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INFLUENCE OF MULTI-STAKEHOLDER INNOVATION PLATFORM APPROACH ON SMALLHOLDER FARMERS MARKETING DECISIONS

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ABSTRACT

One of the very numerous decisions that smallholder farmers face world wide relates to market participation in agricultural markets and, consequently choosing the appropriate marketing channel for their agricultural produce. Such decisions impact on their incomes and subsequently on their welfare. The objective of this study was to determine how a multi-stakeholder innovation platform approach influences pigeon pea (*Cajanus Cajan* L.) marketing decisions in smallholder farming in Malawi. The study relied on primary data collected from 115 households in Balaka District in Malawi during an impact survey done in November 2014. Results confirmed that the multi-stakeholder innovation platform approach improves decision making in pigeon pea marketing. Variables such as access to transport services and market information, improved extension, capacity building through farmer training, adoption of conservation agriculture and membership to farmer groups influenced marketing decisions.

Key Words: Marketing channel choice, market participation, pigeon pea

RÉSUMÉ

L'une des plus nombreuses décisions auxquelles les petits agriculteurs font face généralement est relative à la participation aux marchés entre les marchés agricoles et, par conséquent choisir les canaux appropriés de commercialisation pour leur produits agricoles. De telles décisions impactent sur leurs revenus et ultérieurement sur leur bien-être. L'objectif de cette étude était de determiner comment l'approche de la plate-forme d'innovation multipartite influence les décisions de commercialisation du pois d'angole (*Cajanus Cajan* L.) chez les petits exploitants agricoles au Malawi. L'étude s'est basée sur des données primaires collectées sur 115 ménages dans le district de Balaka au Malawi au cours d'une enquête d'impact conduit en Novembre 2014. Les résultats ont confirmé que l'approche de la plate-forme d'innovation multipartite améliore la prise de décision de la commercilisation du pois d'angole. Les variables tells que l'accès aux services de transport et au marché d'information, améliorent la vulgaristaion, le renforcement des capacités à travers la formation des producteurs, l'adoption de l'agriculture de conservation et les groupements de producteurs ont influencé les décisions de commercilalisation.

Mots Clés: Choix des canaux de commercialisation, participation au marché, pois d'angole

INTRODUCTION

Participation in lucrative markets can be an effective route for rural smallholder farmers to move out of abject poverty (IFAD, 2003; Omiti, 2009). Markets play a significant role in economic development by improving incomes and food security. Well-functioning markets lead to efficient allocation of scarce resources and maximisation of the general welfare of society (Omiti, 2009).

The trade theory postulates that if households participate in markets by selling surplus of what they produce on a comparative advantage, they are set to benefit not only from the direct welfare gains, but also from opportunities that emerge from economies of large-scale production (Barrett, 2008). Indeed, they will also benefit from technological change effects; improved flow of ideas and from trade-based interactions (Barrett, 2008). Moreover, choice of a marketing channel is considered one of the key ingredients to successful marketing of both agricultural and non-agricultural products (Tsourgiannisa, 2008). This is so because different channels are characterised by different benefits (profitability) and costs. Therefore, marketing channel choice decisions are very important especially in a liberalised market economy like that of Malawi where there are alternative marketing channels and, therefore, open to seller's choice.

Understanding factors that influence smallholder farmers' choice of marketing channel for their produce is important to help smallholder farmers to reap maximum benefits from available markets. In addition, such studies are vital in legume production because legume sub-sector (groundnut, soybean, cowpea, and sugar bean) has high potential to help diversify the economy, eliminate nutrition problems, and improve food security status; and therefore alleviate poverty in rural communities.

The objective of this study was to identify and assess the factors influencing agricultural market participation behaviour among smallholder pigeon pea farmers in Malawi.

METHODOLOGY

Data collection. This study made use of cross-sectional household data collection, using a questionnaire with semi structured and structured questions. The questionnaire was pre-tested and corrected for errors before administering it for final data collection. Random sampling was used to select 5 villages in Balaka district, from which we drew a sample.

Resident district agricultural extension officers from the 5 villages provided lists of households and from which we selected a random sample of 115 smallholder farmers. Data were collected in November 2014, through face-to-face administration of questionnaires. Information was collected on household composition and characteristics, cereal and legume crop production and marketing, household market participation, access to infrastructure, household incomes, ownership of land and non-land assets, crop diversification, group membership, conservation agriculture adoption and practice, livestock ownership and access to agricultural inputs on credit and many other socioeconomic variables.

