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Influence of university entrepreneurship training on farmers' competences for improved productivity and market access in Uganda

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Abstract: Entrepreneurial and organizational competences among farmers are critical in improving farmers' productivity and market access for sustainable agricultural development through enhanced household food and income security. Universities are among the institutions with the responsibility to build up these competences. Universities are criticized though for focusing on academic and research roles with minimal impact on communities. Makerere University, Kampala, in response piloted a farmer entrepreneurship training project in a bid to effectively contribute to social transformation. The study assessed the influence of the training on smallholder farmers' competences, productivity and organizational capacity. Data were collected using semi-structured questionnaires and focus group discussions with 184 farmers in the project and non-project farmers in northern Uganda. Quantitative and qualitative data were

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ABOUT THE AUTHOR

Henry Nakelet Opolot is a PhD Student of Agricultural and Rural Innovation in the Makerere University, Kampala, Uganda. His thesis research topic is "Unraveling Critical Factors for a Responsive University-Farming Community Engagement in Uganda". The objective of this study was to analyze critical factors for establishment of a responsive university–farming community engagement. Specifically, he has assessed the application of experiential learning approaches; effectiveness of field attachment; quality of information; application of ICTs; and development of farmers' entrepreneurial competences.

Henry holds a Master of Science in Rural Development from University College Dublin, Ireland (2007) and a Master of Science in Crop Science and Bachelor of Science in Agriculture from Makerere University, Kampala (2004 and 1999). He is employed by the Ministry of Agriculture, Animal Industry and Fisheries in Entebbe where he works as an Assistant Commissioner, Farmland Planning. Henry has worked with the Uganda public service since 2000. With 18 years' professional experience, He has deep knowledge on a broad array of agricultural and rural development.

PUBLIC INTEREST STATEMENT

The manuscript focuses on how outreach activities of universities can be more relevant to community development. In relation to agriculture, the manuscript opines that universities have to play a role in building farmers' entrepreneurial capacity in agricultural development. Such capacity when developed, the farmers will then be able to meaningfully engage with university and be able to uptake the knowledge and technologies generated by universities. This is critical for the transformation. To do this, calls for integration of entrepreneurship training and practice into the curricula of university agricultural training programs. This could facilitate not only continued university presence in communities but also effective hands-on training for students while providing real-life case studies for lectures.

The manuscript therefore highlights the benefits of the training being:

- Enhanced entrepreneurial and organizational competences of farmers.
- Enhanced knowledge and skills in crop value chain development among farmers.
- Strengthened farmer group leadership, accountability, communication and marketing skills.
- Relevance of university knowledge on sustainable agricultural development was demonstrated.

analyzed using SPSS computer package and thematic content analysis, respectively. A multiple regression analysis using the ordinary least square was used to capture the combined influence of entrepreneurship training and other socioeconomic variables on the farmers' productivity. Our study findings show that the training had positively influenced farmers' entrepreneurial and organizational competences. Farmers acquired improved agronomic practices, business planning, value addition and packaging, branding and marketing knowledge and skills. Group leadership, accountability, communication, networking and marketing competencies of the farmers were strengthened. The project demonstrated a possible framework for developing country university efforts to impact on sustainable agricultural development. Integrating entrepreneurship aspects of technical and scientific knowledge, entrepreneurship, social and environmental awareness, experiential education and values and ethics into the curricula would provide universities with capacity to promote rural entrepreneurship.

