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DOI

[10.1016/j.forpol.2020.102331](https://doi.org/10.1016/j.forpol.2020.102331)

Publication date

2021

Document Version

Final published version

Published in

Forest Policy and Economics

License

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[Link to publication](#)

Citation for published version (APA):

Bannor, R. K., Ros-Tonen, M. A. F., Mensah, P. O., Derkyi, M., & Fumey Nassah, V. (2021). Entrepreneurial behaviour among non-timber forest product-growing farmers in Ghana: An analysis in support of a reforestation policy. *Forest Policy and Economics*, 122, [102331]. <https://doi.org/10.1016/j.forpol.2020.102331>

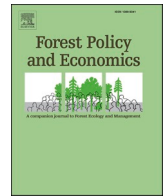
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Entrepreneurial behaviour among non-timber forest product-growing farmers in Ghana: An analysis in support of a reforestation policy

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ARTICLE INFO

Keywords:

Agripreneurship
Entrepreneurial scores
Entrepreneurship development programmes
Non-timber forest products
Reforestation policy
Ghana

ABSTRACT

Despite widespread acknowledgement of the importance of entrepreneurship for poverty alleviation, studies on entrepreneurship are scant for farmers engaged in the production of non-timber forest products. This study, therefore, examines the entrepreneurial status of farmers involved in the production of non-timber forest products, focusing on those involved in a reforestation scheme in three forest districts in Ghana. Caird's revised General Entrepreneurial Tendency test and quantile regression were used to calculate farmers' entrepreneurial scores and the respective influencing factors. Results show that most farmers had low to medium entrepreneurial scores. Across all quantiles, market information and value-addition knowledge had a positive influence on farmers' entrepreneurial scores. The study also revealed quantile-specific factors, with demographic factors (age, gender), years of farming, and networks with value-chain actors having a significant influence only at the lower quantile of entrepreneurial scores, and personal commitment, adaptability to new technology, and scientific advice being more significant at the upper quantile. At the low-to-median quantiles of entrepreneurial scores, socio-economic factors such as land size and off-farm jobs had a positive influence. The paper concludes that farmers with different entrepreneurial scores are susceptible to different factors that help or hinder improving their scores. This implies that entrepreneurship development programmes should be tailored to different farmer segments. Out of inclusivity and feasibility concerns, we recommend achieving this through an integrated yet diversified approach that combines generic and segment-specific needs. One way of doing so is through an annual market fair/exhibition during which NTFPs from community reforestation schemes are branded; networking opportunities among value chain actors are offered; market information on prices, demand and available buyers is provided; and training workshops on post-harvesting processing technologies are organised.

1. Introduction

Entrepreneurship is assumed to be a significant catalyst for economic growth and development in developing countries (Spring, 2009). It can be defined as the pursuit of economic wealth through creative initiatives of the individual operating within an uncertain environment constrained by limited tangible resources (Austin et al., 2006; Mitchell et al., 2002). Entrepreneurs establish new businesses to increase wealth for themselves, as well as for their local and national economies (Spring, 2009). In developing countries, entrepreneurship and entrepreneurial

behaviour have been mainly studied among small and medium enterprises (SMEs) (Adom et al., 2018; Afreh et al., 2019; Obeng et al., 2014; Quaye and Acheampong, 2013). Much less is known about entrepreneurship in agriculture and allied sectors such as forestry (Atiase et al., 2018; Boer, 2013; Chipfupa, 2017; Hilmi, 2018; Nukpezah and Blankson, 2017). Yet, agriculture and forestry dominate the mostly poor and underprivileged economies in rural sub-Saharan Africa (Yeboah and Jayne, 2016). Entrepreneurship development is therefore assumed to play a crucial role in reducing rural poverty and enhancing wealth creation (Smit, 2004).

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<https://doi.org/10.1016/j.forpol.2020.102331>

Received 10 April 2020; Received in revised form 24 July 2020; Accepted 16 October 2020

Available online 24 October 2020

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This paper situates the analysis of entrepreneurship in the context of a strategy by the Ghana Forestry Commission to integrate non-timber forest products (NTFPs) (see [Box 1](#) for definitions) in a reforestation scheme with small-scale farmers; the modified taungya system (MTS). The MTS is a co-management system between the Forestry Commission and small-scale farmers aimed at restoring degraded forest reserves ([Ros-Tonen et al., 2014](#)). Under the arrangement, farmers are allowed to interplant food crops and keep 100% of the proceeds thereof, while being entitled to 40% of the timber revenues and 5% as community benefit in return for their work in tree planting and maintenance, and the protection of the forest reserve ([Acheampong et al., 2016](#); [Andoh and Lee, 2018](#); [Foli et al., 2018](#); [Kalame et al., 2011](#)). After canopy closure (about three years after tree planting), food crops can, however, no longer be grown, and most farmers lose their interest in the scheme. To curb this situation and create mid-term benefits prior to timber harvesting, the Forestry Commission, in collaboration with the non-governmental organisation (NGO) Rural Development and Youth Association (RUDEYA), piloted the introduction of shade-tolerant non-timber forest products (NTFPs)¹ – honey, black pepper (*Piper guineense*) and grains of paradise (*Aframomum melegueta*) ([Treefarms Project Consortium, 2016](#)). This intervention is based on the assumption that the commercialisation of non-timber forest products (NTFPs) creates jobs and income, and serves as a safety net for rural residents and migrants ([Ahenkan and Boon, 2010](#); [Amoah and Wiafe, 2012](#); [Mahapatra and Tewari, 2005](#); [Shackleton and Shackleton, 2006](#); [Sunderlin et al., 2005](#)). As a consequence, it can assumedly act as a rural poverty reduction strategy ([Matias et al., 2018](#)).

According to [Belcher and Schreckenberg \(2007\)](#), two critical – but contested – assumptions underlie policies and projects that promote the commercialisation of NTFPs. From a livelihood's perspective, the commercialisation of NTFPs is assumed to increase income and employment opportunities; while from a conservation perspective, it has been positioned that NTFP commercialisation could provide an incentive for forest conservation ([de Beer and McDermott, 1989](#); [Ros-Tonen, 2000](#)). Several authors ([Belcher et al., 2005](#); [Belcher and Schreckenberg, 2007](#); [Kusters et al., 2006](#); [Ros-Tonen and Kusters, 2013](#); [Sills et al., 2011](#)) are more cautious about these assumptions; positive livelihood outcomes have been reported, but require conditions of secure tenure and market access, equitable rule of law, and partnerships, while win-win outcomes for development and conservation remain illusive. However, because of some success stories about improved livelihoods notably among specialised NTFP harvesters ([Belcher et al., 2005](#)), several governments in the global South, including Ghana, still promote NTFP trade to combine livelihood and conservation aims ([Kusters et al., 2006](#)).

