small-scale farmers can be explained by increased motive to diversify farm incomes to improve living standards. A farmer with EB of initiation is an opportunity seeker gifted with comparative advantage in decision-making and

devotion to undertake new activities to generate supplementary income (Anthony and Woods, 2015). This quality of personality is considered to be the most important of entrepreneurial attributes as it points to a departure from the traditional way of doing business (Boohene *et al.*, 2012). Furthermore, on the other hand, innovativeness is seen in Schumpterian view of EB as the primordial cause of economic system changes. It is a process that at the end distinguishes the subject (innovative farmer) from other and results in having comparative advantages through new outputs. AFI (2015) reported that small-scale farmers' choice for innovativeness and initiation of diversified business are not only one of the best risk management tools but also a way of improving livelihood.

The relative high scores of farmers as risk-takers and self-efficiency are viewed as fundamental elements of EB and entrepreneurs. These two EB constructs are the most common share-outs from EB since they are bound to be linked to other essential entrepreneurial behaviour like initiation, proactiveness and innovativeness (Lumpkin and Dess, 2001; Drnovsek *et al.*, 2009). On another note, self-efficiency gives farmers confidence (task confidence and outcome confidence), business optimism and endurance for success (Drnovsek *et al.*, 2009). Risk-taking behaviour gives farmers daring attitude in venturing in new ideas while being aware of possible negative outcome (Dadzie and Acquah, 2012). Given the risky nature of farming (underperformance), these two behaviour help farmers to avoid or resist socio-economic related shocks.

In entrepreneurial behaviour sciences, a score of 3.292 (the case of proactiveness) is considered to be neutral. In contrast to passive adaptation, proactiveness determines farmers' ability to create new circumstances or to improve the current ones with futuristic and anticipatory initiatives (Covin and Wales, 2012). This quality of EB has been positively related to potential and actual business performance of an entrepreneur (Grant, 2000). Farmers' neutrality vis-á-vis the behaviour slightly showed farmers' passivity or reactive pattern to their business environment. According to Grant (2000), proactive farmers are active in information and opportunity seeking, thus they are the force behind environmental change.

Previous-failure is the EB with the lowest MW of 2.941, which implies that farmers are less sensitive to previous-failure. Due to previous failure experienced, farmers possibly adopt coping mechanisms to prevent against potential failure owing to the fact that farming is a major income generator for these farmers, in particular rice production. Additionally, it is in

the agricultural sector where these farmers disposed of more knowledge and information on socio-economic predictions to overcome the adverse shocks of climate, markets, losses in products and farming-related incomes. Though small-scale farmers are more vulnerable and sensitive to socio-economic shocks due to the size of the farm, lower yield, growing population and land ownership, they respond more efficiently to crop and market failures (Coulibaly *et al.,* 2015). The adopted resilience strategies that lessen the shocks are mostly post hoc measures such as temporary labour, off-farm activities and diversification within agriculture. This pushes farmers to be sensitive to any activities that are subject to failure. Barrett (2015) reported that market failure is one of the most important failures among small-scale farmers, and the strategies to overcome these failures are have improved in terms of effectiveness and efficiency,

Correlation analysis was conducted to estimate the degree and the extent of collinearity among the selected EB variables. The correlation coefficients of EB are presented in Table 5. The results show that the entrepreneurial behaviour of reluctance was highly correlated with many EB factors, and therefore was dropped (Appendix 2). Consequently, the remaining six EB were maintained to be used for further analysis in the study. The VIF value for all explanatory variables was less than 10, with a mean of 1.37, thus confirming no multicollinearity problem.

Table 5. Results of correlation analysis among of entrepreneurial behaviour variables

EB variables	Self-efficiency	Initiation	Risk-taking	Innovativeness	Proactiveness	Previous-failure
Self-efficiency	1					
Initiation	0.593	1				
Risk-taking	0.322	0.423	1			
Innovativeness	0.549	0.558	0.336	1		
Proactiveness	0.170	0.058	0.311	0.342	1	
Previous-failure	0.476	0.447	0.331	0.670	0.556	1

4.2.Socio-economic and institutional characteristics of small-scale rice farmers

The socio-economic and institutional factors of farmers were analysed using percentages and the results are presented in Table 6. The results of these analyses showed that majority of small-scale rice farmers (88.6%) were native to the area while a small proportion of these farmers (11.4%) were migrants. In this target group of farmers, males represented 97.9% and females only 2.1%. This outcome could be attributed to the fact that buying or sourcing for

land under irrigation is unaffordable for women and the deep-root cultural land ownership that passes the title by inheritance to the family as unit (Spinat *et al.*, 2006). Women inherit land from the late husband in cases where there is no mature man in the family to make farm decisions.

Regarding the farming experience, the results show a mean experience of 33 years with a minimum of 2 and maximum of 65 years. The results reveal the long years of experience of these farmers in agriculture which is attributed to the inheritance of farming from generation to generation and the ambition of different policies from colonial time to democracy to make Niono and similar areas of ON the granary of West Africa (Traoré, 2017).

Regarding farming as an occupation, 98% of the farmers inherited the farming business from the family and only 2% were self-appointed farmers, who ventured into agriculture as the sole business among other businesses. The low occupation of self-appointment farmers could be explained by the lower social status of farmers in general and the inability of the sector to offer more youth-oriented initiatives, social norms, financial opportunity, land access, skills, technologies and marketability of agricultural products (AGRA, 2015).

Table 6. Socio-economic and institutional characteristics of small-scale farmers

Variables	Description	Measurement	Mean	SD
Socio-economic variables				
Gender	Gender of household head	1=Male, 0=Female	0.978	0.144
Household size	Size of household members	Number	17.000	10.000
Education	Years of schooling	Years	2.000	3.000
Farm size	Land under rice	Hectare	1.990	1.200
Total land	Total agricultural land owned	Hectare	2.638	1.689
Assets	Farm assets	Log of Currency (FCFA)	13.538	1.676
Business experience	Business experience	Years	33.000	13.000
Institutional variables				
Average farm size	Average farm size of household head's network members	Hectare	2.223	1.353
Average distance	Average distance between network members	Walking minutes	11.460	36.860
Average frequency	Average frequency of meeting among network members	Number of days per month	25.989	4.011
Average years of knowing each other	Average years of network members knowing each other	Years	30.879	11.650
Number of training	Number of trainings attended by the farmers	Number	0.398	0.602

Table 6. Socio-economic and institutional characteristics of small-scale farmers (continued)

Variables	Description	Measurement	Mean	SD
Distance to extension services	Distance between farmer and extension services	Walking minutes	65.080	101.400
Reception of extension services	If farmer has received extension services during the last 2 years	Number	0.368	0.483

Note: SD means standard deviation.

Regarding participation in off-farm activities, the analysis showed that 61% of farmers had off-farm activities. The dominance of off-farm business activities is explained by an increasing uncertainty in farming. Off-farm business is seen a source of stability since it limits strict dependence on agriculture, smoothens out farmers' income flow and allow them to be resilient to shocks as well as getting better price by supplying the products into market at the right time (OECD, 2009; Boukary *et al.*, 2015).

In terms of participation in farmer organizations, the results indicated that 32.6% of farmers are individual farmers whilst 67.4% are members of a farmer group. Farming business is faced with many challenges in Mali that a farmer cannot overcome alone. Farmer groups helped members to access input credit, potential buyers for outputs, more bargaining power and other services such as collective labour, threshing and storage at cheaper prices. This is line with the findings of Millns and Juhasz (2006) who noted that farmer organizations puts farmers in a better business position and also made them more competitive along the value chain.

4.3. Uptake of incentives provided by AOL

4.3.1. Preliminary test

Variable Inflation Factor (VIF) was conducted for continuous variables. The results of this analysis are presented in Table 7. The individual VIF value for the continuous variables was less than 10, with a mean of 1.30, thus confirming that the data had no problem of multicollinearity.

Table 7. Variance inflation factors for continuous variables

Variable	VIF	1/VIF
Average years of knowing each other	1.62	0.617
Average age of network members	1.58	0.631
Average frequency in the network	1.50	0.665
Average distance between network members	1.39	0.719
Land size	1.31	0.766
Number of other trainings	1.24	0.805
Household size	1.21	0.828
Average farm size in the network	1.15	0.872
Distance to extension services	1.12	0.892
Farm assets values	1.12	0.896
Schooling years of household head	1.08	0.929
Mean VIF	**1.30**	

4.3.2. Level of uptake of incentives provided by AOL

The mean frequency on the uptake and non-uptake of incentives by farmers is presented in Figure 3. The results of this analysis show that fertiliser subsidy (Fs) was the subsidy most taken up by farmers followed by the credit incentive (Cg). Conversely, Equipment subsidy (Es) and Agricultural funds (Af) were the least taken of the incentives.

