Effect of Entrepreneurial Behaviour on Farm Performance among Small-scale Farmers: Case of Niono Zone, Mali

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ABSTRACT

This study examines the determinant of Entrepreneurial Behaviour (EB) on farm performance among small-scale rice farmers in Niono zone, Mali. The data of the study were collected from 236 randomly selected farmers who had less than 5 hectares, through a semi-structured questionnaire. Sale, profitability and post-harvest losses (PHLs) were used as farm performance indicators. The data analysis was carried out using confirmatory factor analysis (CFA) on selected EB, and multivariate Tobit model to examine determinant of EB farm performance. The diagnostic test indicated the absence of collinearity issues while post-estimation test of CFA indicated good fitness of the model and reliability and validity of data. The results of the research show that EB of as initiation and innovativeness, household head’s years of schooling and the amount credit in the counter-season improved farm performance by reducing PHLs. Land size , farm assets values and access to model farms improved farm performance by increasing both sales and profitability. The study concluded EB improved farm performance, and its determinant is enforced by other socio-economic and institutional factors of small-scale farmers. The study recommended enhancing more EB as well as establishing better business environment to incentivize farming business towards commercial-oriented farming. This can be done through more training, access to land, improving farmers’ investment ability and sharing of information, techniques and technologies among farmers.

INTRODUCTION

Agriculture is the main contributor to the Malian economy with 80% of employment and 40-45% to the Gross Domestic, but still dominated by small-scale farming (MoA, 2009; GoM, 2014). An export earnings of 30% and annual growth of 3.6 are judged to be under performance (PNISA, 2010; MAAF, 2014). It also faces many challenges such as exponential growth of the population, illiteracy of majority of small-scale farmers, low productivity, decrease in arable land and vulnerability of the production system, climate and related risks (Konaré, 2001; IFAD and Keita, 2011; John et al., 2011).

Agricultural Orientation Law (AOL) established in 2006 was considered to enhance modernizing the Malian Agriculture and face the challenges (GoM, 2006; PDA, 2013). The AOL and its different framework (Agricultural Development Policy and
National Programme for Investment in the Agricultural Sector) gained more attention in the event of a series of riots known as “riots of hunger in West Africa” during the food and nutritional crisis of 2007-2008, and worldwide financial crisis of 2007-2011 (GoM, 2010; GoM, 2014). These policy decisions stipulated better environment for business, simplified trade restrictions and taxation, better institutions, stakeholders’ skills, infrastructures and subsidies for Small and Medium Enterprises of Agriculture. The IFM (2015) and USDS (2015) qualified these strategies as key incentives to boost both national and foreign investments in agriculture sector, hence promoting commercial-orientation farming through agricultural entrepreneurship.

The Entrepreneurial Behaviour is a (EB) is a showcase of particular characteristics for both initiation of business and its successful management (Muhammad and Junaid, 2016). The EB is shaped by favourable policies and the insight of the businessperson which willingness and achievement. It involves creation of business entities, their efficiency and formalization of old ones (Diallo, 2012). This EB is also crucial for enterprise growth, hence its determinant role in policy decision and the country’s economic growth (Gajanyake, 2010). In the field of EB research, many personality traits which are diverse and divergent are believed to be potential for EB (Mueller and Thomas, 2001).

In EB research, there are three main theories: classical, neoclassical and behaviourism. The classical theory views free trade, competition and specialization as the most determinants of EB. The neoclassical theory also called Marshallian analysis links EB to the process of utility maximization and market-clearance (Endres and Wood, 2003). This theory is complemented by Austrian Market Process (AMP) that takes into consideration time scale and human intervention in opportunity discovery. However, the latter ignores the process of opportunity discovery (Endres and Wood, 2003). The economic theory of EB is supplemented by the opportunity-based and resource-based theories that takes into account disposal resources, time frame and place for any business (Akio, 2005).