Although there is a broad literature on NTFPs, there has been scant attention to the role of entrepreneurship and entrepreneurial behaviour² in the success of such a strategy ([Belcher and Schreckenberg, 2007](#); [DeTienne, 2010](#); [Díaz-Pichardo et al., 2012](#); [Fitz-Koch et al., 2018](#); [Shane and Venkataraman, 2000](#); [te Velde et al., 2006](#)). Moreover, notwithstanding the recognition of the need to develop an entrepreneurial culture in farming businesses ([Yeboah and Jayne, 2016](#)), agricultural entrepreneurs still have less entrepreneurial skills compared to other sectors ([Dias and Rodrigues, 2019](#); [Pindado and Sánchez, 2017](#)). Thus, the gains from introducing NTFPs in Ghana's MTS could be short-lived without a critical understanding of what drives farmers to produce NTFPs as entrepreneurs. Moreover, there is limited understanding of the factors that affect and enhance the entrepreneurial behaviour of farmers

cultivating NTFPs. Identifying and predicting which factors will foster entrepreneurial behaviour among farmers is required to enhance entrepreneurship in the agricultural and forestry sectors. If entrepreneurship is accepted as an essential component for rural and national development, then a better understanding of the factors which promote the entrepreneurial behaviour of NTFP farmers is crucial. Against this background, this study addresses the question: what is the current entrepreneurial status of NTFP farmers, and which factors influence their entrepreneurial behaviour?

After introducing the notion of agripreneurship in the next section, [Section 3](#) clarifies the methodology used in this paper. [Section 4](#) analyses which factors affect entrepreneurship across farmers with varying entrepreneurial status. [Section 5](#) discusses the implications of the findings for entrepreneurship development programmes, after which the concluding section argues that in order to be effective, entrepreneurship initiatives should be integrated, yet differentiated, in order to meet the needs of farmers with divergent entrepreneurial skills.

2. Conceptual background: agripreneurship

Agripreneurship or agricultural entrepreneurship refers to the ability of an individual to recognise a profitable agricultural business opportunity by creating a venture that incorporates innovation for a successful agribusiness ([Otache, 2017](#); [Pindado and Sánchez, 2017](#); [Yusoff et al., 2016](#)). Agripreneurship and entrepreneurship are not different in terms of opportunities scouting, self-motivation, risk-taking and the need for achievement; but the first has its unique distinctiveness specific to the agricultural sector ([Díaz-Pichardo et al., 2012](#); [Lans et al., 2020](#); [McElwee, 2008](#); [Pindado and Sánchez, 2017](#)). Given the uniqueness of the sector, an understanding of the agripreneurial process and evaluation of the reasons why and how agripreneurs identify opportunities is essential ([Shane, 2007](#)). Moreover, unlike conventional business entrepreneurs, agripreneurs seem to have less entrepreneurial skills ([Pindado and Sánchez, 2017](#)). Farmers operate in a complex and variant environment, which in developing countries like Ghana is usually strongly constrained and unregulated. This environment acts as a substantial barrier to entrepreneurial activity ([Carter, 1998](#); [Díaz-Pichardo et al., 2012](#); [McElwee, 2008](#)).

Various factors influence farmers in agricultural and allied sectors and the entrepreneurial behaviour of agripreneurs is determined by a range of socio-economic and institutional characteristics ([Dias et al., 2019a, 2019b](#); [Morgan et al., 2010](#)). Hence standardised policies and initiatives to enhance agripreneurship without recourse to robust research will be either counterproductive or influence farmers in unintended ways ([Alsos et al., 2003](#)). Notwithstanding, agripreneurship has received little research attention compared to business entrepreneurship studies that usually focus on large, small and microenterprises in the manufacturing and services sectors ([Dias and Rodrigues, 2019](#); [Díaz-Pichardo et al., 2012](#); [Fitz-Koch et al., 2018](#); [Shane, 2007](#)).

A key distinction in developing countries is between agripreneurs as necessity and entrepreneurial farmers ([Boer, 2013](#)). This aligns with the distinction between survival and growth-oriented entrepreneurs ([Likoko and Kini, 2017](#); [Ros-Tonen et al., 2019](#)). A more refined classification comes from [Alsos et al. \(2003\)](#) who categorised agripreneurs into pluriactive, resource exploiting and portfolio farmers. The pluriactive farmers are similar to the necessity farmers and survival farmers. They have small land sizes and are risk-averse, less mindful of innovations and firmly rooted in farming as a culture. The resource-exploiting farmers are akin to the Boer's entrepreneurial farmers group. This group has networks outside the household – usually small, but more extensive than the former – exploits other opportunities, takes minimal risks, and is cognisant of new farming innovations ([Alsos et al., 2003](#); [Boer, 2013](#); [McElwee, 2008](#)). The third type of agripreneurs, the portfolio farmers, often exploit new ideas and have high capital requirements. They are mostly registered companies with larger farms compared to the first two and have employees outside the household or family members. The

¹ See [Box 1](#) for deliberations regarding the terminology used.

² In this study, entrepreneurial behaviour is used interchangeably with entrepreneurial status. Entrepreneurial scores were used to measure entrepreneurial behaviour of NTFP farmers in this study. Entrepreneurial behaviour refers to people with the potential or tendency to create wealth and accumulate capital by exploiting opportunities ([Caird, 2013](#); [Chell and Baines, 2000](#); [Shane and Venkataraman, 2000](#)).

Box 1**Non-timber forest products?**

NTFPs are defined in this paper as all tangible products of forest origin, excluding wood and wood-based products, either harvested from the forest or cultivated by farmers (Ros-Tonen and Wiersum, 2005; te Velde et al., 2006). Inherent in this definition is that NTFPs can be harvested from the wild as well as from human-modified or human-created vegetation systems such as farms and fallows (Ros-Tonen and Wiersum, 2005:130). However, the discussion of whether “an NTFP is really an NTFP if it is cultivated (...) can be a topic of hot debate” (Belcher and Vantomme, 2003:166).

Although particularly black pepper is generally considered an agricultural crop rather than an NTFP, we use the term NTFP here for three reasons. First, in the study area it finds its origin as a ‘forest food’ (like grains of paradise) and as such both species are domesticated NTFPs. Second, these products were labelled as such by the organisations (RUDEYA and RMSC) that took the initiative to introduce shade-tolerant species in the reforestation scheme and off-reserve tree farms. Third, unlike situations in which they are cultivated as farm products, they are secondary products from the reforestation scheme aside the trees.

Alternative terms have been proposed in the literature for NTFPs not harvested from the wild such as agroforestry products (e.g. Gyau et al., 2014), but we do not consider the reforestation scheme under study an agroforestry system since it is not (yet) a land-use system in which “woody perennials are deliberately integrated with crops and/or animals on the same land-management unit” (Leakey, 2017:5). We neither consider the term agroforestry tree products (AFTPs) (e.g. Leakey et al., 2005) as appropriate as these refer to domesticated trees.

classification suggests that agripreneurship provides an opportunity for business (growth-oriented), while simultaneously offering routes to economic survival (need-oriented) for different types of agripreneurs (Fitz-Koch et al., 2018).