Econometric models for marketing decisions. We modelled the decision to sell pigeon pea, and choice of market in a simple logistic regression and multinomial logit regression respectively; and we report odds ratios for the market participation model and coefficients for the marketing channel made. Our empirical specification for the logit model takes the following form:

$$S_i^* = \beta X_i + \varepsilon_i \quad \text{..... Equation (1)}$$

Where:

S_i^* = the unobserved probability that the farmer either sells or not sells their pigeon peas. The vector X_i controls for the household and farmer related characteristics and ε_i = an error term that follows a logistic distribution. The farmer sells whenever $S_i^* > 0$; and since S_i^* is not observable, from the data we asked the farmers whether they sold or not sold their produce. The farmers sampled were asked whether they sold their pigeon peas or not with yes or no responses. We constructed an indicator variable to represent this decision and is defined below:

$$S_i = \begin{cases} 1 \text{ enters market} \\ 0 \text{ otherwise} \end{cases}$$

In addition, to model the marketing channel choice decision we used the multinomial logit regression model, farmers were asked where they had decided to sell their pigeon pea with the following as responses. To model marketing channel choice using multinomial logit regression, we made the following assumptions:

(i) that the error terms were identical and independently distributed with type *i* extreme value distribution;

(ii) that the probability that a household chooses alternative *J* can be explained by a multinomial model (Greene, 2000) as follows:

$$P_{ij} = \frac{\exp(\beta_i X^{ij})}{\sum_{j=0}^{j} \exp(\beta_j X^{ij})} \quad \text{..... Equation (2)}$$

Where:

X_{ij} = a vector of household of the i^{th} respondent facing alternative *j* and $\hat{a}_j$ = a vector of regression parameter estimates associated with alternative *j*. Following Equation 2, we can adapt the Multinomial Logit Model (MNLM) fitting to this study as follows:

$$P\ (MktChannel\ j_i = j\ ) = \frac{exp(\beta' jX^i)}{\sum_{j=1}^{3} exp(\beta' jX^i)}$$

..... Equation (3)

Where:

i represents i^{th} household, and *i*= 1, 2, 3, 4…., n^{th} household:

j represents the dependent variables (different marketing channels), *j*=1 for Private traders, *j*=2 for ADMARC, and *j* =3 for companies/ processors.

P = the probability of a marketing channel *j* to be chosen by the pigeon pea farmer *i*;

($MktChannel_{ji} = j$) Means that the marketing channel *j* is chosen by farmer *i*; and X_i = (sex *i*, age, labor, cellphone, distance to market, mktinfo… etc.)

The model was tested for the validity of the independence of the irrelevant alternatives (IIA) assumptions, using the Hausman test for IIA. The Hausman specification test compares an estimator θ_1 that is known to be consistent with an estimator θ_2 that is efficient under the assumption being tested (Hausman, 1978). The null hypothesis is that the estimator θ_2 is indeed and efficient and consistent estimator of the true parameters. If this is true, there should be no systematic differences between θ_1 and θ_2. We fail to reject the null hypothesis of the independence of the choice, suggesting that the MNLM specification was appropriate for modeling choice of marketing channel chosen by the pigeon pea farmer. One of the reasons why farmers might decide to sell to private traders or ADMARC *versus* selling to companies or processors, might be the distance to that particular market, market information access, prevailing market prices

per kilogramme, and availability of customers, among others. Taking that into consideration, we then selected variables for the two models market participation model and marketing channel choice model as explanatory variables (Table 1). First, we ran the logit model for market participation in pigeon pea, with independent variables presented in Table 1. Secondly, we ran the MNLM for marketing channel choice. Independent variables are presented in Table 1.

Specification and description of variables. Choice of variables used in the two models was guided by the market participation theory, past empirical work on market participation, knowledge of Balaka innovation platforms and intuition. Some empirical work that guided selection of covariates include studies by several authors (Alene *et al*., 2008; Jagwe *et al*., 2010; Reyes *et al*., 2010).

RESULTS AND DISCUSSION

Descriptive statistics. Table 2 presents descriptive statistics for all the variables used in the analysis.

The demography of the household plays an important role in household farm operations including marketing decisions. This study included various demographic characteristics, such as, gender, age, farming experience of household head and household size (Table 2). The sample was dominated by male headed households as (70%), with mean age of 49.59 years. Household size in the sample was 5.10 and on average the household aged about 19.81 years of farming experience.