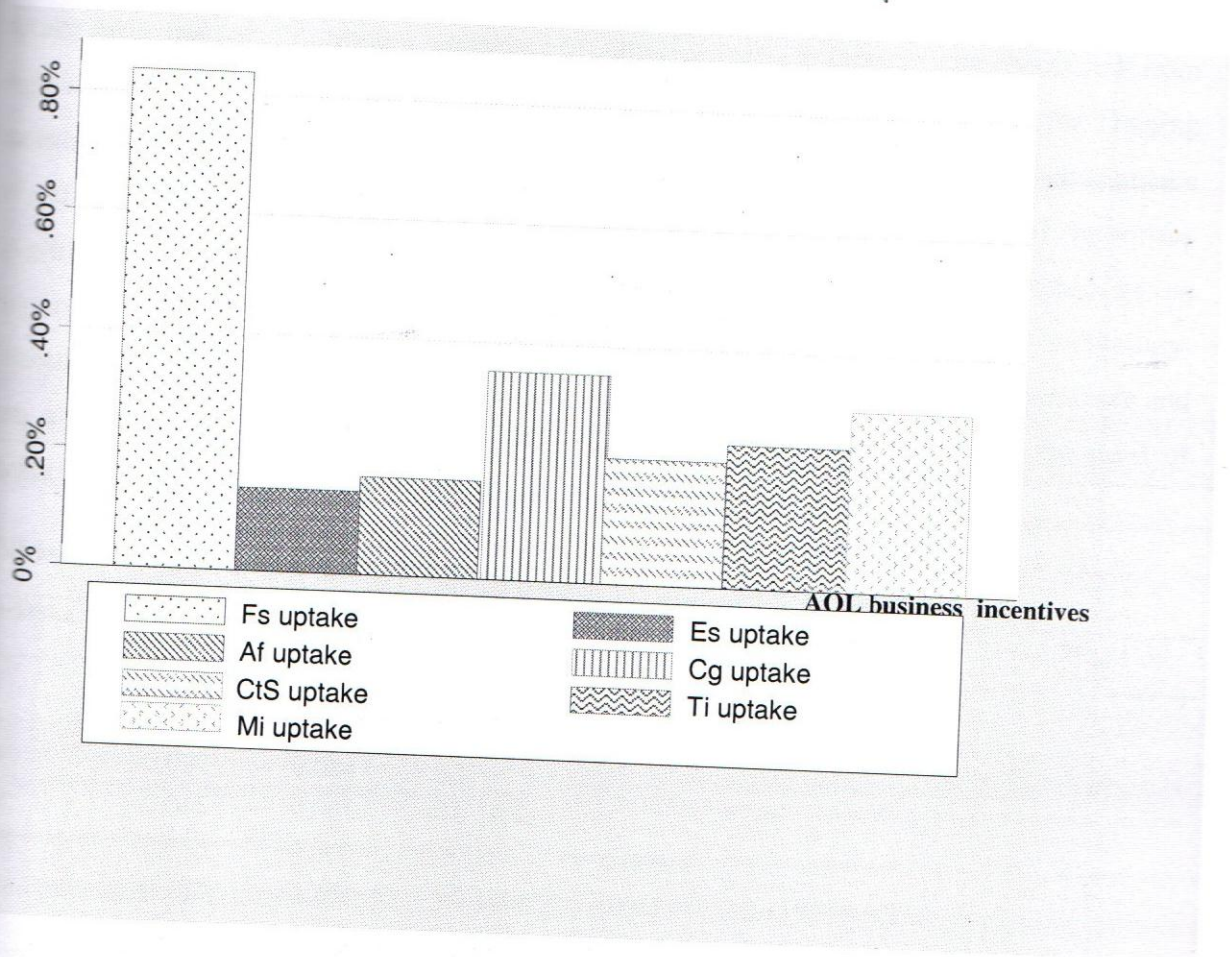

Figure 3. Uptake of AOL business incentives

The reason for high uptake of Fs and Cg may be due to these two subsidies being blanket subsidies and the most accessible to farmers in terms of distance. In addition, they also require relative lesser administrative procedures. On one hand, the equipment subsidized (tractors and accessories) is not adapted to the production system at Office du Niger where the field are divided in small compartment. On the other hand, the Af involved more administrative process and requires some level of literacy which is in general lacking among small-scale farmers.

Table 8 presents results on the correlations coefficients evaluate on the different levels of uptake among the business incentives. The correlation coefficient was positive and significant between uptake of agricultural fund and training incentives at 1% significance level. Similarly, there was a positive relationship between uptake of creation subsidy and training incentives, equipment subsidy and training incentives, as well as between equipment subsidy and agricultural funds at 1%, 5% and 10% levels, respectively. The results imply that uptake and use of Training incentives complements the uptake of Agricultural fund, Creation subsidy and Equipment subsidy. Concurrently, Agricultural fund may be complementing

uptake and use of Equipment subsidy. In other words, a farmer who benefited from Agricultural fund, Creation subsidy and Equipment subsidy would probably ask for Training incentives. Likewise, the uptake of Equipment subsidy would motive a farmer towards uptake of Af. The training incentives being complementary to uptake of several incentives (Agricultural fund, Creation subsidy and Equipment subsidy), can be explained by its important role in gaining financial knowledge, acquiring new techniques and technology-related skills (Mashavave *et al.*, 2017). Adoption of new equipment involves expenditure and can also result in expansion of both farming activities and farm size, thus the need of financial support for farmers after the uptake of Es (Toure, 2014).

Table 8. Correlation among incentives uptake

Variables	Fs	Es	Af	Cg	CsT	Ti	Mi
Fs	1						
Es	0.010	1					
Af	-0.022	0.084*	1				
Cg	-0.015	0.061	0.150	1			
CtS	-0.083	0.060	0.104	0.009	1		
Ti	-0.102	0.201**	0.149***	0.061	0.119***	1	
Mi	0.065	0.157	0.077	0.071	0.039	0.056	1

Note: Fs=Fertilisers subsidy; Es=Equipment subsidy; Af=agricultural fund, Cg= Credit guarantee; Cts=Creation subsidy; Ti=Training incentive; Mi=Market incentives;
*; **, and*** mean significant at 1%, 5% and 10% significance level respectively.

4.3.3. Results of analysis for factors influencing the uptake of incentives

The results of statistics analysis regarding the variables (dependent and independent) used in this objective 2 are given in Table 1 and Figure 3. The factors influencing the uptake of business incentives were determined using the Multivariate Probit model analysis (MVP), and the results are displayed in the Table 9. The model fits well the data with a Wald test $\left[\chi^2(126)=160390\, p=0.021\right]$ and the likelihood ratio test $\left[Loglikelih\,ood=-744.115\right]$. As indicated in the Table 9, the positive and significant value of rho at 10% significance level showed a correlation between the uptake of different business incentives, thus confirming the underlying assumption of MVP about selected variables for the study (Entrenaguez-Entrena and Arriza, 2013).

Table 9. Multivariate Probit results for the uptake of AOL's incentives

Variables	Fertilizers subsidy		Training incentives		Agricultural funds		Credit guarantee		Creation subsidy		Equipment subsidy		Market incentives	
	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE
Socio-economic factors														
Age of household head	-0.015	0.0126	0.023**	0.011	0.003	0.013	0.013	0.010	0.005	0.011	0.013	0.013	0.003	0.011
Schooling of household head	0.033	0.035	-0.004	0.032	0.002	0.033	0.013	0.028	0.027	0.031	0.042	0.035	-0.039	0.031
Household size	-0.007	0.013	0.013	0.011	-0.008	0.014	-0.003	0.010	-0.033**	0.014	-0.002	0.014	0.000	0.011
Land size of household head	0.066	0.072	-0.038	0.067	0.143*	0.075	-0.036	0.061	0.0276	0.065	-0.026	0.080	0.047	0.063
Asset values of farm[1] (CFA)	0.029	0.058	0.004	0.060	0.024	0.086	0.041	0.064	0.002	0.069	0.012	0.061	0.070	0.073
Institutional factors														
Average age of network members	0.016	0.016	-0.003	0.015	0.006	0.016	-0.016	0.014	0.018	0.015	-0.019	0.018	0.004	0.015
Average farm size of network member (ha)	0.075	0.094	0.064	0.081	0.044	0.087	0.147**	0.070	-0.139	0.085	-0.103	0.103	0.091	0.072
Average distance in the network (minute)	0.017	0.010	0.002	0.004	0.000	0.007	-0.004	0.003	-0.002	0.004	0.004	0.003	-0.008	0.006
Average frequency of meeting of the network members (day)	0.009	0.039	0.073*	0.040	0.064	0.043	0.011	0.029	-0.026	0.030	-0.027	0.034	-0.011	0.029
Average years of knowing network members	0.000	0.012	-0.007	0.011	-0.017	0.011	-0.010	0.010	-0.001	0.011	0.017	0.013	0.007	0.010
Number of attended business training	0.059	0.140	0.493***	0.115	0.253**	0.128	0.201*	0.106	0.052	0.110	0.150	0.116	0.239**	0.112
Distance to extension services (minute)	-0.002*	0.001	0.001	0.001	-0.011***	0.003	0.002	0.001	-0.000	0.001	0.001	0.001	-0.000	0.001
Entrepreneurial behaviour														
Self-efficiency	-0.113	0.183	0.079	0.178	0.0148	0.178	-0.164	0.146	0.058	0.161	-0.083	0.185	-0.073	0.157
Initiation	0.065	0.206	-0.207	0.191	-0.120	0.221	0.160	0.177	0.065	0.190	-0.417**	0.196	-0.008	0.178
Risk-taking	-0.224	0.168	-0.001	0.154	-0.081	0.150	0.180	0.129	0.027	0.138	0.151	0.162	0.124	0.138
Innovativeness	0.241*	0.142	-0.146	0.148	0.039	0.154	-0.117	0.128	-0.011	0.142	0.015	0.169	0.078	0.141