3. Materials and methods

3.1. Study area

The study was carried out in seven forest fringe communities in the Nkwawie, Goaso and Mankranso Forest Districts in the Asante and Ahafo Regions of Ghana. These villages were purposively selected because these were the ones where the NGO RUDEYA piloted the introduction of black pepper and grains of paradise in the MTS and off-reserve tree farms between 2010 and 2012 (see Section 1). For general information on the forest districts see Table 1; for location of the selected communities see Fig. 1; and for communities and sample size see Table 2.

3.2. Sampling of respondents

In consultation with the NGO RUDEYA, farmers involved in the cultivation of black pepper and grains of paradise in reforestation schemes were selected. A total of 149 farmers are engaged in the cultivation of black pepper and grains of paradise in the study areas (Tree-farms Project Consortium, 2016). Out of these, 134 farmers (representing 89% of the sample frame) were randomly selected for this study. The questionnaire for this study was pre-tested among a group of 35 farmers in Akwaburaso and Nyamebikyere number 3.

Table 2 displays the distribution of respondents in the selected communities and the NTFP involved. It shows that black pepper was grown in only one community – Nyamebikyere No.3. This can be explained by the fact that RUDEYA established a black pepper demonstration plot there, and found farmers willing to follow up. In the other communities, however, farmers preferred grains of paradise over black pepper, as the latter is a climbing plant that they feared would harm their cocoa trees. Moreover, black pepper turned out to be less shade-tolerant than grains of paradise, resulting in more widespread integration of grains of paradise in the on- and off-reserve tree farms.

3.3. Data collection method

Questionnaires were administered to the selected farmers via face-to-face interviews. Data collected included demographic and household characteristics; respondents’ strengths and weaknesses regarding entrepreneurship; their entrepreneurial status measured through the

GET2 test (see next section for more details); factors influencing farmers’ entrepreneurial behaviour; and constraints to being an entrepreneur.

3.4. Data analysis

3.4.1. Assessment of farmers’ entrepreneurial status

The General Entrepreneurial Tendency (GET test), otherwise known as GET2 test (Caird, 2013)³ was adopted to assess the entrepreneurial behaviour of farmers growing black pepper and grains of paradise. The fundamental principle of this test is that the enterprising farmer might share some characteristics which could be nurtured and developed through entrepreneurship development programmes (Caird, 2013). The GET2 test offers an assessment of the enterprising behaviour of an individual, in our case, NTFP farmer. The significant five entrepreneurial abilities identified in the test include the need for achievement, need for autonomy, creative tendency, calculated risk-taking, and locus of control. The test consists of 54 questions, which are based on five entrepreneurial abilities. The highest score a farmer can get is 54. If a farmer scores 44–54, s/he is presumed to have high entrepreneurial ability. If the outcome score is 27–43, the farmer is ranked to have a medium entrepreneurial ability. A score between 0 and 26 indicates low entrepreneurial ability.

3.4.2. Identifying the factors influencing entrepreneurship scores among farmers: factor analysis and quantile regression

The study made use of factor analysis and quantile regression analysis to examine the factors influencing farmers’ entrepreneurial behaviour. Factor analysis is a data-reduction method, which reduces a large number of variables from questionnaire items to a few manageable factors that explain the dependent variable (Chawla and Sondhi, 2011; Liñán et al., 2011). These factors explain most of the variation of the original dataset. Factor analysis was used to reduce the data on 34 unique attributes (see Appendix 1 and 2) to eight manageable factors. Six sub-entrepreneurial abilities assumed to influence entrepreneurial status guided these attributes, namely (i) production knowledge, (ii) the need for achievement, (iii) risk management, (iv) the need for autonomy, (v) marketing knowledge and networking, and (vi) managerial ability (see Appendix 1 for details). The developed scale was pre-tested

³ The GET2 test is a modified version of the GET test developed by Caird (2013). In this study the GET2 test was used to assess the entrepreneurial potential of NTFP farmers. For more information on the GET2 test, see Caird (2013).

Table 1
Geographical context of the three forest districts.

Forest district ^a	Forest reserves and size ^a	Administrative district/ Region ^b	District population number ^c	Total number of settlements	Localities selected
Goaso	Abonyere; Ayum; Bonsam Bepo ; Goa-shelterbelt; Bonkoni ; Bia-Shelterbelt; Subin (total 390 km ²) ^a	Asunafo North Municipal District (Ahafo Region)	125,000	275 ^a	Ahantamo Npomase Nyamebekyere
	Abonyere; Bonsam Bepo (total 269 km ²) ^b	Asunafo South District (Ahafo Region)	95,580	n.a.	Anwiam Nobekaw Akwaburaso
Nkawie	Tano Offin ; Gyemara; Offin Shelterbelt; Asananyo (total 753 km ²) ^c	Atwima Mponua Administrative District (Ashanti Region)	108,000	310 ^c	Nyamebekyere No.3
Mankranso	Tinte Bepo; Tano Offin ; Opuro River; Kwamisa; Asufufu Basin (total 891 km ²) ^d	Ahafo-Ano South Administrative District (Ashanti Region)	161,000	219 ^d	

Note that some forest reserves cover multiple administrative districts. Those in bold were the ones closest to the selected villages. N.a. = not available. Sources: ^aANMD Assembly (2018); ^b ASD Assembly (2016); ^cAMDA Assembly (2014); ^dAASD Assembly (2014); ^eGSS (2012).

during the pilot phase of the survey and the necessary adjustments were made. The questions under each proposed ability (sub-scale) were checked for internal consistency as well as the broad-scale (see Appendix 2 for details). The questions were assembled from literature and pre-survey expert interviews and focus group discussions with farmers and foresters. Each proposed ability had between four and eight questions (Appendix 1). Farmers scored the responses to the 34 questions on a Likert scale ranging from ‘strongly disagree’ (score of 1), ‘disagree’ (score of 2), ‘neutral’ (score of 3), ‘agree’ (score of 4), and ‘strongly agree’ (score of 5). In the factor analysis, all questions (variables) under investigation were analysed together to extract the underlined factors.

By the use of 0.50 as the cut-off point for the rotated component matrix (see Appendix 3), eight factors were obtained (Appendix 4 and 5). A factor denotes a linear combination of variables, which is not directly observable, but is usually inferred from the response pattern (Chawla and Sondhi, 2011; Liñán et al., 2011). The variables extracted from the factor analysis were personal commitment, pay attention to details, family support, availability of farm labour, adaptability to new technology, marketing information, value-addition knowledge and networks with value-chain actors.