Land is generally scarce in Malawi (GoM, 2003) which implies that farm households must adopt productivity increasing technologies to meet household food needs. Sustainable intensification will improve the odds of producing surpluses to sale on the market as well.

This study also included a number of institutional variables that can be used to explain marketing decisions in Balaka. Extension services access within the study sample was at 76% and extension frequency was 2.90 visits per farming season. Access to market information was very high (97%), indicating that within Balaka most farmers had access to marketing information, which could increase the odds of making informed marketing decisions. In addition, distance travelled to reach the nearest main pigeon pea market was only 4.37 Km; while access to transport services was at 42%. The results indicate favourable conditions for market participation in the district.

One of the main activities of Balaka innovation platform was to promote adoption of conservation agriculture (Mango *et al.,* 2015). Conservation agriculture was expected to improve soil fertility and raise crop productivity, including pigeon pea, hence improving chances of producing marketable surpluses. Adoption of conservation agriculture in the area was very high (90%). In addition, the study also included social capital variables, such as group membership and access to training services. Improved access to social capital is important as it promotes information sharing which can speed awareness on innovative practices in farming (production and marketing) and their adoption. Access to training services was at 75% and 86% of the households who were members of at least one group within the district.

On the other hand, the study also included a variable for actual marketing experiences of pigeon pea. Nearly half of the households (47%) were reported to have participated in collective marketing. For those who participated on the pigeon pea marketing, average price per kilogramme received was US$0.33 and the amount of grain delivered to the market per household was 173.15 kg.

The study also included ownership of a bicycle and cell phone as study covariates. Bicycles are a common mode of transport in Balaka and are expected to assist a lot in delivering farm produce to the market and

TABLE 1. Definition and specification of variable

Variable	Description	Variable type	Responses
MktChnl	Indicates the channel taken by the farmer when selling his/her pigeon pea	Categorical	1- ADMARC 2 –Companies 3-Private traders
Pigeonpeas_sell_5_2	Indicates whether the farmer sold his/her pigeon peas in the past 12 months	Dichotomous	1 = Yes, 0 = No
hh_sex_2_5	Indicates the gender of the household head	Dichotomous	1 = Male, 0 = Female
Age	Age of household head in years	Count	Count
age1	Age of household head in years (Transformed to natural log of age)	count	count
hh_size_2_11	Size of the household	Count	count
years_hh_farming_2_16	Number of years in the farming business	Count	count
expfarming	Number of years in the farming business. (Natural log of years in farming)	Count	Count
landsize_2_10	Arable land size holding (ha)	Count	Count
Ext_Accss	Extension services access	Dichotomous	1 = Yes, 0 = No
Extensionfreq	Extension services reception frequency per year	Count	Count
CA_Practice_3_1	Identifies whether farmer is practicing Conservation agriculture	Dichotomous	1 = Yes, 0 = No
Group	Identifies whether farmer through innovation platform has membership to any farmer group or association	Dichotomous	1 = Yes, 0 = No
IP_training_16_1	Variable identifies whether farmer received any form of training from the Innovation Platform	Dichotomous	1 = Yes, 0 = No
Mktinfo_Accss	Indicator variable for access to any form of pigeon pea market information	Dichotomous	1 = Yes, 0 = No
Transpt_Accss	Indicator variable for access to transport for fetching produce to the market	Dichotomous	1 = Yes, 0 = No
Distmkt	Distance to the nearest main market (Km)	Count	Count
Pigeonpeas_howsold_5_10	Indicator variable showing how pigeon peas were sold	Dichotomous	1=collectively; 0= otherwise
Pigeonpeas_price_5_8	The price per kg at which the farmer sold their pigeon pea (US$)	Count	Count
Pigeonpeas_amntsold_5_3	The amount of pigeon pea sold (kg)	Count	Count
Bicycle_17_1	Indicator variable for ownership of bicycle	Dichotomous	1 = Yes, 0 = No
Cellphone_17_1	Indicator variable for ownership of a cell phone	Dichotomous	1 = Yes, 0 = No
Radio_17_1	Indicator variable for ownership of a radio	Dichotomous	1 = Yes, 0 = No