Table 9. Multivariate Probit results for the uptake of AOL's incentives (continued)

Variables	Fertilizers subsidy		Training incentives		Agricultural funds		Credit guarantee		Creation subsidy		Equipment subsidy		Market incentives	
	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE	B_1	SE
Proactiveness	-0.099	0.084	0.005	0.078	-0.143	0.084	-0.048	0.069	0.029	0.076	0.004	0.070	0.026	0.073
Previous-failure	0.090	0.134	-0.065	0.131	0.011	0.131	0.022	0.113	-0.210*	0.123	-0.057	0.148	-0.282***	0.119
Constant	0.194	1.665	-3.339**	1.629	-1.817	2.041	-1.255	1.442	-0.556	1.530	1.018	1.597	-1.584	1.532
Wald chi^2	**160.39****													
Likelihood ratio	**-744.114**													
Iteration	**25**													
$Rho_{Af\text{-}Es}=rho_{Ti\text{-}Es}=rho_{Ti\text{-}Af}=rho_{Ti\text{-}CtS}$	**0**													
Chi2 (21)	**29.792***													
Number of observation	**236**													

Note: 1 means variable is in natural log; *, **, ***, respectively means significant at 10%, 10% and 1% Af-Es; Ti-Es; Ti-af; Ti-CtS

The results show that farmer's age had a positive influence on the uptake of training incentive at 5% significance level. A unit increase in age enhances the uptake of Ti by a proportion of 0.021. The possible explanation could be that young farmers who may have acquired business knowledge and training from school will not need to undergo the same training, unlike older farmers who may be uneducated hence the need for further agricultural training. Additionally, many youth prefer non-agricultural activities which do not require agricultural training. Chander (2017) noted a similar observation where he stated that in developing countries like Mali, youth are disinterested in farming instead migrate to the cities in search of new livelihood options.

Household size had a negative influence on the uptake of Creation subsidy (CtS) significant at 5% level. An additional member to the household size decreases the likelihood of the CtS uptake by 0.034. This implies that the more the household members, the less they ventured into new farming enterprises. Larger households are more likely to be less commercial-oriented due to limited investment owing to the high dependency ratio. Spinat *et al.* (2006) and Oden (2011) reported that larger households may face several challenges such as conflicts that lead to reducing the land size resulting from land subdivision where everyone claims a portion thus reducing their ability to engage in productive farming enterprises as well as failure to qualify for creation subsidy.

Regarding farm characteristics, land size had a positive influence on the uptake of Agricultural fund at 10% significance level. An increase in farmers' total land size is an incentive towards uptake of Agricultural fund by a proportion of 0.128. In Mali like many African countries where agriculture is still dominated by extensive farming, increase in land size is a great way to accomplish increased farm production. Hence, there is need for farmers with large farms to look for more financial support to meet the costs of production. This is in line with the findings of NEPAD (2016) who reported that the size of the farm positively affects farmers' decisions to venture in new farming activities which demand external financial support. Similarly, Brondeau (2017) confirmed that small land size at *Office du Niger* is among disincentives which prevent farmers from exploiting opportunities related to finance farming.

Average farm size in farmers' network significantly influenced the uptake of credit guarantee (Cg) positively at 5% significance level. A unit increase in farm size within the network increases farmers' probability to uptake Cg by 0.151. Being in a network with farmers having

relatively large farm size motivates member through sharing information and knowledge to be more imitative in techniques and actions, thus the uptake of credit. In addition, the credit institutions favouring group of farmers over individual ones pushes small-scale farmers to come together to apply for credit incentives, which makes the uptake of credit relatively difficult for individual farmers. According to Ramirez (2013), social network motivates farmers to share knowledge and information while building trust which enables them to guarantee each other on financial obligations such as credit. This is similar to the findings of Bandiera and Rasul (2002) who noted that uptake decisions such as group guarantees depend on the choice of network members who jointly agree on the grounds of similar socio-economic opportunities and challenges.

Number of trainings attended in the last five years influenced positively the uptake of Training incentives (Ti), Agricultural fund (Af), Credit guarantee (Cg) and Market incentives (Mi) at 1%, 10%, 5% and 5% significance level, respectively. In other words, an additional unit of training enhances the uptake of Ti, Af, Cg and Mi by a proportion of 0.494, 0.214, 0.211 and 0.237, respectively. Training provides farmers with knowledge, awareness on the business environment and motivation to explore and uptake of opportunities such as Ti, Af, Cg and Mi. Additionally, well trained farmers develop more skills on market analysis and its trends, hence may engage in marketing and seize the opportunities presented better than others. According to Szabo *et al.* (2013) a successful business needs much training which could help to overcome business related risks associated with new enterprises. Additionally, ICP (2012) noted that previously trained farmers on financial access are more daring to engage in future financial services such as Af and Cg than others since the training offers them better perception of farming related risks and administrative costs of the financial institutions.

Average frequency of meetings in the network positively influenced the uptake of Training incentives at 10% significance level. A unit increase in the number of network meetings increases the uptake of Ti by 0.073. Frequent meetings could enhance the ability of network members to share information and motivate each other on the uptake of Ti. Further, they could also strategize on how to work together so to embrace the opportunity collectively. Again, Ti promotion favours collective training over individual one which is possible in regular network meetings. Bandiera and Rasul (2002) reported that the more the discussion among network members the more their openness to new ideas and uptake of opportunities such as future training.

The distance to extension service providers had a negative effect on the uptake of Fertiliser subsidy and Agricultural fund at 10% and 1% significance level, respectively. A minute increase in the time taken to access extension service demotivates farmers from the uptake of *Fs* by 0.002 and *Af* by 0.009. Extension service providers are the key promoters of Fertilisers subsidy and Agricultural fund through training and sensitization. When the distance to the extension service providers is long with a lot of bureaucracies involved too, farmers get discouraged. Blanket Fs which is also time-fixed attracts a crowd of farmers which makes access time and the production calendar shorter and insufficient. The result is that many inconvenienced farmers opt for alternative sources of fertilisers at their own costs. Despite *Af* not being a blanket subsidy, its process is longer and not simple to understand for illiterate or non-trained farmers, thus the importance of assistance from extension services providers is necessitated. According to Gallo *et al.* (2014), a simplified administrative procedure is a significant determinant for efficient and effective uptake of public services in a business environment since any administrative burden is considered as a cost for enterprises. Teklewold *et al.* (2013) also concurred that a process that has more bureaucracy is less likely to be adopted by farmers.

Lastly, as far as entrepreneurial behaviour is concerned, different relationships with Fs, CtS, Es and Mi were observed. Innovativeness is the only entrepreneurial behaviour found to have a positive effect on Fs while proactiveness, initiation and previous failure had negative effects on Es, Af, CtS and Mi. Regarding innovativeness, there was a positive and significant relationship with uptake of Fs at 10% significance level. An increase of one level in farmers' EB of innovativeness increased the Fs uptake by a proportion of 0.241. Since access to Fs is accompanied with hurdles such as delay in the release, strict deadlines in application and unique delivery station, the requirement for farmers is to be more innovative to overcome these challenges. Lacking innovativeness to overcome these hurdles can result in delay or non-respect of agricultural calendar by farmers, thus causing farmers to forgo the uptake. Innovative farmers could easily synchronise the production calendar and the delivery period of fertilizers to avoid distorting the production process (Kraus, 2012). On the contrary, ON (2017) reported that any decision with potential to delay the production calendar is less likely to be taken by innovative farmers since it negatively affects both productivity and food security.

The initiation behaviour had a negative influence on Equipment subsidy 5% significance level. An increase of one level in EB of initiation decreases the uptake of Es by 0.417. Even

though, farmers may have initiatives to adopt Es, they may be unable to do so due to compartmentalization of the plots and the subsidy covers large equipment which is not suited for small plots. Essentially, the division of land fits more to the use of Moto cultivator and its accessories than the tractor as proposed by AOL. These observation is supported by CAFON (2004) who found that heavy machineries which require high management costs do not benefit small-scale farmers at Office du Niger even if they were quite initiative. Similarly, according to DBIS (2015), if exploration and exploitation of ideas results in repeated challenges and costs beyond initiative farmers' capability it makes them more dubious and the execution of such opportunities becomes difficult.