The factor analysis is formally expressed as:

$$F_i = W_{i1}X_1^* + W_{i2}X_2^* + W_{i3}X_3^* + \dots + W_{ik}X_k^* \quad (1)$$

where:

- X_1^* = ith standardised variable
- F_i = Estimate of ith factor
- W_i = Weight or factor score coefficient for ith standardised variable
- K = Number of variables

To analyse the extent to which factors identified from the factor analysis and other socio-economic factors influence farmers’ entrepreneurial scores as defined by the GET2 test, the quantile regression model was used. Quantile regression allows examining a complete description of the conditional distribution of the entrepreneurial score variables to just the conditional mean as in the Ordinary Least Square (OLS) estimation of the classical model (Anokhin and Schulze, 2009; Cade and Noon, 2003; Gujarati, 2015; Gustavsen and Rickertsen, 2006). Instead of looking at the measures of distribution as a whole, we were interested in the examination of the various segments of the distribution with a view to proposing segment-specific policy recommendations. In this study, the researchers were interested to know if the entrepreneurial scores of farmers in the different quantiles of the entrepreneurial scores’ distribution are similar or different, mainly because farmers behave similarly relative to entrepreneurship (Alsos et al., 2003). Consequently, it was essential to analyse not only the average effect via OLS, but also the differences at different levels of entrepreneurial scores (in our case 0.05, 0.25, 0.5 and 0.75 based on the distribution of the scores).

Knowledge of entrepreneurial behaviour of farmers at the different quantiles of entrepreneurial scores can assist policymakers and practitioners in pursuing specific strategies for a group of farmers who differ in entrepreneurial status. Given that it was expected that OLS estimates

would not sufficiently reflect the influence of the regressors throughout the distribution of the entrepreneurial scores (Verropoulou and Tsimbos, 2013), we employed the Quantile Regression (QR) model. The advantage of the QR model is that the assumption that the error is normally distributed is not mandatory as compared to OLS. In order to examine heteroscedasticity in the distribution of the entrepreneurial scores, the Breusch-Pagan/Cook-Weisberg test (Prob>Chi2) was used (Prob>Chi2 of 0.022 and 0.087 of model 1 and model 2 respectively (see Table 5 for more details). This indicated heteroscedasticity in the model, hence QR usage is appropriate for the study. The quantile regression is explained as follows:

Suppose a two-variable regression model in eq. (2):

$$A_i = M_1 + M_2 + X_i + u_i \quad (2)$$

In Ordinary Least Square (OLS) regression, error sum of squares is minimised:

$$\sum u_i^2 = \sum (A_i - M_1 - M_2X_i)^2 \quad (3)$$

In order to minimise the error sum of squares for the two parameters, the two ordinary equations obtained are set to zero and solved simultaneously.

However, in quantile regression (QR) the absolute sum of errors is minimised:

$$\sum |u_i| = \sum |A_i - M_1 - M_2X_i| \quad (4)$$

Thus, those values of parameters that minimise the sum of absolute errors is calculated. If \hat{A}_i is the estimated value of A_i , eq. (4) amounts to minimising

$$\sum |u_i| = \sum |A_i - \hat{A}_i| \quad (5)$$

When Eq. (5) is minimised, the line that we obtain is called the median regression line (0.50 quantile), also known as the LAD (least-absolute deviation) estimator (Gujarati, 2015). In such a regression, half of the observations lie above the line and the other half below the line. In minimising Eq. (5), the estimated errors, \hat{u}_i , above and below the line receive equal weights. The LAD estimator can be generalised to the k^{th} quantile estimators, but now the errors above and below the k^{th} quantile (say 0.05 and 0.25) do not receive equal weights. Consequently, to estimate the k^{th} quantile, the following expressions are minimised as presented below using a single regressor:

$$\min \sum_{i=1}^n \lambda_k (A_i - XM) = k \sum_{(A_i - XM) \geq 0} |A_i - XM| + (1 - k) \sum_{(A_i - XM) < 0} |A_i - XM| \quad (6)$$

Where $XM = M_1 + M_2X_i$; $0 < k < 1$ and λ_k is a measure of the weighted distance of the quantile. If $\hat{A}_i^k = \hat{M}_1^k + \hat{M}_2^k X_i$, the estimated k^{th} quantile, Eq. (6) amounts to minimising the weighted sum of residuals $\sum |A_i - \hat{A}_i^k|$ with positive residuals receiving a weight of k and negative residuals receiving a weight of $(1-k)$. The first sum in Eq. (6) is the sum of