TABLE 2. Descriptive statistics of the sample

Variable	Variable definitions	Obs	Mean	Std. Dev.	Min	Max
hh_sex_2_5	Indicates the gender of the household head (male=1)	115	0.70	0.46	0	1
Age	Age of household head in years	115	49.59	14.83	22	79
age1	Age of household head in years (Transformed to natural log of age)	115	3.86	0.32	3.09	4.37
hh_size_2_11	Size of the household	115	5.10	2.03	1	10
years_hh_farming_2_16	Number of years in the farming business	115	19.81	12.19	0.4	57
expfarming	Number of years in the farming business. (Natural log of years in farming)	115	2.73	0.84	-0.916	4.043
landsize_2_10	Arable land size holding (ha)	115	1.69	1.52	0.1	12
Ext_Accss	Extension services access (yes=1)	115	0.76	0.43	0	1
Extensionfreq	Extension services reception frequency per year	115	2.90	2.78	0	12
CA_Practice_3_1	Identifies whether farmer is practicing Conservation agriculture (yes=1)	115	0.90	0.31	0	1
Group	Identifies whether farmer through innovation platform has membership to any farmer group or association (yes=1)	115	0.86	0.35	0	1
IP_training_16_1	Variable identifies whether farmer received any form of training from the Innovation Platform (yes=1)	115	0.75	0.44	0	1
Mktinfo_Accss	Indicator variable for access to any form of pigeon pea market information (yes=1)	115	0.97	0.16	0	1
Transpt_Accss	Indicator variable for access to transport for fetching produce to the market (yes=1)	115	0.42	0.50	0	1
Distmkt	Distance to the nearest main market (Km)	115	4.37	1.90	0.2	15
Pigeonpeas_howsold_5_10	Indicator variable showing how pigeon peas were sold (collectively=1)	72	0.47	0.50	0	1
Pigeonpeas_price_5_8	The price per kg at which the farmer sold their pigeon pea (US$)	72	0.33	0.11	0.1	0.55
Pigeonpeas_amntsold_5_3	The amount of pigeon pea sold (kg)	72	173.15	547.55	1	4500
Bicycle_17_1	Indicator variable for ownership of bicycle (yes=1)	115	0.72	0.45	0	1
Cellphone_17_1	Indicator variable for ownership of a cell phone (yes=1)	115	0.75	0.44	0	1
Radio_17_1	Indicator variable for ownership of a radio (yes=1)	115	0.74	0.44	0	1

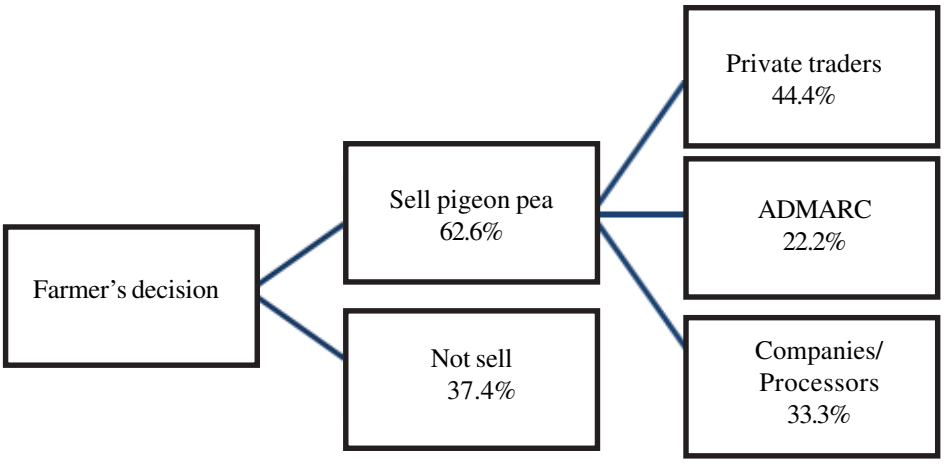
Notes: Data was collected from selected smallholder farmers in Balaka district in Southern province of Malawi

fetching inputs from the market to the house. Cell phones are key for communication with different stakeholders within the pigeon pea value chain and also in money transfer and hence can influence marketing decisions. Within the sample, 72% of the households owned at least one bicycle; while 74% of them owned at least a cell phone within the household.

Marketing decisions. Figure 1 summaries the scheme for pigeon pea marketing decisions in Balaka, Malawi. Generally, pigeon pea market participation was high (62.6%). The most preferred channel of selling pigeon pea was to private traders (44.4%). The second preferred channel was through companies/ processors (33.3%) and the least preferred was ADMARC (22.2%). The result shows that smallholder farmers acknowledged the importance of participating in the pigeon pea market as indicated by the high proportion of them who sold their produce on the market. Farmers aim to improve their incomes from farming and, hence, end up participating in produce markets as sellers. The preferance of smallholder farmers for private markets compared to government could be due to the fact that, private traders and companies often have agents operating at village level, which made it easier for the farmer to transact; unlike ADMARC (a government institution) which often require farmers to transport their produce to a central collection/buying point.