Subjects: Agriculture; Agricultural Development; Agricultural Economics; Crop Science; Agriculture and Food; Food Packaging; Processing; Product Development; Sustainable Development; Rural Development

Keywords: entrepreneurship; farmer training; farmer competences; productivity; agricultural sustainability

1. Introduction

Uplifting the agricultural sector from the largely peasant level to commercial status in developing countries requires the development of entrepreneurial and organizational competences of the majority smallholder farmers. This has in recent decades been recognized as critical in improving agricultural productivity and market access in order to attain better livelihoods through enhanced household food and income security (Collet & Gale, 2009; Diaz-Pichardo, Cantu-Gonzales, & Lopez-Hernandez, 2014). For this to happen though, smallholder farmers require to be supported. The role of training in building farmers' capacity for successful agricultural development cannot be overemphasized (Food and Agriculture Organization [FAO], 2013). Universities are among the institutions in an innovation system framework with the responsibility to build up these competences for sustainable agricultural development among farmers (Kibwika, Wals, & Nassuna-Musoke, 2009; World Bank, 2012). Building farmers' competences for agricultural development translates into increased demand for improved knowledge, information and technologies, some of which are generated by universities. While universities in developing countries have overtime implemented capacity-building activities in farming communities, the extent to which the farmers' entrepreneurial and organizational competences have been built and its influence on household livelihoods is seldom clear. Often times, these trainings have been random, ad hoc and unstructured (FAO, 2013).

This is not the case, however, with other engagement models like for Earth and Land-grant Universities whose outreach objective is to address poverty and promote economic development through education (Damian, Cary, Navina, & Bryce, 2007; World Bank, 2012). In this case, communities have been empowered through training and capacity building based on their identified needs. The design of these models is such that students are equipped with entrepreneurial among other value chain competences and then engage in community development projects that bring about positive change. The attachment sessions are focused on students working with communities to identify needs and develop collaborative solutions. This approach is said to be successful in moving the university–community interaction from outreach to engagement levels on account of aligning universities interests with those of the communities (through need identification) on which training programs are based (Nancy, 2009). The students then work with farmers to design strategies to address the identified needs, thereby contributing to community improvement processes.

2. Entrepreneurial competences required by farmers

An entrepreneurial farmer can loosely be seen as that who looks at his farm as a business in which he/she invests with a view of making profits while ensuring further growth of the farm. Broadly, entrepreneurial competences necessary for farmers to enhance their productivity and competitiveness include strategic planning, opportunity (market) identification, relationship building, marketing and value chain development (Bergevoet, Giesen, Saatkamp, van Woerkum, & Huine, 2005; Holster, Klerkx, & Elzen, 2008; Morgan, Marsden, Miele, & Morley, 2010). In addition, product development, record keeping, improved organizational functioning and diversification are important in enabling farmers to create new value through creativity, applying social capital and taking risks in adopting and use of new technologies (Chegini & Khoshtinat, 2011; Ezeibe, Okorji, Chan, & Abudei, 2012; Golnaz, Zainalabidin, & Mad, 2011; Lans, 2009).

With these competences, farmers' abilities and attitudes towards entrepreneurship rather than just farm management are strengthened while making agriculture a viable venture. Once the farmers are able to improve their household income and food security, the uptake of improved technologies will be hastened. More so, improving competences in agriculture with entrepreneurial mindset is viewed as a precondition for ensuring sustainable agricultural and rural development. As asserted by Hennon (2012), entrepreneurial competence aids creativity and innovativeness that reorient farmers into taking up and applying new management practices that embolden their confidence and attitudes to take risks of using improved technologies. Coming along with entrepreneurship is organizational competence. This enables farmers to work in a cooperative manner, thereby benefitting from economies of scale (Basso, Fayolle, & Bouchard, 2009). Therefore, entrepreneurship in agriculture is a means of not only technology generation but also wealth and employment creation among farming communities (Dabson, 2011; Diaz-Pichardo et al., 2014; Karlsson, Johansson, & Stough, 2010; Moroz & Hindle, 2011).