Previous-failure had negative effects on both *CtS* and Mi at 10 and 1% level, respectively. An additional increase in the level of farmers' previous-failure behaviour decreases farmers' uptake decision of CtS and Mi by 0.210 and 0.282, respectively. The unpredictable weather, socio-economic shocks and the lack of insurance in agricultural sector makes farming business risky and some failed attempts on farming are irreparable. The fear associated with repeat of any failed initiative demotivates farmers from the uptake of CtS and Mi. The findings are in agreement with the findings of Gajanyake (2016) who noted that, no matter its causes; previous-failure (crop or market failure) increases farmers' risk aversion and decreases their motivation for both reinvestment and venturing in new business portfolios such income generating activities. DCED (2012) reported that farmers' previous failure added to other socio-economic and institutional challenges such as poor yields and lack of market reliability which push out a product from the value chain and consequently smallholder farmers as well as reduces their ability to initiate new enterprises.

4.4.Determinants of small-scale farm performance

Sales, post-harvest losses and profitability were used as farm performance indicators. The descriptive statistics for these different variables are indicated in Table 2. The Multivariate Tobit model was used to determine the factors influencing farm performance. In a multivariate equation such as MVT, a method with higher iteration is always preferred since it is more likely to lead to a better convergence of estimates (Roodman, 2017). Thus, CMP process was used to achieve convergence in the MVT analysis. Through CMP, having the highest iteration power and its maximum likelihood approach to estimating these three equations as a system (not as different steps), has concise benefit and potential efficiency gains due to its consideration of linkages among the error processes (Baum, 2016). Additionally, this process provides both individual model fit and full model fit of the

different equations, thus easing the comparison and judgement. The results of these individual models and full model analyses are presented in and Appendix 3 Table 10 respectively. The likelihood ratio of $[\chi^2 963) = 237.7, p = 0.000]$ and $\log likelihood = -191.748$ suggests a joint significance of error correlation, implying that the use of MVT is more efficient. This result is consistent with the significance of error linkage coefficient (rho) across equations of sales-profitability, which supports the econometric assumption of interdependence between sales and profitability.

The results as presented in Table 10 show that the years of schooling of the household head had a negative and significant influence on PHLs at 10 % level. In other words, one year increase in household head's years of schooling reduces PHLs by 13%. Traditionally, farmers learn by imitative approach at family level while the school provides learners with analytical approaches. Schools provide both practical and gradual learning which may contribute to improved farmers' management skills and consequently reduced PHLs. According to Atanda *et al.* (2011), if PHLs' means of learning techniques and technologies are made available, the learned farmers benefit more since they are the most exposed. Further, the authors noted that structured learning is important as it may improve skills of handling products which is capital to reduce the post-harvest losses at all farm levels, storage, process and marketing level

Table 10. Result of Multivariate Tobit analysis on farm performance indicators

Variables	Profitability[1]		Post-harvest Losses[1]		Sales[1]	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Farm and farmers' characteristics						
Age of household head	0.005	0.005	-0.023	0.026	0.005	0.005
Schooling years of household head	-0.007	0.013	-0.130*	0.073	-0.008	0.013
Household size	0.008	0.005	0.052**	0.027	0.008*	0.005
Nature of business	0.073	0.047	-0.942**	0.266	0.068	0.047
Income of off-farm business[1] (FCFA)	-0.007	0.007	-0.046	0.039	-0.007	0.007
Total land of household head (ha)	0.229***	0.028	0.057	0.160	0.228***	0.028
Farm asset value[1] (FCFA)	0.080**	0.026	-0.002	0.147	0.079***	0.026
Institutional factors						
Number of attended business training	-0.012	0.047	0.301	0.264	-0.012	0.046
Average age of network members	-0.002	0.005	0.023	0.031	-0.002	0.005
Average farm size of network members	0.030	0.031	0.300*	0.178	0.030	0.031
Average distance between network members	-0.001	0.001	-0.014*	0.007	-0.002	0.001
Average frequency of meeting in the network	-0.011	0.013	-0.094	0.073	-0.012	0.013
Access to a model farm	0.182**	0.095	0.879	0.537	0.180**	0.094
Amount of business credit[1] (FCFA)	0.001	0.011	-0.167**	0.061	0.000	0.011
Entrepreneurial Behaviour						
Self-efficiency	0.019	0.068	-0.048	0.388	0.019	0.068
Initiation	-0.082	0.080	-0.081*	0.453	-0.088	0.079
Risk-taking	-0.051	0.059	-0.125	0.334	-0.052	0.059
Innovativeness	-0.009	0.058	-0.581*	0.326	-0.010	0.057
Proactiveness	0.014	0.032	-0.231	0.179	0.013	0.031
Previous-failure	0.013	0.051	0.052	0.287	0.013	0.050
Constant	12.636***	0.611	16.244**	3.492	12.744***	0.610

Note: [1] is in natural log; *, **, ***, respectively means significant at 10%, 5% and 1%

Household size had a positive influential effect on both sales and PHLs at 10% and 5% significant levels, respectively. This is to say, a unit increase in household size increases the sales by a 0.8% and PHLs by 5% respectively. The possible explanation could be that larger families tend to depend on relatively low quality family labour which sometimes encounters conflicts and is characterised by inadequate handling skills that lead to huge post-harvest losses. PHL is related to higher production quantities because farmers tend to lower attention to post-harvest handling practices when they experience bumper crop production (World Bank, 2011). The reports further notes that this then translates to lower loss prevention. The positive relationship between household size and sales could be implicated to the fact that majority of farmers practice rice monoculture and frequently exchange rice for other commodities to meet mix their food basket and increased food quantity to meet the demand presented by larger families. Koide *et al.* (2015) reported that the feasibility of rice production is largely dependent on availability and stability of labour which can be guaranteed by larger family size. Stable labour will enhance production and trade in the output generated.

The nature of farming business had a negative and significant influence on PHLs. This implies that changing the nature of business from family to others (individual or partnership) would reduce the level of PHLs by around 94%. Compared to the family business, other types of farming businesses are more strict on labour and services qualities, efficiency in technique and accountability which could significantly reduce the PHLs. Additionally, management of family owned businesses tend to be more risk averse and slow in decision-making that can delay adoption of new techniques of handling PHLs. NEPAD (2016) asserted that in family farming the responsibilities are not well determined neither is management quality good enough. Further, the report notes that this affects negatively on productivity, life cycle of products and the quality which is actually a loss to the producer. Japan Brand ODA (2017) similarly found that the individual farm business owners are more careful and motivated than the family business, thus making them experience relatively higher production and lesser PHLs.

Farmers' access to a model farm had a positive influence on both sales and profitability at 5% significant level. In actual terms, having access to a model farm would increase farmers' sales and profitability by 18%. The model farms are known for innovation, opportunity seeking and efficiency with relatively advanced techniques and technologies. Small-scale farmers who access these model farms can benefit from their skills and innovative ideas which in turn

may affect their production process and marketing strategies by imitating model farms. Model farms can also source labour and create trade relationships with small scale farmers which results in improved output and output price hence increased profit. Adesina and Baidu-Forson (1995) reported that farmers' adoption behaviour of new techniques or technologies offered by model farms is influenced by the level of their exposure to the latters. The author further noted that the direct effects for adopters can be gains in production and reduction in production costs while the indirect effects can be increase in supply and income, thus improving welfare.

Total agricultural land size of a farmer had a positive and significant influence on both sales and profitability at 1% level. An increase in land by 1 hectare increases both sales and profitability by about 23%. This may be due to the economy of scale which is important in reduction of transaction costs as well as increase in production. Large farms also have not only relative higher access to financial institutions but also higher amount of money desired for farm activities. This contributes to large farms efficiency, thus increase in volume of outputs and subsequent profitability. Additionally, relative huge volume of outputs from large farms is more attractive to potential customers, which can also influence their market intelligence, output prices and willingness for more sales and perhaps more profits. This is in line with the findings of Pollit and Steer (2011) and Chidi *et al.* (2015) who found that bigger farms potentially yield more output and increases the total profit per hectare by decreasing work cost per unit of land. Additionally, according to Foster and Rosenzweig (2010), large land holding enhances access to better inputs and financial services, mechanization and potential business partners, thus effecting positively on both sales and profitability.

The average farm size in the network had a positive influence on PHLs at 10% significant level. An increase in farm size within social network by 1 ha brought about an increase in PHLs by 30%. This could be explained by availability of limited infrastructure like storage facilities; hence farmers who possess some of these facilities are bound to share with other network members who are mostly close relatives. In addition, the extension services being quasi-non-existent in the area, the farmers rely exclusively on farmer-led initiatives to handle challenges such as crop diseases and reduction of PHLs which by distorted information and "learn from your own mistake" process can have drawbacks on network members who imitate. Garikai (2014) found that an increase in land size in the network is related to an increase in both production and PHLs since an extra output may require more facilities and extra costs of handling which is expensive for small scale farmers. The problem is further

escalated when network members have identical characteristics, sharing the same information and imitate each other's ways of production.