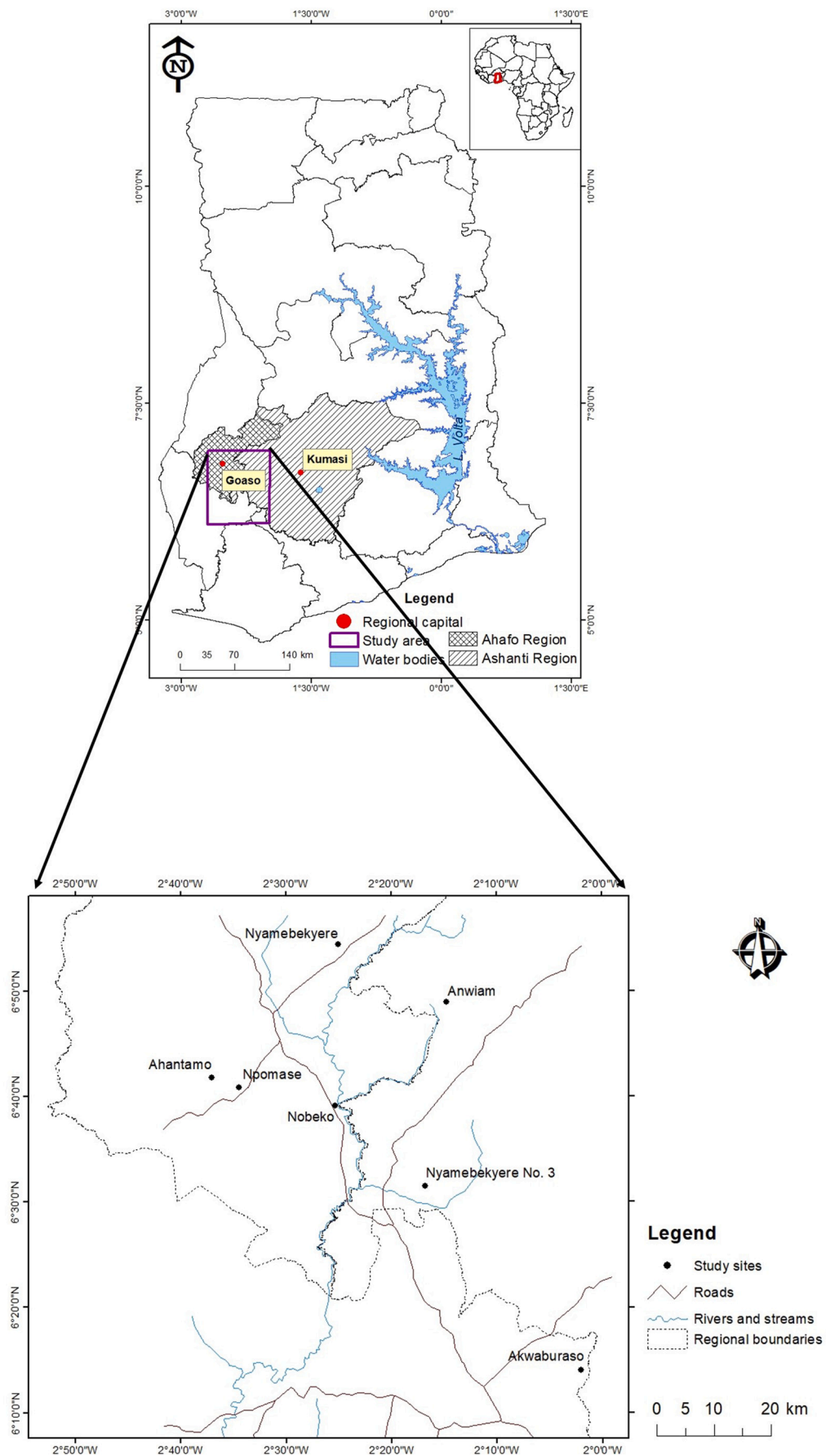


Fig. 1. The study sites.

Table 2
Communities and number of respondents.

Forest district	Settlement	Sample size	Type of NTFP produced
Mankranso	Nyamebkyere No.3	20	Black pepper
Nkawie	Akwaburaso	25	Grains of paradise
Goaso	Anwiam	20	Grains of paradise
	Ahantamo	11	Grains of paradise
	Nobekaw	10	Grains of paradise
	Npomase	11	Grains of paradise
	Nyamebkyere	37	Grains of paradise
Total		134	

Source: Authors' computation based on field data, 2018.

vertical distances of observations above the estimated quantile and the second sum is the vertical distances of observations below the estimated quantile.

The quantile regression analysis (see Section 4.5) worked with two models. Model 1 consists of the eight factors extracted from the factor analysis as independent variables. Model 2 is made up of three of the extracted factors that were significant in the first model (family support, marketing information and value-addition knowledge) as well as other relevant socio-economic variables. The latter included demographic variables such as age, education, gender, monthly per capita expenditure and household size, and production characteristics such as years of farming, farm size and off-farm jobs. Based on the literature and expert interviews, we assumed these variables to influence the entrepreneurial abilities of sampled farmers.

3.5. Description of variables

Appendix 5 describes the variables used in the Ordinary Least Square (OLS) and Quantile Regression Models. Sixteen variables with the eight factors generated from the factor analysis were considered. The researchers hypothesised that the variables under demographics (except age), production, value addition and marketing characteristics would have a positive influence on the entrepreneurial scores of NTFP farmers. The dependent variable in Appendix 5 is an entrepreneurial score received by a farmer from the GET2 test.

4. Results

4.1. Summary characteristics of farmers

Appendix 5 shows that the mean entrepreneurial score recorded was 28.78, with a standard deviation of 7.69. The results suggest that overall, the NTFP farmers have medium to low entrepreneurial abilities. The mean age is 51, indicating that youth participation in the cultivation of NTFPs is very low despite efforts by government agencies and NGOs such as RUDEYA to promote the involvement of the youth in the NTFP value chain. Appendix 5 further reveals that more females (56%) are engaged in NTFP production under the MTS than men (44%). The monthly average per capita expenditure of the households was GHS 72 (USD 14.40) per household member.⁴ The respondents have 10 years of farming experience, on average, and their average land size is approximately 3 acres (1.21 ha).

4.2. Entrepreneurial characteristics and status of farmers

NTFP farmers display limited entrepreneurial status. Of the 134 respondents, 21.6% have low entrepreneurial scores (0–26) and 78.4% a medium score (27–45). Those with low entrepreneurial abilities are mainly survival farmers. Notwithstanding the absence of high scores, the majority (68.7%) had high need of achievement, whereas scores on

internal locus of control are medium (54.5% of respondents) to high (44.0%). However, most farmers have low to medium scores on other entrepreneurial attributes (need for autonomy, creative tendency and calculated risk-taking) (see Table 3).

4.3. Strength of factor analysis

The strength of the factor analysis solution was measured to test the consistency and validity of the attained reduction. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity results are presented in Table 4. The table reveals that the value of KMO figures is higher than 0.5, implying that factor analysis could be used for the set of data collected for this study. Furthermore, Bartlett's test of sphericity for the significance matrix, which is another essential attribute to be considered for factor analysis, showed a *p*-value of less than 1%. This suggests that there is significant association matrix between the variables used in the factor analysis.

4.4. Naming of extracted factors

Cumulatively, eight factors resulted from the analysis, explaining a total of 69.347% of the variations in the whole dataset. Appendix 4 describes the proportion of variation for the first to the eighth factor as 16.6, 12.0, 10.0, 7.7, 6.9, 5.7, 5.3 and 5.2%, respectively, after the performance of varimax rotation. The extracted factors that influence entrepreneurship among farmers from the most important to the least were access to market information, personal commitment, attention to details, adaptability to new technology, family support, knowledge on value addition; availability of farm labour, and networks with value-chain actors.

4.5. Factors influencing entrepreneurial scores of farmers

Table 5 presents the results of both OLS and quantile regression, with regression estimates from the 0.05, 0.25, 0.50 and 0.75 quantiles (see Section 3.4.2 for details).

Based on the OLS estimate of 0.701, Model 1 shows that *personal commitment* has a strong impact on farmers' entrepreneurial score. However, this effect was statistically significant only at the 0.50 and 0.75 quantiles, with no effect on the lower quantiles (0.05 and 0.25).

Family support has a negative impact on entrepreneurial scores in both models and at all quartiles, but this effect was statistically significant only for those with entrepreneurial scores at the higher (0.50 and 0.75) quantiles. *Availability of farm labour* had no statistically significant effect on entrepreneurial scores.

The estimated OLS suggests a negative effect of *adaptability* to new scientific information and technical advice on entrepreneurial status. However, this effect is reflected at the lowest and upper quantile only, with a high regression coefficient (1.181) particularly at the upper quantile. This suggests that the influence of adaptability on farmers' entrepreneurial abilities increases for individuals with higher entrepreneurial status.

Access to market information has more influence on entrepreneurial scores at the 0.05 quantile than on the higher quantiles in both Model 1 and 2. Although access to market information affects the upper quantile

Table 3
Summary of entrepreneurial characteristics of farmers (*N* = 134).