EB theory distinguishes “solo venture” and “homophile” based on number of businesspeople involved in identification, creation and exploitation of opportunities. The “solo venture” is concreted by an individual while “homophile” is realized by group businesspeople (Endres and Wood, 2003). Lau (2012) and Kautoen (2014) counted diverse personality traits for the value of EB: risk-taking aptitude, will for self-employment, reluctance, innovativeness, desire for change and opportunism. Mueller and Thomas (2001) also supported other personality traits to be crucial for EB: autonomy, self-reliance, self-efficiency, proactiveness, initiation and resourcefulness.

According to behavioural science the EB can be affected differently by different social factors such as ethnicity, network and emulation (Salaff et al. 2013). Gleason (2003) argues that culture, collectivism, and previous means such as events, skills, awareness, education and work experience can also sharp both the ability and willingness of a person towards business. Akhter and Sumi (2014) found that social burden and the risk aversion make women less entrepreneurs compared to men. Kautonen (2014) also reported that some types of entrepreneurialships with regard to age follow the inverse u-shape with a pick at 35-44 years. Lastly, Bula in 2012 pointed out that the entrepreneurship in Least Developed Countries is more of imitation than innovation.

The EB theory has discordant views and its application lacks details due to its inability to measure “unconsciousness in self-estimation” and high biasedness if only few traits are considered in the study (Østergaard, 2014). Welter (2011) highlighted that EB studies should equally consider external factors and intrinsic values of the entrepreneur, multifaceted view and “cut across levels” of analysis. According to Collins (2004), the boundaries between the personal traits considered in behavioural study overlap, and neither internal
factors nor external ones alone can lead to a conclusive research.

Recent agricultural reforms have been considered by different partners of development of Mali to be incentives for small-scale farmers’ farming business. However, there is lack of knowledge about determinants, motivation and ability of farmers to exploit these business opportunities that enable transition towards commercial-oriented farming. Filling the gap of knowledge on EB, socio-economic and institutional determinants of farm performance is paramount of importance since it determines the key factor for transition to commercial-oriented farming.

This study is to contribute to fulfil the current gaps of knowledge on farm performance as well as socio-economic and institutional factors influencing this performance. The paper first seeks to find out the role of farmers’ EB on farm performance, which is important in determining transition to commercial-orientated farming. It is also help find out factors influencing farm performance, which is important for efficient and effective policy decision-making. Sales, profitability and post-harvest losses were used as indicators of farm performance. Since all indicators are continuous variables, the multivariate tobit was use of its ability to estimate a set of factors that influence the farm performance and the relationship between the different indicators simultaneously (Patnaik and Sharma, 2013). Consideration of this interdependency of indicators is crucial since ignoring it may lead to misspecification of the model, thus misleading in formulation of policy.

The study is structure as follows: a first section to introduce the study; the second section displays the methodology that includes study area, sampling method and both conceptual and analytical frameworks; third section presents the findings and discussion of the study; the last section is composed of conclusion and recommendations.

**Materials and methods**

**Study area**

The study was carried out at Segou region particularly in Niono zone located at Office du Niger, at 235 km northeast from the capital city Bamako. Niono zone is in the lowland of Kala in the central delta of river Niger within the geographic coordinates of 14°15´N5°59W. The zone is the second oldest zone of irrigated perimeter of Office du Niger. It is also the most important point of French colonization, and remains up to now the country icon of rice production (Merieau, 2001). It has an accommodated area of 13696 hectares for irrigation on perimeters. The potential of water and land suitable for irrigation by gravity added to more than half century experience of farmers in irrigated agriculture made Niono being in relative technology advancement, having better farming skills in the country and attractive area for investment in irrigated agriculture (GEDURU, 2009; Jean-Michel et al., 2016).