The average time taken to walk from a network member to the other negatively influenced the PHLs 10% significance level. The results imply that an additional minute of walking time to another farmer in the network decreases the PHLs by 1.4%. Generally, in a network, the process of consultation among members slows when the distance between the members is long and farmers may end up acquiring conflicting ideas from the several network members. It is on this background that farmers may resort to making individual decisions on post-harvest handling which are faster when their network members are far. Again when the network members are far from each other, they are less likely to share the scarce facilities such as storage tools and equipment which can contribute towards reduced losses. Sumisidin (2017) found that the role of collective action which allows for sharing of knowledge and information was affected by many members in the network and the distance. Members far from each other missed out on the opportunity to access right information, thus poor agricultural practices which can result in PHLs in the absence of extension services.

The amount of credit in the main counter-season was negatively correlated with the PHLs at 5% significance level. Access to credit in the counter-season assisted farmers to reduce PHLs by 17%. The credit in Niono generally is limited to the amount of rice fertilizers, and it is recovered immediately after the harvest. Access to more credit could enable farmers to cover costs related to improvement of quality of both goods and services such as threshing machine and storage. This in turn could help in reducing the losses since the quality of agricultural products highly depends on the process and handling they undergo at different levels namely, pre-harvest, harvest, transportation, storage and market. This is supported by Kumar *et al.* (2006) who noted that any tentative improvement in the quality and quantity of agricultural produce such as post-harvest handling requires an extra cost which can be covered adequately when farmers have access to credit. World Bank (2011) also pointed out that institution-related issues, financial problems and lack of loans are the major causes of increased PHLs in Sub-Saharan Africa.

Innovativeness behaviour negatively influenced PHLs at 10% significant level. A farmer with the behaviour was 58% less likely to experience PHLs. Innovative farmers are characterized by their systematic approach and strategic orientation in decision-making process. These qualities make them more autonomous and aggressive competitors, which contributes to their

sense of marketing, learning and entrepreneurial orientation which include reduction of PHLs. The inadequacy of extension services and inefficiencies of farmers' organizations in ON require farmers to be more innovative to handle agricultural challenges like PHLs. Rudman (2008) concluded that after establishing good links, socio-economic factors and farm characteristics, the innovativeness of a farmer is key to enhancing farm performance due to its positive impacts on loss reduction.

Initiation likewise was significantly negative towards PHLs 10% significance level. A farmer with initiation behaviour was 8% less likely to experience PHLs. The behaviour is embedded in self-motivation and action-oriented which improves farmers' ability to make efficient decision and achievement on their own. It also allows individual farmers to come up with strategies that will turn the situation where they would face lesser losses. Additionally, in an environment characterized by scarce resources and facilities such as was the case at ON, initiation behaviour allows exploitation of a wide range of opportunities and strategies to deal with challenges like PHLs. Spielman (2010) similarly noted that initiative ability of a famer could as well help to minimize production and market-related risks like PHLs, thus transforming them into opportunities.

CHAPTER FIVE
SUMMARY CONCLUSION AND RECOMMANDATIONS

5.1. Summary

This study aimed at determining the level of entrepreneurial behaviour (EB) and its effect on both the uptake of business incentives and farm performance among small-scale farmers' in Niono zone at Office du Niger, Mali. The study targeted specifically the rice farmers in the study area. The data for the study was collected from 236 small-scale farmers whose farm size is below 5 hectares. The interview of farmers was conducted using semi-structured questionnaire. The data on EB was subjected to Confirmatory factor analysis (CFA) and its post estimation test such Bartlett's sphericity test, Keyser-Meyer-Olkin sample adequacy and Cronbach's' alpha. The CFA analysis indicated that the data were reliable, valid and fitted well to the use of data reduction method. The descriptive statistics were used to determine socio-economic and institutional characteristics of farmers while multivariate Probit and Tobit were used to determine factors influencing the uptake of incentives and farm performance respectively. These two models indicated good fitness to the data at 5% and 10% respectively.

The entrepreneurial behaviour of small-scale farmers is scaled "Very Strong" for Initiation, Self-efficiency, Risk-taking and Innovativeness whereas the Previous-failure and Proactiveness are scaled at "Somewhat Strong". This implies that farmers' EB is general good except the Proactiveness. The findings also showed the dominance of male in the system at 98%, Off-activities at 61% and farmers' group membership at 67%. The results of Probit model shows that the age, land size, network, other business training, distance to extension service providers and EB of innovativeness had positive influence on the uptake while the household size and EB of Initiation and Previous-failure affected it negatively. On the other hand, years of schooling, access to a model, amount credit in counter-season and EB of Innovativeness and Initiation reduced post-harvest losses while the sales and profitability are positively affected by household size, total land size and access to a model farm.

5.2.Conclusion

1. Entrepreneurial behaviour of small-scale farmers had higher mean scores in initiation, innovativeness, self-efficiency and risk-taking while it had lower scores in proactiveness and previous-failure.

2. Entrepreneurial behaviour influences positively and negatively the uptake of business incentives. The effect of EB depends on the nature business incentives provided by AOL.
3. The Entrepreneurial Behaviour plaid great role in small-scale farm performance through its positive effects on performance indicators which were sales, profitability and post-harvest losses. The study also concluded that the positive effects of EB on farm performance are amplified by other socio-economic and institutional factors of farmers such as land size, farm assets values, off-farm incomes and access to model farm.

5.3. Recommendations

The results highlight a wide range of measures to make uptake of incentives and farm performance better.

1. Seemingly, the medium level of overall EB makes it clear that there is need to push the EB a higher level among small-scale rice farmers mostly their proactiveness, previous-failure, self-efficiency and risk-taking through farmers' group training, sensitization, access to information and farming risks reduction.
2. Policies such as AOL and its related policies that aim at promoting commercial-orientation system among small-scale farmers should consider new values and orientation favourable to small-scale farmers' entrepreneurship. Additionally, the policies should consider the set of positive factors that appeal and facilitate the emergence of small-scale farmers' EB, thus giving the chance to changes challenges into business opportunities.
3. The development policies towards commercial-orientated farming should develop well EB of farmers and built also adequate environment to the development of farming business. This can be implemented through developing business skills, improving farmers' investment ability, interaction with extension service providers and sharing of knowledge and information in the social network among small-scale farmers.

5.4. Suggestions for further research

This study used cross sectional data, future studies should use panel data with more characteristics of entrepreneurial behaviour since the behaviour is dynamic. Further research can be done to establish the level of entrepreneurial behaviour of other actors in

the value chain and determine its effect on both business incentive uptake and their performance. This allows finding out the strengths and weaknesses of the rice subsector in order to exploit its potential.

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APPENDICES

Appendix 1. Household questionnaire

My name is Mahamadou Soumaila KONTE. I am a student from Egerton University. We conduct this study to assess farmers' entrepreneurial behaviour and their farm performance for commercial-oriented farming as the Agricultural Orientation Law stipulated. You have been identified as a useful informative farmer to help us (Egerton University) to assess the level and ability of commercial-orientation production among farmers. Your participation is voluntary and you are guaranteed that the information you give remains confidential and it will only be used for the purpose of research. Kindly respond to the queries below.

Questionnaire number: .....

Enumerator name: .....

Date of interview: ..... / ..... /.....

A. Section A: farm and farmers' characteristics

A.1. Zone of Niono: ..... (**ZNiono**)

A.2. Irrigation system: *1= ARPON 2= GRUBER 3= RETAIL 4=Hors casier 1*..... (**IrrigSyst**)

A.3. Name of the household head: ..... (**NHhldHead**)

A.4. Age of the household head: ..... (**AgHhldHead**)

A.5. Gender of the household head: *1= Male; 0= Female* ..... (**GenHhldHead**)

A.6. Years of schooling of household head: ..... (**SchoHhldHead**)

A.7. Years of farming experience ..... (**ExpHhldHead**)

A.8. Are you native of Niono? *1= Yes 0= No* ..... (**NtveHhldHead**)

A.9. How many people are you living and eating together in the past six months in your household?

Household members	Number
Men	

Women	
Children (less than 15)	
TOTAL	

A.9. What is your current total land size for farming in hectare? .....**(LdSize)**

A.10. Please, indicate the value of the productive assets in your farm **(FamAssets)**

Items		Current Number	Current unit value	Current total value	Items		Current Number	Current unit value	Current total value
		Cnum	**Untval**	**Totval**			**Cnum**	**Untval**	**Totval**
Plough	1				Tractor	14			
Shed	2				Airer	15			
Storage	3				Vehicle	16			
Seeder	4				Lorry	17			
Moto cultivator	5				Threshing machine	18			
Manual sprayer	6				Grinder	19			
Motorized sprayer	7				Weighing Balance	20			
Cart	8				Generator	21			
Wheelbarrow	9				Motorbike	22			
Bicycle	10				Mobile phone	23			
Radio	11				Drilling	24			
Television	12				Other (specify)	25			
Solar	13				Other (specify)	26			

B. Farm business and institutional characteristics

B.1. What is the nature of your main farm business? 1=Sole proprietorship 2=Partnership 3=0thers (specify)..... **(NatBuz)**

B.2. If the nature of ownership is partnership, please indicate the number of partners involved.....**(NberPart)**

B.3. What is the nature of land ownership of the main plot? 1=Title 2=Rent 3=Without titled 4=Others (Specify).....**(NatLdOwnp)**

B.4. Did your family have the farming as a business? 1=Yes 0=No .....(**FmyBuz**)

B.5. Do you have access to a model farm where you can learn agribusiness? 1=Yes **0**=No .....(**AcModFam**)

B.6. Are you member of any agricultural farmers' group? *1=Yes 0= No*..... (**MberAgGp**)..