Entrepreneurial characteristic	Low (%)	Medium (%)	High (%)
Need of achievement	0.0	31.3	68.7
Need for autonomy	31.3	60.5	8.2
Creative tendency	43.3	56.7	0.0
Calculated risk-taking	53.7	45.5	0.8
Internal locus of control	1.5	54.5	44.0

Source: Authors' computation based on field data, 2018.

⁴ 1 GHS = 0.20 USD on 1 July 2018.

Table 4

Kaiser-Meyer Olkin Test.

Kaiser-Meyer-Olkin measure of sampling adequacy		0.727
Bartlett's Test of Sphericity	Approx. Chi-Square	2682.466
	Df	0.528
	Significance	0.000***

Source: Authors' computation based on field data, 2018.

in Model 1, it has no effect on the entrepreneurial status at the upper quantile in Model 2. However, unlike all other independent variables, except value-addition knowledge, this variable is statistically significant at all quantiles. This is also reflected in the OLS estimates of 0.878 and 0.890 under Model 1 and 2, respectively.

All quantiles, as well as the OLS scores, recorded a significant favourable influence of *value-addition knowledge* on farmers'

Table 5

Factors influencing entrepreneurial scores of NTFP farmers.

Variables	Model 1					Model 2				
	OLS estimates	Quantile regression estimates				OLS estimates	Quantile regression estimates			
		0.05	0.25	0.50	0.75		0.05	0.25	0.50	0.75
Personal and demographic characteristics										
Age						0.005 (0.418)	0.055** (0.260)	0.017** (0.040)	0.004 (0.040)	-0.0320 (0.073)
Ln education						0.007 (0.191)	0.282** (0.119)	0.039 (0.187)	0.011 (0.185)	-0.006 (0.334)
Gender						-0.168 (0.574)	0.703** (0.356)	0.470 (0.559)	0.047* (0.553)	0.042 (1.001)
Monthly per capita expenditure ^a						0.008** (0.004)	0.014*** (0.003)	0.010** (0.004)	0.002 (0.004)	0.114* (0.007)
Household size						0.022 (0.123)	0.173** (0.076)	0.194* (0.120)	0.030 (0.119)	0.081 (0.214)
Personal commitment	0.701*** (0.248)	0.068 (0.340)	0.125 (0.344)	0.742** (0.361)	1.360*** (0.307)					
Pay attention to details	-0.170 (0.188)	0.168 (0.340)	0.222 (0.344)	0.494 (0.361)	0.081 (0.307)					
Family support	-0.372 (0.247)	-0.119 (0.340)	-0.066 (0.344)	-0.696* (0.036)	-0.823*** (0.307)	-0.366 (0.282)	-0.801 (0.176)	-0.131 (0.275)	-0.444* (0.272)	-0.762 (0.507)
Production characteristics										
Years of farming ^b						-0.051 (0.132)	0.259*** (0.082)	0.091 (0.129)	0.154 (0.127)	0.222 (0.231)
Ln farm size						0.675 (0.658)	0.088 (0.409)	1.050* (0.641)	1.267** (0.635)	0.080 (1.149)
Off-farm job						1.399** (0.703)	0.555 (0.436)	2.463*** (0.685)	2.045*** (2.396)	1.143 (0.244)
Availability of farm labour	-0.254 (0.200)	0.288 (0.340)	0.062 (0.344)	0.350 (0.360)	0.249 (0.307)					
Adaptability to new technology	-0.489* (0.289)	0.633* (0.340)	0.017 (0.344)	0.129 (0.361)	1.181*** (0.307)					
Value addition and marketing characteristics										
Marketing information	0.878*** (0.283)	0.783** (0.340)	0.691** (0.344)	0.638* (0.361)	0.671** (0.030)	0.890*** (0.290)	1.151*** (0.180)	1.109*** (0.283)	1.011*** (0.280)	-0.762 (0.507)
Value-addition knowledge	0.929*** (0.207)	1.085*** (0.340)	0.554* (0.343)	1.110*** (0.361)	1.277*** (0.307)	0.972*** (0.281)	0.801*** (0.175)	0.752*** (0.275)	0.912*** (0.271)	1.248** (0.491)
Networks with value-chain actors	0.200 (0.203)	0.903*** (0.340)	0.360 (0.343)	0.360 (0.361)	0.249 (0.307)					
Constant	28.80*** (0.271)	24.183*** (0.339)	26.53*** (0.343)	28.80*** (0.360)	31.158*** (0.305)	27.372*** (2.486)	15.54*** (1.543)	23.438*** (2.422)	27.942*** (0.677)	32.978*** (4.338)
Prob>F	0.000					0.001				
R Square	0.225					0.235				
Pseudo R ² =		0.175	0.061	0.146	0.248		0.264	0.135	0.205	0.199
Brush Pagan/Cook-Weisberg test (Prob>Chi2)	0.022					0.087				

Source: Authors' computation based on field data, 2019. NB: Significance; 1% = ***, 5% = **, 10% = *. NB: Where QR and OLS are quantile regression at different quantiles and Ordinary Least Squares regression, respectively. Figures in parenthesis are robust standard errors.

^a The results on the relationship between entrepreneurial scores and per capita expenditure should be interpreted with caution as there is possible a reverse causality between the two, despite the low correlation coefficient of 0.1891. Moreover, literature is ambiguous about this variable, with [Zhu et al. \(2017\)](#) also reporting a positive relationship between household per capita expenditure and willingness to engage in NTFP businesses, but no such relationship found in the study of [Pindado and Sánchez \(2017\)](#).

0.05 and 0.50 quantiles. The entrepreneurial scores are positively affected by per capita *expenditure* based on both the OLS estimate and across all quantiles, except the median (0.50). This effect is the strongest at the upper quantile (0.114). *Household size* affects the entrepreneurial scores at the two lower quantiles only, and *years of farming* had a positive influence on entrepreneurial scores only at the lower quantile (0.05). *Farm size* particularly influences farmers' entrepreneurial status at the 0.25 and 0.50 quantiles. Based on the OLS score, the entrepreneurial score of a farmer is affected by having an *off-farm job*, but this effect is seen only at the 0.25 and 0.50 quantiles.