**Sampling procedure**

The study used multi-stage sampling procedure to collect both qualitative and quantitative data. Firstly, Niono zone was purposively selected based on its high potential of irrigated rice production and relative better socio-economic and institutional organizations of farmers in the country. Secondly, rice producers having less than 5 hectares were selected. The selection ignored farmers called “non-residents” due to their inaccessibility and subsistence farming practices. Lastly, a linear sampling technique was carried out select population of interest from the list of farmers at ON. The interval of selection was 25, thus every 25th farmer on the list was for an interview. A sample size of 236 households was determined using a formula proposed by Cochran (1957) cited by Polonia (2003):
Whereas \( n \) is the sample size; \( p \) is the population of interest; \( q = 1 - p \) and \( e \) is admitted error.

An interview of 236 households was carried out by trained enumerators. The interview was preceded by a pre-test for understanding the local trend, evaluation of the instrument reliability and adjustments in order to include all relevant details of the study as proposed by Sitzia (1999). The collected information concerned farmers’ self-estimation of EB, related information to the selected indicators (sales, profitability and PHLs) and farm and farmer’s socio-economic and institutional characteristics such as farm size, age, years of schooling, farming experience, inputs, yield, prices, farm assets, network, credit and access to extension services providers.

**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. This small-scale farmers’ profit maximization objective is captured in the following equations:

\[
\pi_i = TR_i - TC_i \tag{2}
\]

\[
\partial \pi_i = MR_i - MC_i \tag{3}
\]

\[
AtMax \pi_i, MR_i = MC_i
\]

The 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.

**Conceptual framework**

The study adopted a conceptual framework based on the relationship between the EB and farm performance (Figure 2). Commercial-orientation of small-scale farmers is influenced by both internal factors (farm size, farmer’ age, education level, farming experience, business ownership and farm ownership) and external factors. (legislations and other institutional factors such as distance to market, access to financial institution, extension services and social network). This performance is noticed through putting more output into market, more profitability and less post-harvest losses.

The selected three indicators, sales, profitability and PHLs are considered to be the main incentives of making investment decisions at farm level. The profitability is determined using the gross margin (GM) analysis which is the difference between output value and the value of total variable cost as follows:

\[
GM = Q_j P_j - X_j P_{xj} \tag{4}
\]

Where:

- \( GM \) is Gross Margin;
- \( Q_j \) is the quantity of output \( j \) of farm;
- \( P_j \) is the output \( j \) price;
- \( X_j \) is the amount of input \( j \) used; and
- \( P_{xj} \) is the input \( j \) price.

The limitation of using GM is that the fixed costs are excluded, hence possibility of inaccurate conclusion due to its incompleteness. Also, the results of this model are generally acceptable for only the current season of production.

To determine the sales and PHLs, the study used respectively the ratio of output sold and the output lost at post-harvest level since both indicators are more likely exerted by the quantity of output gained as well the land size. The monetary value of each was obtained by multiplying their respective ratio of the amount by the price.

According to Harris and Lindblad (1976), the economic cost of PHLs is represented by:
Figure 1. Conceptual framework

Table 1. Entrepreneurial behaviour retained after Confirmatory Factor Analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk-taking</td>
<td>3.957</td>
<td>0.054</td>
</tr>
<tr>
<td>Self-efficiency</td>
<td>3.881</td>
<td>0.052</td>
</tr>
<tr>
<td>Proactiveness</td>
<td>3.292</td>
<td>0.109</td>
</tr>
<tr>
<td>Initiation</td>
<td>4.190</td>
<td>0.048</td>
</tr>
<tr>
<td>Previous failure</td>
<td>2.941</td>
<td>0.082</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>4.117</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Bartlett’s test of sphericity
\[ \chi^2 = 3237.45, DF = 406, \rho = 0.000 \]
Kaiser-Meyer-Olkin test = 0.92
Cronbach’s alpha = 0.52 to 0.80

Note: Std. Err means standard error
\[ PHL = V_S - V_D \]  

Whereas:

PHL represents post-harvest loss; \( V_S \) is the value of a standard set; and \( V_D \) is the value of damaged product.