B.7. Name three people with whom you talk about farming (**PleTF**) 1=.....2=.....3=.....
...

Name of the network member	Age	Are you from the same tribe? *1=Yes 0=No*	What is their farm size	What is the distance to the network member ?	What is the frequency of communication (*days per months*)?	Do they belong to farmer group? *1=Yes 0=No*	How long did you know each other (*years*)?
NPleTF	**APleTF**	**TrPleTF**	**FSzPleTF**	**DsPleTF**	**FqPleTF**	**FGPleTF**	**KnPleTF**
1.							
2.							
3.							

B.8. Did you receive any advice from extension services provider for the farm business in the last one year? *1=Yes 0= No*.....(**RecExtSvce**)

If yes, indicate the number of contacts you had with the extension services provider..... (**CtExtSvce**)

B.9. What was the main source of the extension services provider? *1=Office du Niger; 2=NGO; 3=Government institution; 4=Local radio; 5=Television; 6=Phone; 7=Internet; 8=Farmers' group; 9=Farm to farm; 10=Others (specify)*..... (**SceExtSvce**)

B.10. Please, fill this table on the following services provided by the government during the last five years

Initiatives	Are you aware of the following government initiatives *1=Yes 0=No*	If yes, what was the Source of information (*See the codes below*)	Did you access the following government initiatives since 2006? *1=Yes 0=No*	Indicate the year(s) of you accessed the government initiatives	What was the amount accessed (FCFA) or number of accession?
	InitiatAw	**InitiatInfo**	**InitiatAc**	**InitaitYr**	**NberAcInitiat**
Inputs subsidies					
Equipment subsidies					
Agricultural Fund					
Credit guarantee					
Creation subsidies					
Training					
Market access through government support					

Codes for information: *1=Office du Niger; 2=NGO; 3=Government institution; 4=Local radio; 5=Television; 6=Phone; 7=Internet; 8=Farmers' group; 9=Farm to farm; 10=Others (specify).* ***Codes for input subsidies:*** *1=Fertilizer; 2=Seed; 3=herbicide; 4=others (specify)*..... ***Codes for fund:*** *1=Calamity; 2=Bonus; 3=Others (specify)*..... ***Code for the extent of the market access:*** *1=Permanent; 2=Temporary; 3=Once*

B.11. Do you have access to market information*1=Yes 0=No*.....(**AcMktInfo**)

B.12. What is the distance to the nearest permanent market place (number of minutes used to walk to the market center)? ..... (**DsMkt**).

B.13. What is the distance to the nearest extension services (number of minutes used to walk to the market center)? ..... (**DsExtSvce**).

B.14. Did you access credit for your farm business these last 2 years*? 1=Yes 0=No S1:* ..... *S2:*.....(**AcCred**).

If yes, indicate the amount that was obtained *S1:* ..... *S2:*.....(**AmCred**)

B.15. Did you attend any other training on farming as a business in the last 5 years? 1=Yes 0=No ..... (**BuzTrng**)

If yes, indicate the number of trainings attended? ..... (**NBuzTrng**)

What topic were covered during the training (s)? ..... (**TpBusTrng**)

B.16. What difficulties do you encounter in the process of accessing initiatives? *0=None; 2= Not interested; 3=Bribes are involved; 4=The procedure is difficulte; 5=Others (specify).....(**NotAc**)*

C. Entrepreneurial behavior

Reluctant in farming business

C.1. What is the attractiveness to farming to you? (*indicate the level from least to most*)

Statement	Level of agreement				
	1	2	3	4	5
a. I prefer Salaried work (**Rel1**)					
b. I prefer being a business trader (**Rel2**)					
c. I prefer Farming business (**Rel3**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.2. If farming business, explain your choice of being farmers by stating your agreement

Statement	**Tick the answer**
a. Desire for self-employment (**Rel3a**)	
b. Inheritance (**Rel3b**)	
c. Social network (**Rel3c**)	
d. Market availability (**Rel3d**)	
e. Better than other business (**Rel3e**)	
f. No opportunity for other business (**Rel3f**)	
g. Farming experience (**Rel3g**)	
h. To achieve a personal goal (**Rel3h**)	

C.3. Self-efficiency

Statement	Agreement				
	1	2	3	4	5
a. Shifting to commercial-oriented farming would be simple for me (**SelEf1**)					
b. Running a commercial-oriented farm would simple for me (**SelEf2**)					
c. I have necessary skills to start commercial-oriented farming (**SelEf3**)					
d. My farm assets allows me to become commercial-oriented farmer (**SelEf4**)					
e. Starting commercial-oriented farming, I have a high likelihood to succeed (**SelEf5**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.4. Initiation

Statement	Agreement				
	1	2	3	4	5
a. I have tried to become commercial-oriented farmer (**Initiat1**)					
b. I am willing to make anything to become commercial-oriented farmer (**Initiat2**)					
c. My professional intention is to become commercial-oriented farmer (**Initiat3**)					
d. I have strong thought of shifting commercial-oriented farming in the future (**Initiat4**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.5. Risk-taking

Risk taking is defined as willingness of person to invest in farming project, ideas and process although uncertain outcome and high cost of failure.

Statement	Agreement				
	1	2	3	4	5
a. I like devote my assets and my time to farming business of high profitability (**RiskTak1**)					
b. I prefer activities with less risky outcomes (**RiskTak2**)					
c. I don't like to newly venture if there is uncertainty about outcome (**RiskTak3**)					
d. If a business is highly risky and high profitable, I would go for profit but with insight into the risk (**RiskTak4**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.6. Innovation

Innovation is to come out with new products or services, technological process, operational methods and farming strategies.

Statement	Agreement				
	1	2	3	4	5
a. I tried once to bring new ideas and plans in my business (**Innova1**)					
b. I prefer doing my business as other people do, without any change (**Innova2**)					
c. If I gain what to feed my family and me, I don't struggle myself with any new way of doing farming (**Innova3**)					
d. I always want to distinguish myself from other farmers by bringing ideas, techniques and technology that are new for them (**Innova4**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.7. Proactiveness

Poactiveness is the devotion of an entrepreneur to take anticipated actions in order to explore opportunities.

Statement	Agreement				
	1	2	3	4	5
a. I work hard and ever try to improve my business competiveness and growth (**Proac1**)					
b. My attitude, aptitude and ability make me ready to commercial-oriented farmer in the nearest future (**Proac2**)					
c. I always look for opportunities and exploit them before other farmers (**Proac3**)					
d. Farming is the most important for me, I should be ahead of others in modernizing it (**Proac4**)					
e. I now am satisfied with my business and fulfilling all my needs and wants, there is no need for more venturing (**Proac5**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

C.8. Previous failure

Statement	Agreement				
	1	2	3	4	5
a. My previous failure in farming business is scaring me to engage in commercial-oriented farming (**PrevFail1**)					
b. If my business idea fails, I neither correct it nor improve it and I will not try (**PrevFail2**)					
c. If business fails once, I would not try the same business even if a new environment seems to make it more profitable (**PrevFail3**)					
d. If a new venture fails, I do not dare trying any other similar business activities to that new venture (**PrevFail4**)					

Code for agreement: *1= Disagree; 2= Strongly disagree; 3=Neutral; 4= Agree; 5= Strongly agree*

Performance

D.1, Please, fill in the table on production costs in the last year

Crop	Inputs	Unit (*see codes below*)	Land size (Hectare)		Amount		Price (FCFA)per unit	
			Season1	Season2	Season1	Season2	Season	Season2
Crp	**InpCrp**		**LdSzS1**	**LdSzS2**	**AmInpS1**	**AmInpS2**	**PrInpS1**	**PrInpS2**

Codes for crops: *1=Rice; 2=Onion; 3=Tomato; 4=Irish potato; 5=Gombo; 6=Others (specify) .....* ***Codes for inputs:*** *1=Seed; 2=Urea; 3=DAP; 4=Manure; 5=Herbicide;* ***Codes for unit:*** *1=Bags; 2=Crate; 3=Others (specify).....*

D.2, Please, fill in the table on the labor used in your main crop production

Culture	Activité	Saison1				Saison2			
		Man-day	Machine	Hour	Prix	Man-day	Machine	Hour	Prix
Crp	**Acty**	**MandS1**	**MacS1**	**PrS1**	**HrS1**	**MandS1**	**MacS1**	**PrS1**	**HrS1**

D.3, Please, fill in the table on the type of livestock

Type of livestock	Number of head	Number sold	Average price	Number lost after harvesting
TypLvk	**NberLvk**	**NLvkSld**	**AvPrLvk**	**NLvkLost**