5. Discussion

This study examined the entrepreneurial status as well as the factors influencing the entrepreneurial scores of farmers engaged in the production of grains of paradise and black pepper introduced in a reforestation scheme (the modified taungya system) in Ghana. It thereby looked at the differential impact of factors across four quantiles of entrepreneurial status.⁵

5.1. Entrepreneurial status and NTFP marketing

The low to medium entrepreneurial scores among the farmers align with studies that reveal that farmers have lower entrepreneurial status than people active in non-agricultural sectors (Pindado and Sánchez, 2017). This suggests that a substantial proportion of the NTFP-producing farmers are survival farmers (Likoko and Kini, 2017; Ros-Tonen et al., 2019). A low entrepreneurial status goes together with low calculated risk abilities, and medium to low need for autonomy, creative tendency and internal locus of control. This also implies low levels of innovation, usually stemming from the limited resources available to farmers. These limited resources make farmers risk-averse and unwilling to invest in new ventures with unknown viability and profitability (Bannor et al., 2020; Caird, 2013). Yet, most farmers displayed a high need of achievement, indicating optimism about engagement in the production of NTFPs in the reforestation scheme and a desire to pursue entrepreneurial dreams (Collins et al., 2004; Vantilborgh et al., 2015). Existing literature indicates several factors that determine the willingness to adopt new crops, such as assured markets, success stories of other farmers, and government support (Ruf and Schroth, 2015). In this case, government support (and that of the NGO RUDEYA) is provided, but the marketing of the NTFPs remains a challenge due to the small quantities produced and the lack of market information (Treefarms Project Consortium, 2016). Such marketing problems are also reported in the broader NTFP literature (Belcher and Schreckenberg, 2007; Ros-Tonen, 2000; Ros-Tonen and Kusters, 2011; Shanley et al., 2012), suggesting that willingness to engage in NTFPs in this case is primarily driven by trust in the opportunities provided through government and NGO support, rather than by proven profitability.

Entrepreneurship has been suggested as a relevant factor for the successful marketing of NTFPs (Belcher and Schreckenberg, 2007; te Velde et al., 2006). It is therefore important to analyse the determinants of entrepreneurship. Market information and value-addition knowledge appeared to be key factors influencing entrepreneurial scores across all quantiles of entrepreneurial status. This is consistent with findings from previous studies (Belcher and Schreckenberg, 2007; Díaz-Pichardo et al.,

⁵ Because this study draws on cross-sectional data, the influence of factors that require time series data, such as environmental and climate change or macro changes in e.g. infrastructure, regulatory and fiscal conditions, and labour market conditions, could not be considered. Future studies could include time series or panel data for more in-depth analysis of the influence of the business environment or 'entrepreneurial ecosystem' (Nicotra et al., 2018) and the challenges to entrepreneurship posed by climate and environmental change (Ahmed and McQuaid, 2005).

2012; Sinyolo et al., 2017), including in Ghana (Amoah and Wiafe, 2012; Mumuni and Oladele, 2016). Those with limited resources, however, have little to no idea about the market dynamics of NTFPs (Rahman and Westley, 2001). Market information is insufficiently available, adversely affecting the entrepreneurial abilities of the NTFP farmers. This implies that public and private actors should promote marketing intelligence, for instance through price forecasting, a commodity platform, and/or text- and voice-based market information on prices, demand and available buyers. Moreover, the high regression estimate for value-addition knowledge suggests knowledge of NTFP processing to be a crucial determinant of farmers' entrepreneurial scores. Despite this importance, most NTFPs are sold without any further value addition or packaging, mainly because collectors have insufficient knowledge of the value-addition activities required for NTFPs (Amoah and Wiafe, 2012). This suggests a widespread need for training on post-harvest processing and management. A concrete suggestion on how to meet these needs is given at the end of the next section.

5.2. Differential impacts on entrepreneurial status and implications for entrepreneurship development

Initiatives aiming to enhance farmers' entrepreneurial scores, should also take differential impacts of the various variables into account. The quantile regression analysis showed that the lowest entrepreneurial scores (at the 0.05 quantile) are particularly sensitive to basic demographic variables (age, education and gender), years of farming, marketing information, value-addition knowledge and networking with other value-chain actors. The positive influence of age on farmers' entrepreneurial abilities – suggesting that older farmers are more entrepreneurial – is inconsistent with findings by Folmer et al. (2010) and Sinyolo et al. (2017), who reported a negative relationship between age and entrepreneurship.

Several factors had a significant effect on entrepreneurial status only at the lowest quantile. This applies, first, to education, which initially seems to contradict previous studies that report an insignificant effect of education on farmers' entrepreneurial score (Folmer et al., 2010; Nagler and Naudé, 2014; Sinyolo et al., 2017). However, this can probably be explained by the fact that formal education, rather than enhancing agripreneurship, is likely to move farmers away from agriculture to more remunerative employment opportunities. Farming experience was the second factor significant at the lowest quantile only. This is in line with other studies that found that farming experience and 'learning by doing' are more relevant for entrepreneurship than formal education (Sinyolo et al., 2017). However, we have no explanation for the fact that this is significant only for farmers with low entrepreneurial scores. Networks with other value-chain actors constitute the third variable significant at the lowest quantile only. This is rather surprising, as literature suggests this to be an essential entrepreneurial variable across a broader range of farmers and NTFP extractors (Belcher and Schreckenberg, 2007; McElwee, 2006; Mumuni and Oladele, 2016; Ruiz-Pérez et al., 2004). Such networks allow farmers to gather information and hunt for opportunities (Chell and Baines, 2000), thus enhancing their entrepreneurial behaviour. Lastly, the importance of gender at the lowest as well as the median quantile, suggests that a male farmer is likely to have a higher entrepreneurial score compared to a female farmer. This cannot be generalized across cultural settings. Sinyolo et al. (2017), for example, reported that female-headed households in Kwa-Zulu Natal (South Africa) were more entrepreneurial in agriculture than male-headed households. In Ghana, however, despite widespread engagement of women in entrepreneurial activities in the trade and service sectors, several institutional constraints to female agripreneurship have been reported, such as limited access to land and credit, and prevailing gender norms (Kuada, 2009; Langevang et al., 2015). These findings suggest that the entrepreneurial status of farmers in this group can best be enhanced by providing market information and value-addition skills, while promoting networking and addressing the

gender-based constraints to agripreneurship.

Unlike the lowest quantile, education, gender and years of farming had no effect on entrepreneurial scores at the 0.25 quantile. However, age, household size, marketing information and value-addition knowledge are similarly affecting entrepreneurial scores. A plausible reason for the positive influence of household size on entrepreneurship is the free labour large families have at their disposal for the production of a greater variety of crops, including NTFPs. This creates the opportunity for farmers to generate a higher income. At this quantile, farm size and off-farm jobs appear as new influencing variables, which are also important in the group with median entrepreneurial scores (0.5 quantile). Farmers with bigger land sizes are more likely to expand the production of NTFPs to their off-reserve plots, as they have enough space to cultivate NTFPs. Since demographic variables and land size are hard to influence through entrepreneurship development programmes, entrepreneurial skills of farmers in this group can best be enhanced through entrepreneurial training programmes that focus on market information and value-addition knowledge. Especially the latter may enhance off-farm income-generating opportunities that positively influence the entrepreneurial skills in this group.