Results on the level of farmer participation (62.6%) in pigeon pea markets are not surprising since the innovation platform has been working hard through various stakeholders exchanging market information, and linking farmers to a variety of pigeon pea markets (Mango, 2014). However, there is need to refer to the logistic regression model results (Table 3) to confirm which variables drive pigeon pea market participation significantly in the study area.

During the survey farmers were asked to disclose prices at which they sold pigeon pea. We then computed average prices offered to farmers by marketing channel. Results show that the government institution (ADMARC) was offered the best price and the private traders the lowest. Average prices (US$) offered in the three different markets according to the results are as follows: Private traders (0.26 per kg); Companies/processors (0.30 per kg), and ADMARC (0.32 per kg). Results, thus



ADMARC = Agricultural Development and Marketing Corporation, Not sell represents farmers who did not sell their produce

Figure 1. Market participation and marketing channels used by farmers in Balaka in Malawi.

indicate that to some extent, some factors other than price could be affecting choice of marketing channel by the farmer. Factors such as institutional, demographic and social capital variables could be constraining farmers to access marketing channels that offer higher prices, thereby forcing them to sell to private traders. In addition, the results could be an indication that considering price alone in choosing a marketing channel is not a good decision; consideration of a combination of factors could be important. We, thus refer to the multinomial logit regression results to explain what affect choice of marketing channel used by farmers. With results from the multinomial logit regression, we were able to tell which combination of factors affect choice of a specific marketing channel, and ascertain whether variables influenced by the innovation platform activities in Balaka also influenced marketing channel choice significantly.

Several other studies have used the same approach to ascertain variables explaining marketing channel choice. For example Mburu *et al.* (2007) used the same approach to explain determinants of marketing channel choice amongst smallholder dairy producers in Kenyan highlands. Jari (2009) also used the same approach and found out that several factors including; market information, expertise on standards, contractual arrangements, social capital, market infrastructure, group participation and tradition significantly influence market channel choice in smallholder farming in Kat River valley of Eastern Cape province of South Africa.

Logistic regression results. Logistic regression results show that extension service reception frequency, transport access, distance to the nearest main market, group membership, trainings from the innovation platform and conservation agriculture adoption significantly influenced participation decision in the pigeon pea market (Table 3). Odds ratios show the predicted change in odds for a unit increase in the corresponding explanatory variable.

Extension service reception frequency measures the rate of visits by extension agents to a farmer per year. In this study, each household was visited by an extension agent about 3 times per farming season. Extension service reception frequency by the smallholder farmer was found to be significant at 10%, implying that the more extension visits a smallholder pigeon farmer got, the more chances of participating in the market.

The odds of participating in the pigeon pea markets were found to increase by 18% for a single day increase in extension reception frequency. This result implies that the innovation platform was effectively reinforcing extension service delivery so well as to improve participation in legume markets. Improved extension influenced farmers positively in pigeon pea markets. These results are, similar to findings by Alene *et al*. (2008) who concluded that input use and extension increases the odds of participation in commodity markets in Kenya.

Access to transporting services by farmers in the district and distance to the main market were also significant in explaining pigeon pea marketing participation (Table 3). This implies that if farmers get more and reliable transport services in this area, their chance of participating on the pigeon pea market improves. The odds of participating in the pigeon pea market were 2.6 times more likely for those who had access to transport services as compared to those who did not have access.

As highlighted earlier, average distance travelled by farmers to the main pigeon pea market was 4.37 Km. This indicates that pigeon pea farmers are now linked to nearby markets through the innovation platform, which helps them to reduce marketing costs; hence, improving marketing margins. This has been made possible by the construction of a ware house in Balaka town by Agriculture Commodity Exchange that buys farmers pigeon peas in bulk. So farmers do not have to go to Blantyre.