PHLs are not completely physical, instead economic. PHLs reduction is considered as profit maximization problem and is influenced by many socio-economic factors. For a performing farm with two inputs \( \dot{X} \) (input to PHLs) and \( \ddot{X} \) (all input to production), the generalized equation is:

\[ Y = f(X \dot{X}) \]  

At profit maximization:

\[ \pi = PY - C_L \ddot{X} - C_A X \]  

Whereas: \( C_L \) is the Cost for PHLs mitigation measures; \( C_A \) is the cost for all production; By solving this expression for \( Y \), the output can be expressed as function of \( \dot{X} \):

\[ Y = \frac{\pi}{p} + \frac{w_2}{p} \ddot{X} + \frac{w_i}{p} \dot{X} \]  

Where \( p \) is the intercept of \( Y \); and \( \frac{w_2}{p} \ddot{X} \) is the slope of profit line (\( \pi \)), which represents the marginal product of PHLs reduction. Based on the product values, this implies that the higher the prices of products the greater the benefits and vice-versa. Therefore, rational farmers accept to mitigate PHLs when benefits are greater than the costs.

Sale is expressed as proportion of output let into market over the total value of production.

\[ S = \frac{V_{om}}{V_{ta}} \]  

Mathematically this will be:

\[ S = \frac{V_{om}}{V_{ta}} \]  

Where \( S \) is commercialized output; \( V_{om} \) is the value of output let to market; and \( V_{ta} \) is value total product.

The correlation analysis was used to assess the extent to which sales, profitability and PHLs are related. These indicators are all continuous variables and have zero as threshold. In such a case, the Ordinary Least Square (OLS) would be inappropriate due to its inconsistency with censored data and inability to simultaneously estimate the relationship among underlying latent variables (Kongolo et al., 2011). The presence of zero in the equation also makes the use of Seemingly Unrelated Regression due to inconsistence of estimators (Moon and Perron, 2006). Likewise, the univariate tobit as well as bivariate tobit would also be limited for its failure to estimate simultaneous equation of three equations and inability to consider the interdependence of dependent variables and their latent variables (Arppe, 2008). Anastasopoulos et al. (2008) stated that a multivariate model performs better due to the holistic approach of the former in terms of interrelation of dependent and latent variables. The model assumes the presence of a latent variable, a parameter determining the relationship between the latter and the independent variable, and an error term with normal distribution that captures the random influences of the two variables’ relationship (Adesina and Baidu-Forson, 1995). This is explained in the equations below:

\[ Y = \begin{cases} y^* & \text{if } y^* > 0 \\ 0 & \text{otherwise} \end{cases} \]  

The likelihood function of mvtobit model is given by the following formula:

\[ L = \prod_{i=1}^{s} = p(y_i = y^* | y_i > 0) = \prod_{i=1}^{s} = \frac{1}{f(y_i - x_i \beta)} s \frac{F(x_i \beta)}{s} \]
Where \[ \prod \] is the product of positive observation for \( y_i \), \( f(.) \) density function, \( F(.) \) cumulative distribution function and \( s \) the standard deviation. The unknown parameters are the solution to the Maximum Likelihood Function (MLF).

The independent variables \( (x_i) \) in this study are entrepreneurial behaviour and the socio-economic and institutional characteristics that can influence farm performance of small-scale farmers. Lastly, the dependent variables \( (Y) \) are represented by sales, profitability and post-harvest losses of farm as indicated in Table 2.

Entrepreneurial behaviour is of psychological constructs based on self-estimation. It uses psychometric tools to measure intention, ability, attitude and traits related to behaviour. The psychometric tool used by the study to measure the EB constructs 5-point Likert scale similarly to Bertram (2017). The self-estimation or psychometrical tools have five different levels of predetermined answered, “Agree”, “Strongly agree”, “Neutral”, “Disagree” and “Strongly disagree”. This scaling technique of 5-point Likert scale is unidimensional, non-comparative and preferably to be treated as ordinal data. The groups of statement were formed by an agglomeration of many related items, thus the appropriateness of using, sum method to analyse the Likert scale.