Code for livestock:*1=cow; 2=bull; 3=donkey; 4=horse; 5=goats; 6=sheep; 7=poultry; 8=other (specify).....*

Please, fill in the table on the profitability and post-harvest losses

Crops or byproducts (*see codes below*)	Land size (*ha*)	Amount produced	Unit (*see codes below*)	Amount consumed	Amount sold	Amount lost after harvesting	Unit price (FCFA)	Where did the loss occur (*See the codes below*)
Crp/Byp d	**LdSz**	**AmPdce**		**AmCmed**	**AmSld**	**AmLostHv**	**Upr**	**MoLost**
Season1								
Season2								

***Codes for crops**: 1=Rice; 2=Onion; 3=Tomato; 4=Irish potato; 5=Straw; 6=Residuum; 7=Others (specify) ..... **Codes for unit**: 1=Kg; 2=Liter; Bag; 4=Basket; 5=Others (specify)..... **Codes for loss:** 1=Harvest; 2=Threshing;3=Transport to storage; 4=In the Storage; 5= Transport to the Market; 6=In the market; 7=Others (Specify)*

D.6. Do you have any off-farm income? Yes ☐ No ☐

If yes, fill in the table

Type of off-farm activity	Number of months	Average Income per month
TypBuz	**NMthBuz**	**AvIncMth**

Codes for business: *1=Trading business; 2=Remittance; 3=Salary; 4=Man-day work; 5=Others (specify) .....*

Thanks for your precious time

Appendix 2. Correlation coefficients of entrepreneurial behaviour

Variables	Reluctance	Self-efficiency	Initiation	Risk-taking	Innovativeness	Proactiveness	Previous-failure
Reluctance	1						
Self-efficiency	0.616	1					
Initiation	0.493	0.593	1				
Risk-taking	0.411	0.322	0.423	1			
Innovativeness	0.525	0.549	0.558	0.336	1		
Proactiveness	0.325	0.170	0.058	0.311	0.342	1	
Previous-failure	0.588	0.476	0.447	0.331	0.670	0.556	1

Appendix 3: Individual model fit for the three indicators (sales, profitability and post-harvest losses)

A. Individual model fit of profitability

Source	SS	df	MS
Model	64.4536049	21	3.06921928
Residual	83.1468729	214	.388536789
Total	147.600478	235	.62808714

Number of obs	236
F(21, 214)	7.90
Prob > F	0.0000
R-squared	0.4367
Adj R-squared	0.3814
Root MSE	.62333

logtotal_profi~y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
AgHhldHead	.0052083	.0048237	1.08	0.281	-.0042996	.0147163
SchoHldHead	-.0070422	.0133813	-0.53	0.599	-.0334181	.0193338
Hhldsize	.0076361	.0048763	1.57	0.119	-.0019756	.0172478
NatBuz	.0731042	.0489384	1.49	0.137	-.0233588	.1695672
logIncOffBuz	-.0069598	.007228	-0.96	0.337	-.0212069	.0072873
total_land	.2290385	.0294537	7.78	0.000	.1709819	.2870951
lnAssets	.0801692	.0270581	2.96	0.003	.0268347	.1335036
AvAge	-.0022512	.0057058	-0.39	0.694	-.013498	.0089956
AvFarmSze	.0298754	.0327207	0.91	0.362	-.0346207	.0943715
AvDist	-.0014239	.0013313	-1.07	0.286	-.0040481	.0012003
AvFrq	-.0105039	.0133687	-0.79	0.433	-.0368552	.0158474
NBuzTrng	-.0109393	.0485564	-0.23	0.822	-.1066492	.0847707
logAmCredS1	.0038486	.0091836	0.42	0.676	-.0142533	.0219504
logAmCredS2	.000716	.0112286	0.06	0.949	-.0214169	.0228489
AcModFam	.1821408	.0986453	1.85	0.066	-.0123001	.3765817
Self_efficiancy	.0200711	.0712533	0.28	0.778	-.1203771	.1605194
Initiative	-.0818634	.0831818	-0.98	0.326	-.2458241	.0820972
Risk_taking	-.0497137	.0613034	-0.81	0.418	-.1705495	.0711222
Innovativeness	-.0086208	.0599548	-0.14	0.886	-.1267984	.1095569
Proactiveness2	.0134403	.0328208	0.41	0.683	-.0512532	.0781337
Previous_failure	.0142318	.0527325	0.27	0.788	-.0897098	.1181735
_cons	12.63614	.6418904	19.69	0.000	11.37091	13.90138

B. Individual model fit of sales

Source	SS	df	MS
Model	64.1197368	21	3.0533208
Residual	82.1919215	214	.3840744
Total	146.311658	235	.622602801

Number of obs	236
F(21, 214)	7.95
Prob > F	0.0000
R-squared	0.4382
Adj R-squared	0.3831
Root MSE	.61974

logtotsales	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
AgHhldHead	.0051306	.0047959	1.07	0.286	-.0043226	.0145838
SchoHldHead	-.0076815	.0133042	-0.58	0.564	-.0339055	.0185426
Hhldsize	.007724	.0048482	1.59	0.113	-.0018324	.0172803
NatBuz	.0679738	.0486565	1.40	0.164	-.0279337	.1638813
logIncOffBuz	-.0069699	.0071863	-0.97	0.333	-.0211349	.0071952
total_land	.2276535	.0292841	7.77	0.000	.1699313	.2853757
lnAssets	.0794389	.0269022	2.95	0.003	.0264117	.1324662
AvAge	-.0021531	.005673	-0.38	0.705	-.0133351	.0090289
AvFarmSze	.030042	.0325322	0.92	0.357	-.0340826	.0941667
AvDist	-.001469	.0013237	-1.11	0.268	-.0040781	.0011401
AvFrq	-.0110707	.0132917	-0.83	0.406	-.0372702	.0151289
NBuzTrng	-.0106071	.0482767	-0.22	0.826	-.1057659	.0845517
logAmCredS1	.0040603	.0091307	0.44	0.657	-.0139373	.0220579
logAmCredS2	-.0002717	.011164	-0.02	0.981	-.0222771	.0217337
AcModFam	.1799191	.0980772	1.83	0.068	-.013402	.3732402
Self_efficiancy	.0193597	.070843	0.27	0.785	-.1202796	.1589991
Initiative	-.090088	.0827028	-1.09	0.277	-.2531044	.0729284
Risk_taking	-.0502811	.0609503	-0.82	0.410	-.1704211	.0698588
Innovativeness	-.0099431	.0596096	-0.17	0.868	-.1274401	.107554
Proactiveness2	.0115966	.0326318	0.36	0.723	-.0527243	.0759174
Previous_failure	.0138173	.0524288	0.26	0.792	-.0895258	.1171603
_cons	12.74432	.6381936	19.97	0.000	11.48637	14.00227

C. Individual model fit of post-harvest losses

Source	SS	df	MS
Model	64.4536049	21	3.06921928
Residual	83.1468729	214	.388536789
Total	147.600478	235	.62808714

Number of obs =	236
F(21, 214) =	7.90
Prob > F =	0.0000
R-squared =	0.4367
Adj R-squared =	0.3814
Root MSE =	.62333

logtotal_profi~y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
AgHhldHead	.0052083	.0048237	1.08	0.281	-.0042996	.0147163
SchoHldHead	-.0070422	.0133813	-0.53	0.599	-.0334181	.0193338
Hhldsize	.0076361	.0048763	1.57	0.119	-.0019756	.0172478
NatBuz	.0731042	.0489384	1.49	0.137	-.0233588	.1695672
logIncOffBuz	-.0069598	.007228	-0.96	0.337	-.0212069	.0072873
total_land	.2290385	.0294537	7.78	0.000	.1709819	.2870951
lnAssets	.0801692	.0270581	2.96	0.003	.0268347	.1335036
AvAge	-.0022512	.0057058	-0.39	0.694	-.013498	.0089956
AvFarmSze	.0298754	.0327207	0.91	0.362	-.0346207	.0943715
AvDist	-.0014239	.0013313	-1.07	0.286	-.0040481	.0012003
AvFrq	-.0105039	.0133687	-0.79	0.433	-.0368552	.0158474
NBuzTrng	-.0109393	.0485564	-0.23	0.822	-.1066492	.0847707
logAmCredS1	.0038486	.0091836	0.42	0.676	-.0142533	.0219504
logAmCredS2	.000716	.0112286	0.06	0.949	-.0214169	.0228489
AcModFam	.1821408	.0986453	1.85	0.066	-.0123001	.3765817
Self_efficiancy	.0200711	.0712533	0.28	0.778	-.1203771	.1605194
Initiative	-.0818634	.0831818	-0.98	0.326	-.2458241	.0820972
Risk_taking	-.0497137	.0613034	-0.81	0.418	-.1705495	.0711222
Innovativeness	-.0086208	.0599548	-0.14	0.886	-.1267984	.1095569
Proactiveness2	.0134403	.0328208	0.41	0.683	-.0512532	.0781337
Previous_failure	.0142318	.0527325	0.27	0.788	-.0897098	.1181735
_cons	12.63614	.6418904	19.69	0.000	11.37091	13.90138

Appendix 3 : Policy brief paper

Policy research brief

May 2018

Small-scale Rice Farmers' Entrepreneurial Behaviour towards Commercial-orientation Strategies of Agricultural Orientation Law in Niono Zone at Office du Niger, Mali

Mahamadou Soumaila KONTE, Oscar Ingasia, Edith Gathungu and Souleymane KOUYATE

Summary

Transition from subsistence farming towards commercial-oriented farming has been one of the biggest ambitions for the government in Mali since the event of democracy in 1994. The recent local and regional reforms in agricultural and related sectors in Mali are judged development partners as incentives for both local and international investors in farming business. These reforms were supposed to result in economic growth, stability and better livelihood.