The odds of market participation were found to increase by 22% for every decrease

TABLE 3. Logistic regression results on market participation of pigeon pea farmers in Malawi

Variable	Definitions	Odds ratio	Std. Err.	P-value
hh_sex_2_5	Indicates the gender of the household head (male=1)	1.57	0.8422	0.398
hh_size_2_11	Size of the household	0.92	0.1089	0.462
expfarming	Number of years in the farming business. (Natural log of years in farming)	0.86	0.2571	0.611
Extensionfreq	Extension services reception frequency per year	1.18	0.1113	0.075*
Mktinfo_Accss	Indicator variable for access to any form of pigeon pea market information (yes=1)	0.25	0.3677	0.346
Transpt_Accss	Indicator variable for access to transport for fetching produce to the market (yes=1)	2.67	1.2871	0.041**
Distmkt	Distance to the nearest main market (Km)	0.78	0.0980	0.046**
Group	Identifies whether farmer through innovation platform has membership to any farmer group or association (yes=1)	2.50	0.1905	0.070*
IP_training_16_1	Variable identifies whether farmer received any form of training from the Innovation Platform (yes=1)	3.10	0.1882	0.054*
CA_Practice_3_1	Identifies whether farmer is practicing Conservation agriculture (yes=1)	5.95	5.2594	0.044**
Bicycle_17_1	Indicator variable for ownership of bicycle (yes=1)	2.57	1.5541	0.120
Cellphone_17_1	Indicator variable for ownership of a cell phone (yes=1)	0.52	0.3320	0.303
_cons	Constant	126.21	416.35	0.143
Number of observations	Number of observations		115	
LR chi2(12)	Likelihood ratio (LR) chi-square test		22.70	
Prob > chi2	The probability of obtaining the chi-square statistic (22.70) given that the null hypothesis is true		0.003***	
Pseudo R2	The pseudo R-squared		14.93%	

*P-value significant at 10%; **P-value significant at 5%; ***P-value significant at 1%; dependent variable of the model is sell pigeon pea (1=yes)

in distance to the main market, and *vice versa*. In other words, results showed that the innovation platform successfully improved market participation through linking farmers to markets and transporters. These results are consistent with those of Heltberg and Tarp (2002), Alene *et al.* (2008) and Ouma *et al.* (2010) who reported that improving access to transport services and shorter distances travelled to produce markets reduce transacting costs and hence improve market participation. Household with access to transport are more likely to secure means of delivering their produce to markets of their choice in time. Moreover, access to such information reduces smallholder farmers risk perceptions and improves the likelihood of participating in the pigeon pea market (Boughton *et al*., 2007).

In addition, some of the key roles of the innovation platforms, i.e. to offer production and market related trainings, to enhance conservation agriculture adoption and to encourage farmers to collaborate with other stakeholders through farmer associations and other social groups influenced market participation. Group membership is regarded as a proxy for access to social capital and or indigenous technical knowledge (Hailemariam *et al*., 2013). The odds of market participation were 2.5 times more likely for farmers who had access to social capital, compared to those without access.

The result also complements the role of innovation platform in encouraging farmers to work hand in hand with farmer associations for them to benefit from social capital and other benefits associated with working in groups. Social capital helps in moulding farmer decisions; farmers become more market oriented than production oriented. According to Mangisoni *et al.* (2011) farmers are generally expected to inspire, encourage, and motivate each other when they are in groups or associations, and as such help them uplift their production and marketing decisions. In addition, Fischer and Qaim (2012), Markelova *et al*. (2009) and Fischer and Qaim (2014) argue that, social capital in smallholder farming assists in overcoming market failures and high transaction costs associated with exchange, provide important platforms for capacity building, information and innovation, improve market power, and reduce likelihood of opportunistic behaviour in marketing (Markelova *et al.*, 2009; Fischer and Qaim, 2012; Fischer and Qaim, 2014).

One of the main functions of the innovation platform, also through extension services reinforcement, is to offer training to farmers mainly on production and marketing. Within the sample, 75% of the farmers reported to have received training from the platform at the time of the survey. Trainings through the innovation platform were significant ($P<0.05$) in influencing market participation. Education from the trainings increased the odds of participating in the pigeon pea market. Education and awareness improves decision making for the farmer, and as result the farmers can conceptualise marketing issues, resulting in them participating in markets to improve their income.

In addition, conservation agriculture practice influenced market participation (Table 3). The odds of participating in the market of pigeon peas were more likely (5.95) for farmers who participated in conservation agriculture compared to those who did not. Conservation agriculture practice within the sample was at 90% at the time of the survey. Conservation agriculture adoption being one of the activities reinforced through the platform, therefore, helped in enhancing market participation. This can be explained by the fact that through CA adoption, farmers realise relatively higher output compared to non-adopters. This leaves them with surpluses for sell. With surpluses, farmers are more likely to participate in pigeon pea markets.