The Confirmatory Factor Analysis (CFA) was used for EB scores of small-scale farmers. The CFA consisted of running Principal Component Analysis (PCA) on the seven selected EB followed by a Promax rotation. This rotation is important due to its assumption of existence of high correlation among factors and its ability of achieving a simplified structure (Yong and Pearce, 2013). Therefore, factor loadings will simplify the interpretation of results since constructs with high correlations are loaded into the same components (Katchova and Enlow, 2012). The relevancy weightage was applied on each factor using a formula adapted from Achilleas (2013) as follows:

\[
EBRW = \sum_{i} \frac{F_{score_i} \times item_i}{T_{score}}
\]

Where: \( EBRW \) is the Entrepreneurial behaviour relevancy weightage; \( F_{scores_i} \) is \( i^{th} \) factor score; \( item_i \) is \( i^{th} \) item of the statement; and \( T_{score} \) is the total factor score.

The EBRW requires that the values of CFA using 5-point Likert scale should be within 1-5 as the level of scale itself. Accordingly, all factors were relevant and were retained for further analysis. Subsequently, a correlation test was carried out on the set of retained EB. The factor of EB for reluctance had high correlation with many other EB, therefore it was discarded in order avoid multicollinearity issues. As post-estimation tests, Bartlett’s test of sphericity, Kaiser-Meyer-Olkin (KMO) measures of sample adequacy and Cronbach’s coefficient alpha were carried out to assess relevance of using CFA in the study, sampling adequacy and data reliability as suggested by (Boohene et al., 2012; Glen, 2016).

Farm performance indicators

Chittihaworn et al. (2011) consider that the indicators of farm performance are the key elements to find out farm improvement and its business opportunities. Its analysis is complicated since it involved many factors and the specificity of Line of Business entities. Ted (2015) divided the Key Performance Indicators (KPI) into four main groups of metrics: “Financial Metrics”, “Customer Metrics”, “Process Metrics”, and “People Metrics”. However, many recent empirical studies focus on use financial perception, non-financial perception, and historical perception as indicators (Kraus et al., 2012).

By use of any indicators, farm performance is influenced by factors that can be classified into internal and external (Harris et al., 2012). Kökemuler (2016) posits that matching the ability of
using internal factors, taking opportunities and consideration of the risks of external factors is the key to a performing farm. In other words, farmers’ EB is one of the most determinants for farm performance. The authors define the internal factors as the ones related to farmer’s characteristics and organizations more or less controlled by farmers: motivation, devotion, skills, information and networks. Morrison et al. (2014) found the marital status as internal factor that affects farm performance and that male-run enterprises perform better than female-run enterprises. In all above mentioned studies, the external factors (beyond farmer’s control) are legislation, political, technological, access to loans, norms, and preference and affordability of the product by consumers.

Sale is the amount of outputs let into market. A farm unable to put any output into market is qualified subsistence farm (Chirwa and Matita, 2012). The sale is the commonest option for small enterprises to remain in business and it is their most used indicator to assess farm performance and making decisions (Chen et al., 2003). According to Chen et al. (2003), this indicator primes on the others due its demand of additional capital, labour and yielding in risen profitability. The sales can be used as indicator in four ways: net-market position, specialization index, sales-to-income ratio and sales-to-output ratio, (Jaleta et al., 2009). The latter way is preferred to others in the context of small-scale farmers since it considers factors such as market surplus, household itself, location, specific transaction costs that are more crucial than crop type in determining household sales level. However, using cross-sectional data in analysis of sale is limited due to time and context specificity, and it lacks of sufficiency to reflect situation which can be done only over long period of observation (Jaleta et al., 2009).