3. Building farmers' entrepreneurial capacity

For agricultural transformation to occur in developing countries necessitates that famers are enabled to assume the mantle of their own development. This, according to McElwee (2008), should be reflected in farmers adopting new practices, attitudes and behaviors that lead them to mobilize social capital to benefit from collective actions. According to Berggren and Silver (2009), it is through networking that entrepreneurs share information while acquiring knowledge and skills. These interactions are critical in creating entrepreneurial behavior among farmers as they get exposed to the world outside their communities. Pushing through this view calls for appreciating the categories of individual farmers. In a typology by Diaz-Pichardo et al. (2014), McElwee (2008) and KIT, Faida MaLi and IIRR (2006), there is a farmer as farmer and a farmer as entrepreneur. The former is said to engage in a supply chain with limited diversification, low awareness of market opportunities, not part of a network and a price taker, while the latter follows a value chain approach thereby exploiting higher value chain, off-farm and collective market opportunities. The thrust of training farmers on entrepreneurship is focused on transforming them from farmers only to farmers as entrepreneurs.

Formal education, formal training and non-formal training programs are the major ways of capacity building. Orienting farmers to thinking and acting in an entrepreneurship perspective focuses on formal training and non-formal capacity building (McElwee & Bosworth, 2010; Rudmann, 2008). For purposeful development of a farmer's capacity, formal training designed after a need analysis is most suitable. In this way, new thinking and positive attitudes towards further agricultural development are imparted (Ezeibe et al., 2012). The intended outcome should be change in knowledge and behavior that should enable farmers not only increase productivity but engage in practices that lead to livelihood diversification. While farmer training has been done by many organizations including universities, it is noted that most do not go beyond disseminating agronomic and managerial practices. The case for universities is of more interest to this study. The level of effect of university outreach activities on community competences in developing countries is still limited (Bender, 2008). As Kibwika (2006) observed, emphasis has been put in improving competencies of university graduates and scholars through community outreach. On the other

hand, evidence of universities making impact in agricultural transformation, especially in developed countries, is widely documented (Kimmel, Bruce, Stephenson, Robertson, & Cowgil, 2011; World Bank, 2012).

Through practical capacity-building outreach activities, such universities have empowered rural communities to enhance and manage their own development. With such examples, the demand for developing country universities to move from outreach to long-term engagement so as to increase their responsiveness to community needs is growing. Universities, through a concept of university–community engagement (Mugabi, 2015; Openjuru & Ikoja-Odongo, 2012), are implementing community training activities in a bid to effectively contribute to sustainable agricultural development. To strengthen and upscale such efforts, the effect of the ongoing engagements needs to be established. In addition, the context-specific factors that may limit the application of training outcomes by particular smallholder farmers need to be understood.

3.1. Strengthening university–farming community engagement through farmer training

The Makerere University School of Agricultural Sciences (SAS) with support from the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) piloted a Community Action Research Project (CARP) titled "Developing an Outreach Framework for Strengthening University-Farming Community Engagement for improved and sustainable livelihoods (SUFACE)" to be built on previous outreach initiatives (Ebanyat et al., 2010). One of the specific objectives of the project was to build entrepreneurial capacity of smallholder farmers through a value chain development approach in northern Uganda. To build the entrepreneurial capacity of farmers, the project used two graduate students to conduct trainings. The students had to first undergo practical-based entrepreneurship training at the Earth University in Costa Rica and University of Pretoria in South Africa. The farmers were trained for a period of 4 months on aspects of marketing, record keeping, value addition, business planning, financial management, weather forecasting and budgeting. Using the two crops (soybean and groundnuts), the farmers, as a result of training, developed value-added products such as soy coffee, soy milk, roasted and packed groundnuts and groundnut paste. This approach was meant to take university outreach to an engagement level where there is added value to the community livelihoods. However, there is paucity of empirical evidence on the impact of the training and understand the enabling and constraining factors in the adoption and application of entrepreneurial competences learnt for further improvement and upscaling.