The constraints facing Mali in implementing strategies towards commercial-oriented farming of small-scale farmers are complex and unclear in empirical literature. Nonetheless, establishing farming business incentives has not been embrace as expected by small-scale farmers. Entrepreneurial behaviour (EB) of small-scale farmers along with socio-economic and institutional factors may rather be the cause. Consequently, both the country's economy and stakeholders' livelihood are negatively affected due to underperforming business entities.

This policy brief summarises the options to implement the policy of AOL with regards to institutional commitment and socio-economic factors for better implementation and sustainability. These options include a combination of farmers' EB and the business environment that facilitates new business venture as well as business management.

Background

Agriculture is the backbone of the Malian economy which contributes to about 80% of employment, 40-45 to the GDP and 30% to export earnings. The downtrend of the sector exacerbates food insecurity and poverty, thus fragility economy and stakeholders. The Agricultural Orientation Law (AOL) was established in 2006 to face these challenges with the ambition of modernizing the agriculture through local production and small-scale farmers. . The implementation of AOL has been enforced through establishment of its different

frameworks which are Agricultural Development Policy (PDA) and National Programmes for Investment of Agricultural Sector (PNISA). The implementation strategies include subsidies on fertilisers, equipment, business start-up, credit guarantee, training and the different agricultural funds such as project, risk and calamity. These business incentives are key elements that are deemed necessary to modernize agricultural sector.

In determining factors influencing the uptake of AOL incentives, the options and critical issues to be taken into consideration by policy makers can be:

- What are the common EB among small-scale rice farmers?
- What is the level of incentives uptake among small-scale farmers?
- What is the extent to which the EB is influencing farm performance and the uptake of AOL business incentives?
- What are other socio-economic and institutional factors that are influencing farm performance and the uptake of AOL incentives?
- What are the measures to improve the implementation of AOL's commercial-orientation strategies among small-scale rice farmers?

The key question is: why are these points crucial for implementing AOL's strategies? The production of Malian agriculture particularly rice has recently increased, yet below the expectation. This makes the country unable to feed its growing population and yet it possesses the potential to produce more than the need for national consumption. Therefore, the country is highly dependent on the international market which by instability (prices, quantity and quality) threatens both the country and its small-scale farmers.

Transition to commercial-orientation is one of the best ways towards Malian economic growth and stability as well as improved livelihood of small-scale farmers. Availability of resources (water and land), potential consumers for local products and political supports are powerful spur to implement this commercial-orientation. The AOL of 2006 by taking into account farmers' need in both business facilitation and limited restrictions is judged as key elements in developing commercial-orientation strategies.

Measurement and data analysis methods

The data for this research was collected from 236 small-scale rice farmers in Niono zone at Office du Niger who have a land size below 5 hectares. A five-point Likert scale was used to measure the EB and thereafter a confirmatory factor analysis (CFA) was conducted on the EB

constructs since they are psychometric variables. The CFA was followed by post-estimation tests, Kaiser-Meyer-Oklin measure of sampling adequacy, the Bartlett's test of sphericity and the Cronbach's coefficients alpha. The results indicated the fitness of CFA for the data and both adequate sampling, reliable and valid constructs. Lastly, multivariate Probit (MVP) and Tobit (MVT) were applied to determine the factors influencing the uptake of AOL's business incentives and farm performance since the dependent variables are binary and continuous variables respectively.

Level of entrepreneurial behaviour among small-scale farmers

This research considered EB of risk-taking, initiation, innovativeness, reluctance, proactiveness, self-efficiency and previous-failure since they are the most determinants in a successful business. The EB of small-scale farmers are good (second highest level) except for proactiveness and reluctance. Low scores of the two latters indicated not only a passive adaption to business environment but also dissatisfaction and demotivation of farmers towards farming. Better scores in risk-taking and previous-failure may not be due to farmers' risk-loving attitude rather the dominance of rice monoculture. Lastly, the high scores in initiation, self-efficiency and innovativeness showed farmers' readiness towards commercial-oriented farming, which is an allure for achieving AOL's policies (PDA and PNISA).

Factors influencing commercial-orientation of small-scale farmers

The percentage of AOL's business incentives uptake varies and remains in general lower than expected (Figure 1). The Fertilisers–Equipment subsidies are substitutes while the Equipment subsidy-Training incentives, Credit guarantee-Creation subsidies and Equipment subsidy-Agricultural funds are complementary.

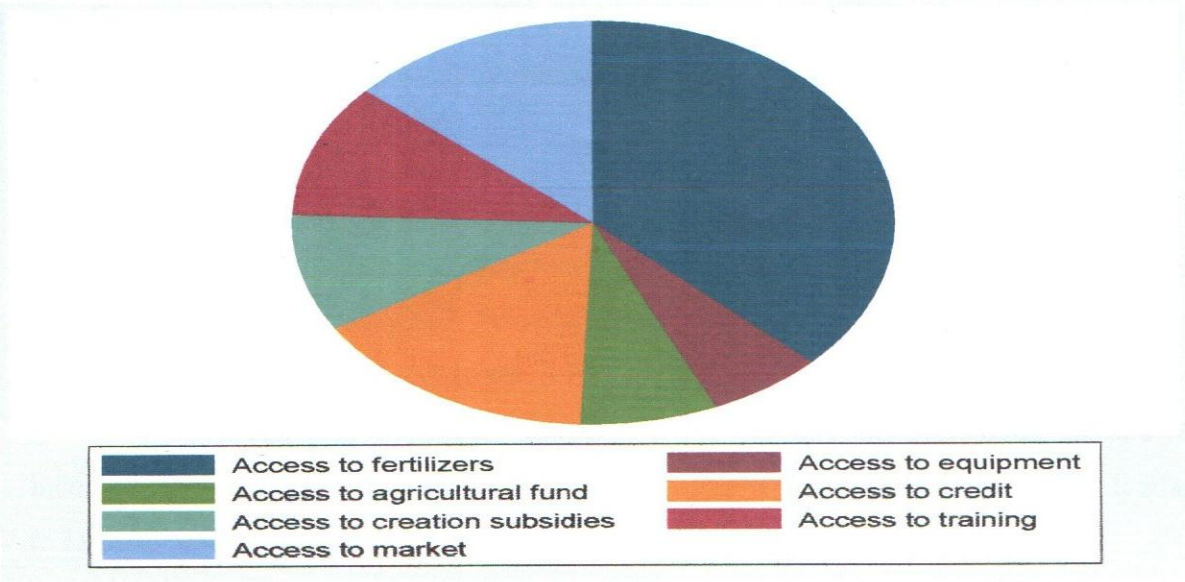

Figure 1: Uptake of AOL's business incentives by small-scale farmers.

The Entrepreneurial Behaviour affected the uptake of AOL's business incentives differently regarding farmers' judgement on benefit and constraints of the incentives. Incentives judged inadequate like Fs and ones involving much administrative procedures, timing and various institutions such as the Af are lees taken due to the inadequacy of target equipment and tedious administrative procedures. The dominance of monoculture, unpredictability in farming business and lack of information analysis makes the previous-failure disincentives farmers from the uptake of Market incentives and Creation subsidy. Similarly to EB, many socio-economic and institutional factors such age and land size, the household size, farm size in farmers' network and frequency of meeting also contribute to the uptake of AOL's business incentives.

Regarding farm performance, the indicators used are sales, profitability and post-harvest losses (PHLs). Higher EB of initiation and innovativeness as well as farmers disposing of better facilities, credit in the counter-season, higher farm asset value, off-farm activities, larger land size and access model farms perform better than others. However, the bigger household and a network with bigger farm size are less strict in PHLs handling, thus underperforming at this level.

Conclusion

The uptake of incentives was less than expected though the farmers' EB was good except the proactiveness and reluctance. The EB contributed to the uptake differently regarding the

benefit and administrative burdens. In addition to the effect of EB, other socio-economic and institutional factors are impulse to implementation of AOL's strategies.

Recommendations

With the farming business incentives, the transition to commercial-orientated farming must be much more realized than it is currently. The effective implementation of AOL should involve improving small-scale farmers' EB through more training, farmer-to-farmer approaches and access to adequate information and simplified services. Similarly, the government should also facilitate farmers' investment and diversification of source of incomes. Lastly, the incentives such as Equipment subsidy and Funds should be well adapted to farmers' socio-economic conditions for better implementation. .

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