In benchmark analysis, the profitability is the precondition for strength and advancement of any relationship between production and market (Franks and Collis, 2016). Kahan (2013) considered the profitability being the indicator of farm survival, growth, success and a payback for farmer’s time and efforts. As define by Alda (2008), a farm is said to be make profit at a given period if the total sale revenues are greater than the cost. 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 its weakness 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 since better quality positively influences farm profit maximization (Freiesleben, 2005). A defective product is a product that has lost one of its natural qualities that depreciate it or make it unusable for its origin purposes. Kays (1999) classified the defect factors into biological, entomological, physiological, cultural or environmental, mechanical damage, extraneous matters and aberration or variation due to genetic. Additionally, minimization of post-harvest losses (PHLs) can also be used as an indicator of enhanced quality and better performance. PHL is a defect in products (visible or invisible) that occurs between harvest and final consumption. The use of defect in products as an indicator is limited to an extent where the defect is not always visible and cannot be detected immediately (Rosselli, 2014).

Results and Discussion

Results of preliminary test

Diagnostic tests were carried out, and indicated the values of individual Variation Inflation Factors of less than 10 with a mean of 1.30. This result confirmed the absence of multicollinearity issues.
with the data. Bartlett’s test of sphericity, KMO measure and Cronbach’s alpha (see Table 1), carried out for CFA post-estimation tests, indicated fitness of data for CFA, marvellous sampling adequacy and data reliability.

**Determinant of farm performance among small-scale farmers**

Sales, post-harvest losses and profitability were the indicators used for farm performance measurement. The mvtobit was used to determine the factors influencing farm performance. The results of this analysis are presented in Table 2. The likelihood ratio of \( \chi^2 = 237.7, p = 0.000 \) 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 of sales and profitability.

The results as presented in Table 2 show that household head’s years of schooling negatively and significantly influenced the PHLs at 10% significance level. In other words, one year increase in household head’s years of schooling reduced 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 PHLs at all farm levels, on-farm activities, storage, process and marketing level.

Household size had a positive 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 can lead to huge PHLs. 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 Group, 2011). The reports further notes that this 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 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 individual farmers compared to the family one were 92% less likely to experience PHLs. This is because the former are more strict on labour and services qualities, efficiency and accountability which 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 (2017) asserted that in family farming the responsibilities are not well determined neither is management quality good enough. Further, the report stated that this affects negatively on productivity and products 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 having 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 those model farms. The latter can also source labour and create trade relationships with small-scale farmers which results in improved output and output price hence increased profitability. 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. The author further noted that the direct effects for adopters can be gains in production and reduction in production cost while the indirect effects can be increase in supply and income.

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

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**Table 2. Multivariate tobit results on farm performance indicators**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Profitability</th>
<th>Post-harvest Losses</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm and farmers’ characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of household head</td>
<td>0.005</td>
<td>0.005</td>
<td>-0.023</td>
</tr>
<tr>
<td>Schooling years of household head</td>
<td>-0.007</td>
<td>0.013</td>
<td>-0.130*</td>
</tr>
<tr>
<td>Household size</td>
<td>0.008</td>
<td>0.005</td>
<td>0.052**</td>
</tr>
<tr>
<td>Nature of business</td>
<td>0.073</td>
<td>0.047</td>
<td>-0.942**</td>
</tr>
<tr>
<td>Income of off-farm business (FCFA)</td>
<td>-0.007</td>
<td>0.007</td>
<td>-0.046</td>
</tr>
<tr>
<td>Total land of household head (ha)</td>
<td>0.229***</td>
<td>0.028</td>
<td>0.057</td>
</tr>
<tr>
<td>Farm asset value (FCFA)</td>
<td>0.080**</td>
<td>0.026</td>
<td>-0.002</td>
</tr>
<tr>
<td><strong>Institutional factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of attended business training</td>
<td>-0.012</td>
<td>0.047</td>
<td>0.301</td>
</tr>
<tr>
<td>Average age of network members</td>
<td>-0.002</td>
<td>0.005</td>
<td>0.023</td>
</tr>
<tr>
<td>Average farm size of network members</td>
<td>0.030</td>
<td>0.031</td>
<td>0.300*</td>
</tr>
<tr>
<td>Average distance between network members</td>
<td>-0.001</td>
<td>0.001</td>
<td>-0.014*</td>
</tr>
<tr>
<td>Average frequency of meeting in the network</td>
<td>-0.011</td>
<td>0.013</td>
<td>-0.094</td>
</tr>
<tr>
<td>Access to a model farm</td>
<td>0.182*</td>
<td>0.095</td>
<td>0.879</td>
</tr>
<tr>
<td>Amount of business credit (FCFA)</td>
<td>0.001</td>
<td>0.011</td>
<td>-0.167**</td>
</tr>
<tr>
<td><strong>Entrepreneurial Behaviour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficiency</td>
<td>0.019</td>
<td>0.068</td>
<td>-0.048</td>
</tr>
<tr>
<td>Initiation</td>
<td>-0.082</td>
<td>0.080</td>
<td>-0.081*</td>
</tr>
<tr>
<td>Risk-taking</td>
<td>-0.051</td>
<td>0.059</td>
<td>-0.125</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>-0.009</td>
<td>0.058</td>
<td>-0.581*</td>
</tr>
<tr>
<td>Proactiveness</td>
<td>0.014</td>
<td>0.032</td>
<td>-0.231</td>
</tr>
<tr>
<td>Previous-failure</td>
<td>0.013</td>
<td>0.051</td>
<td>0.052</td>
</tr>
<tr>
<td>Constant</td>
<td>12.636***</td>
<td>0.611</td>
<td>16.244**</td>
</tr>
</tbody>
</table>