Multinomial Logit regression. One of the objectives of the paper was to analyse decisions around choice of market preferred by the

farmer. We used a multinomial logit regression model to explain differences in choices regarding available markets for pigeon peas. Results reveal that land size, transport access and selling pigeon peas collectively influenced decisions by household to sell through Agricultural Development and Marketing Corporation (ADMARC) and/or companies/ processors (Table 4). In addition, age of farmer and possession of a mobile phone influenced the decision to sell to ADMARC significantly. Access to training through the innovation platform, and practicing conservation agriculture influenced significantly the decision to sell through the channel of companies/ processors relative to private traders.

Table 4 summarises the multinomial logit results. Private traders were the base outcome in our analysis. In STATA, by default, private traders was set as the reference group and, therefore, we estimated the model for factors influencing selling to ADMARC as a marketing channel relative to private traders and also factors influencing selling to companies/ processors as a marketing channel relative to private traders. Therefore, since parameter estimates are relative to the referent group (private traders), the standard interpretation of the multinomial logit is that for a unit change in the predictor variable, the logit outcome *n* relative to private traders (referent group) is expected to change by its respective parameter *ceteris paribus*.

Land size influenced decision to sell pigeon pea produce through ADMARC and Companies relative to private traders. The result imply that if a farmer was to increase land size by one hectare, the multinomial log-odds for selling output through ADMARC relative to private traders would be expected to increase by 0.98; while holding all other variables constant. The same for companies or processors, one hectare increase in land size would increase the multinomial log odds of selling through companies/processors relative to private traders by 1.05; while holding all other variables constant. In simple terms; the result implies that farmers with larger land sizes would prefer to sell their output to the Agricultural Development and Marketing Corporation (ADMARC) and or to companies or processors than to sell to private traders. This probably was because farmers with larger land sizes were more likely to produce more output and, hence, they tended to rely on stable marketing channels compared with unreliable private traders. The logic of the result is consistent with that of Bernard *et al*. (2007), who reported that poorer households are less likely to participate in proper marketing channels e.g. dairy cooperatives in Ethiopia. However, considering that land is scarce in Malawi (GoM, 2003) sustainable intensification through adoption of productivity increasing technologies seem to be a better option to improve marketable surpluses in pigeon pea. According to Mangisoni *et al.* (2011) adopting productivity increasing technologies will also maximise crop and livestock production per unit area which will subsequently improve food security and livelihoods (Mangisoni *et al.*, 2011).

Access to transport also favoured the use of ADMARC and companies, as preferred marketing channels relative to private traders. This result means, in a way that, farmers with access to transport services will tend to sell their pigeon pea either to ADMARC or companies or processors relative to private traders. This could be because, with access to transport, farmers can deliver their produce to markets of choice. Those without access are more likely to be left stranded and may end up selling to village based private traders, which more often offer lower prices.

Results also reveal that pigeon pea farmers who sold outputs collectively were more likely to sell their commodity through ADMARC or companies/processors than to private traders (Table 4). The coefficients, however, reveal that ADMARC will be preferred most compared to companies/processors. The results imply that, if farmers decided to sell collectively, they tended to approach markets

TABLE 4. Choice of marketing channel model results among pigeon pea farmers in Malawi