Entrepreneurial scores at the median (0.5) quantile are not affected by basic personal and demographic variables. At this quantile, like the highest one, personal commitment appears as an important variable. Personal commitment is known as one of the relevant factors in explaining entrepreneurial behaviour (Liñán et al., 2011). Anggadwita and Dhewanto (2016), for example, found that personal responsibility towards a business affects the formation of entrepreneurial behaviour, especially among women. The findings of this study showed that personal commitment is significant only for farmers with median and high entrepreneurial skills; groups that are easier targets for entrepreneurship training programmes anyway. In this quantile, farm size and off-farm jobs, as well as market information and value-addition knowledge, affect entrepreneurial scores the most. Family support negatively impacts entrepreneurial scores at this and the upper quantile. Family support is needed for a farmer to adjust to the ever-changing conditions in agriculture and when engaging in time-consuming activities or new crops, such as NTFPs, that take time to mature (Fitz-Koch et al., 2018). The negative relationship with entrepreneurship found in this study is, however, at odds with previous studies (Kuada, 2009; McNally, 2001; Meert et al., 2005; Nordqvist and Melin, 2010). A possible explanation is that NTFPs have not benefited from targeted research efforts and necessary information about growth rates, quantities to be harvested, agronomic practices, etc. Family support for the production and marketing of NTFPs might therefore be less or not available compared to more well-known food and cash crops, which have proven financial viability and shorter maturing periods. These findings suggest that the median group will benefit most from activities that stimulate their personal commitment to the NTFP trade, for instance by organising events where they receive market information, training in value addition, and information on off-farm jobs more broadly.

Variables positively affecting entrepreneurial scores at the highest quantile (0.75) include personal commitment, adaptability to new information and technology, market information and value-addition knowledge. Farmers' ability to adopt modern technologies is among the key factors that determine their entrepreneurial abilities. Starting up a new venture, like integrating NTFPs in the modified taunya reforestation scheme, requires moving from a low to high entrepreneurial status, as it demands creativity to engage with new buyers and suppliers, and new marketing channels to adjust to a new condition (Hansson et al., 2013). This implies that the most entrepreneurial farmers can best be targeted with marketing intelligence through price forecasting and information on demand and available buyers; information on new

processing technologies; and training in post-harvest processing and management.

Three critical questions can, however, be raised regarding tailor-made entrepreneurship development approaches.⁶ First, does a tailor-made approach not raise ethical questions, for instance, when people not considered receptive to a particular training or intervention are excluded? Second, is there proof that a tailor-made approach is effective, considering structural and contextual factors that also determine entrepreneurial skills? Third, are tailor-made approaches feasible considering that budgets available to government agencies and NGOs in developing contexts are likely to be limited?

Regarding the ethical considerations, tailor-made approaches can both be justified and criticized from an inclusive development perspective (Gupta et al., 2015). On the one hand, an explicit inclusivity argument implies a normative and gender-transformative stand towards preferential targeting of marginalised people and their needs (Ros-Tonen et al., 2019). On the other hand, it could be argued that a tailor-made approach implies a risk of exclusion from high-end training of those who are considered 'incapable' or not receptive to such training. An integrated, yet differentiated, package, as suggested below can do justice to both concerns.

Regarding the broader context in which NTFP farmers operate, thinking that tailor-made entrepreneurship approaches are a cure-all for all ills related to a constrained (business) environment is illusive. Gendered access to land, trees, plants and credit; poor infrastructure, including storage and processing facilities; poorly developed markets; and low and fluctuating prices for unprocessed NTFPs are but a few of the constraints known from the literature (Belcher et al., 2005; Belcher and Schreckenberg, 2007; Howard and Nabanoga, 2007; Kuada, 2009; Langevang et al., 2015; Paumgarten and Shackleton, 2011; Ros-Tonen, 2000; Ros-Tonen and Kusters, 2011). Moreover, there is a substantial proportion of 'survival entrepreneurs' (Likoko and Kini, 2017), whose priority is sustaining their family rather than developing their business. Such a category is also known from the NTFP literature as being distinctive from a more solid and higher-income category of specialised NTFP harvesters (Belcher et al., 2005). This survival group is likely to show less interest in and to benefit less from entrepreneurial development programmes.

These critical issues, combined with the budgetary constraints faced by public and private agencies in developing contexts, lead us to recommend⁷ an integrated, yet differentiated, package in the form of annual events, which combine (i) an exhibition and market fair to promote and brand NTFPs from communities and reforestation schemes, with (ii) networking opportunities where value-chain actors can meet and interact, (iii) dissemination of information on prices and marketing opportunities; and (iv) workshops to enhance entrepreneurship skills. Information on prices and potential markets and buyers, and workshops on post-harvest processing will serve all groups, while such events can also address segment-specific needs. This encompasses the opportunity to network (lowest quantile); information on off-farm job opportunities (median and high quantile); and demonstration of the newest processing and management technologies and interaction with buyers and suppliers (highest quantile). In this way, both generic and group-specific needs can be addressed without the risk of excluding particular groups.⁸

⁶ We thank an anonymous reviewer for the suggestion to address some of these questions.

⁷ In the context of this article, the Forestry Commission and Ministry of Food and Agriculture, and NGOs familiar with NTFP trade such as Agribusiness in Sustainable Natural African Plant Products (ASNAPP) and RUDEYA are the organisations best positioned to follow up on the recommendations

⁸ This obviously requires facilitation of transport to the event for the poorest groups.

6. Conclusions

The analysis in this paper has shown that factors influencing the overall low to median entrepreneurial scores of NTFP farmers are different for those with low entrepreneurial skills than for those with a higher entrepreneurial status. Marketing information and value-addition knowledge are important factors across all quantiles. The lowest quantiles are specifically impacted by personal demographic variables and years of farming; whereas land size and off-farm jobs mainly affect entrepreneurial scores at the low to median quantiles. Personal commitment to NTFP production and adaptability to new technology and scientific advice are variables specifically affecting the highest quantile.

These findings suggest that understanding the determinants of entrepreneurial scores is key to designing and implementing strategies that aim to enhance farmers' entrepreneurial abilities at the community, district, and regional levels. In general terms, there is a need for market information and knowledge of value-adding post-harvesting processing. Entrepreneurship development should, however, not only be generically approached, but also be tailored to different segments of farmers for optimal impact. An integrated, yet differentiated, approach allows doing so inclusively and cost-effectively.

Declaration of Competing Interest

None.

Acknowledgements

Research funding from the Forestry Commission of Ghana and the Treefarms project (treefarms.wordpress.com) financed by the Applied Research Fund of the Food & Business Global Challenges programme of WOTRO Science for Global Development (Project W 08.270.324) is gratefully acknowledged. We thank Kwasi Kobia Tiekou (RUDEYA) and Richard Kwaduro Aasante (RMSC) for support during data collection and Kwabena Asubonteng for making the map (Fig. 1). We are appreciative of the constructive comments of two anonymous reviewers to an earlier version of this paper.

Appendix A. Supplementary data

Supplementary data (Appendices 1-5) to this article can be found online at <https://doi.org/10.1016/j.forpol.2020.102331>.

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