**Note:** 1 is in natural log; *, **, ***, respectively means significant at 10%, 5% and 1%
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 relative higher access to financial institutions and loan for their activities. This contributes to 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. 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 farmer’ 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 at 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 sources. 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 PHLs. Sumsudin (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 subject to poor agricultural practices which can result in PHLs in the absence of extension services.

The amount of credit in the 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, pre-harvest, harvest, transportation, storage and market. Kumar et al. (2006) 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.
WBG (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 this behaviour was 58% less likely to experience PHLs. Innovators are characterized by their systematic approach and strategic orientation in decision-making process. These qualities make them more autonomous and aggressive competitors with higher sense of marketing, learning and entrepreneurial orientation which includes reduction of PHLs. The inadequacy of extension services and inefficiencies of farmers’ organizations at ON require farmers to be more innovative to handle agricultural challenges like PHLs. Rudman (2008) concluded that after establishing good links, socio-economic and farm characteristics, the innovativeness of a farmer is a key to enhance farm performance due to its positive impacts on loss reduction.

Initiation was significantly negative towards PHLs at 10% significance level. A farmer with EB of initiation was 8% less likely to experience PHLs. The EB is embedded in self-motivation and action-oriented which improves farmers’ ability to make efficient decision and achievement on their own. It also allows farmers to come up with strategies that will turn the situation where they would face lesser losses. 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 et al. (2010) similarly noted that initiative ability of a farmer could as well help to minimize production and market-related risks like PHLs, thus transforming them into opportunities.

Conclusion and recommendations

The outcomes of sales and profitability are highly correlated, confirming that the higher the sales the more the profitability. The study established EB such as initiation and innovativeness as well as household head’s years of schooling and the amount credit in the counter-season as main factors that contribute to farm performance by reducing PHLs. Similarly, land size, farm assets values and access to model farms improved farm performance by increasing both sales and profitability. Conversely, household size, family business and farmer’s network reduced farm performance by increasing PHLs.

Based on the results, the study recommends that entrepreneurial behaviour should be enhanced and improved among small-scale farmers by trainings, sharing information and promoting farmer-to-farmer approaches. Policies should also be developed to help farmers’ investment in farming business through improved access to land, financial institutions, agricultural modern technologies and farm management skills.

Reference


Anastasopoulos, P.Ch., Tarko, A.P., Mannering, F.L. Tobit Analysis of Vehicle Accident Rates on Interstate