Variables	Definitions	ADMARC			Companies/Processors		
MktChnl	Indicates the channel taken by the farmer when selling his/her pigeon pea (1=ADMARC, 2 =Companies, 3=Private traders)	Coef.	Std. Err.	P-value	Coef.	Std. Err.	P-value
hh_sex_2_5	Indicates the gender of the household head (male=1)	-0.6439	1.1736	0.583	1.0407	0.9801	0.288
age1	Age of household head in years (Transformed to natural log of age)	-5.8674	2.2828	0.010**	-2.8134	1.8637	0.131
years_hh_farming_2_16	Number of years in the farming business	0.0298	0.0573	0.603	0.0024	0.0471	0.960
landsize_2_10	Arable land size holding (ha)	0.9821	0.5793	0.090*	1.0532	0.4705	0.025**
CA_Practice_3_1	Identifies whether farmer is practicing Conservation agriculture (yes=1)	22.0765	1883.5	0.991	3.4040	1.8956	0.073*
Transpt_Accss	Indicator variable for access to transport for fetching produce to the market (yes=1)	2.307204	1.2308	0.061*	1.6017	0.8897	0.072*
Mktinfo	Indicator variable for access to any form of pigeon pea market information (yes=1)	-0.6446	1.1408	0.572	-0.4919	0.9237	0.594
Group	Identifies whether farmer through innovation platform has membership to any farmer group or association (yes=1)	0.3879	1.4700	0.792	0.1928	1.2148	0.874
Ext_Accss	Extension services access (yes=1)	-2.3884	1.9670	0.225	0.2953	1.3266	0.824
IP_training_16_1	Variable identifies whether farmer received any form of training from the Innovation Platform (yes=1)	0.3978	1.5000	0.789	1.8104	1.0572	0.087*
Pigeonpeas_howsold_5_10	Indicator variable showing how pigeon peas were sold (collectively=1)	2.2115	1.0661	0.038**	1.6431	0.8411	0.051*
Pigeonpeas_price_5_8	The price per kg at which the farmer sold their pigeon pea (US$)	0.0161	0.0141	0.255	0.0142	0.0111	0.201
Distmkt	Distance to the nearest main market (Km)	0.0872	0.0626	0.163	0.0467	0.0546	0.392
Pigeonpeas_amntsold_5_3	Amount of pigeon pea sold in Kgs	-0.0075	0.0049	0.127	-0.0045	0.0027	0.100
Cellphone	Indicator variable for ownership of a cell phone (yes=1)	-3.5674	1.6101	0.027**	-0.9182	1.1939	0.442
Radio_17_1	Indicator variable for ownership of a radio (yes=1)	1.1347	1.6394	0.489	-0.3667	1.2396	0.767
_cons	Constant	-1.0213	1883.5	1.000	1.6983	7.3427	0.817
Private_Traders	Marketing channel (private traders)	(base outcome)					
LR chi2(32)		60.20		Log likelihood		-46.280059	
Prob > chi2		0.0018***		Pseudo R2		39.41%	

*p-value significant at 10%; **p-value significant at 5%; ***p-value significant at 1%; N=72; base outcome=private traders

that could buy large quantities of output. Private sector traders cannot buy all their produce in most cases, and if they buy they may not offer competitive prices. Since the innovation platform has been promoting collective marketing in Balaka, this result also imply that, through the platform farmers have been urged to secure reliable markets for their produce for greater profits.

It is clear that farmer age influenced the decision of farmer outputs to ADMARC (Table 4). The coefficient is negative, implying that old age discouraged farmers selling through ADMARC relative to private traders. The result implies that the aged are less energetic thus relying on traders who go round villages on foot or bicycle looking for products (Msukwa, 2005). The aged are less likely to hustle to deliver produce to distant markets so they tend to wait for mobile traders.

Use of information communication technology (ICT) such as mobile phones also influenced choice of marketing channel by the farmer (Table 4). The result shows that the multinomial odds of selling pigeon pea to ADMARC decrease for farmers with mobile phones, hence the negative sign of the coefficient. This could be due to the fact that farmers seldom communicate direct with ADMARC in order to deliver their produce; as a result communication between farmers and ADMARC is not critical.

It is also important to note that some of the major activities the Balaka Innovation Platform has been pushing for such as adoption of conservation agriculture by farmers and training of farmer in various agricultural activities covering production, marketing and post-harvest handling were also significant in explaining marketing channel choice. The coefficients for the two variables were greater than 1 and positive, implying a positive significant influence on choosing companies as the destination for their pigeon pea outputs. The results imply that farmers receiving training and practicing CA tended to prefer selling to companies or processors their outputs than to mobile traders. This implies that farmers who received training can make better marketing decisions because they know the risks of relying on traders and, hence they opt to rely on companies and or processors which are better in terms of prices and services they offer. The same for CA adopters, these farmers are more likely to produce more from their fields as CA is believed to raise productivity *ceteris paribus* (*Zingore*, 2006). Farmers with more output tend to send much of their output to stable markets, markets that absorb their output other than private traders who usually buy smaller quantities.

CONCLUSION

A number of variables influenced by the innovation platform were key in influencing marketing decisions. The study has shown that innovation platform activities are some of the key factors influencing marketing decisions in Balaka. It, therefore, suggested that, the bringing together of relevant stakeholders along the pigeon pea value chain is a relevant development intervention that improves marketing decisions and hence returns from farming activities. Study findings thus support the need to continue facilitating the multi-stakeholder innovation platform approach in Balaka and other smallholder farming areas to improve market participation behaviours in legumes such as pigeon pea. Out-scaling and up-scaling of the approach will be important in mitigating losses farmers incur by not participating effectively in produce markets. To a certain extent, our results have far reaching implications on income and food security strategies in Balaka, and Malawi at large.

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