This study interrogated how the project training of farmers in entrepreneurship influenced knowledge and organizational capacity for increased productivity and market access. Achieving increased incomes, however, is a function of improved competencies such as knowledge, skills and organizational abilities of the farmers. In this study therefore, we aimed at establishing what the farmers were able to do after the training, their perceptions on the benefits of the training and factors affecting the uptake and application of entrepreneurship training outcomes that are meant to endear the farmers to take up university-generated knowledge and technologies. The study, therefore, analyzed the influence of the entrepreneurship training of farmers by Makerere University based on what the farmers were able to learn and do as a result of the training, what benefits they perceive to have achieved in their respective groups and what were the enabling and constraining factors to acquisition and application of the skills gained. This article then outlines the significance of the findings to theory and practice in fostering the universities' role in agricultural development.

4. Data and methods

Data were collected from the two districts of Kole and Lira in northern Uganda where the SUFACE project was implemented. The two districts were purposively selected based on the two crop value chains with Lira being the only district where SUFACE farmer groups were involved in the groundnut value chain and Kole had more farmers involved in the soybean value chain. Two farmer groups were selected from each district. The two farmer groups growing groundnuts had

a total of 40 members, while the two groups growing soybean had 60 members in total. During the study, 92-project (treated) and, for comparison, 92 non-project (untreated) farmers were interviewed representing a turn-up rate of 92% of the targeted 200 farmers. This was based on the nearest-neighbor propensity score-matching principle where treated and untreated subjects at a ratio of 1:1 were considered (Austine, 2010). Data from individual group members were collected through a household survey using a structured questionnaire. Four focus group discussions (FGDs) were also held with selected members of each of the study SUFACE group guided by the respective group leaders on the basis of the Flyvbjerg (2006) on selecting the most informed respondents.

Information was collected on household socioeconomic characteristics, what farmers learnt and were able to do during and after the training, famer's views of the training to group development as well as the contribution of the entrepreneurship training to farmers' productivity. Farmers' views on the usefulness of the training to group development were assessed using a 5-point Likert scale with 1 indicating strong agreement and 5 indicating strong disagreement with the group development parameter statement. The responses to the Likert scale statements were then aggregated into two nominal categories of agree and disagree, and an independent sample *t*-test was used to determine the difference between the means of those who agree and disagree with the statement at a 95% level of significance. A multiple regression analysis using the ordinary least square (OLS) (Hutcheson, 2011) was used to capture the combined influence of entrepreneurship training and other socioeconomic variables on the farmers' productivity.

The explicit form of the regression model is specified as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \ldots\ldots + b_iX_n + e$$

where,

- Y = Yield (output/land area)
- X_1 = Participation in entrepreneurship training (dummy: no = 0; yes = 1).
- X_2 = Age (years)
- X_3 = Education (years in school)
- X_4 = Labor (number of persons above 10 years.
- X_5 = Distance to local trading center (km)
- X_6 = Land own (number of acres)
- X_7 = Ox-plough (use ox-plough = 1, otherwise 0)
- X_8 = Bicycle as main mode of transport (dummy: yes = 1; no = 0)
- X_9 = Total off-farm income (UGX)
- X_{10} = Own mobile phone
- X_{11} = Own radio
- X_{12} = Distance to district trading center; distance to main market (km)
- X_{13} = Distance to warehouse (km)
- e = Error term
- a = Intercept
- b_i = Coefficient of *i*th predictor. i = 1, 2, 3 ……. n

Before running the multiple regression analysis, it was necessary to test for multicollinearity problem among continuous variables and check associations among discrete variables, which seriously affect the parameter estimates. As Gujarati (2004) indicates, multicollinearity refers to a situation where it becomes difficult to identify the separate effect of independent variables on

the dependent variable because of the existing strong relationship among them. In other words, multicollinearity is a situation where explanatory variables are highly correlated. There are two measures that are often suggested to test the existence of multicollinearity. These are variance inflation factor (VIF) for association among the continuous explanatory variables and contingency coefficients (CC) for dummy variables. Therefore, the VIF was used to check multicollinearity of continuous variables. As R^2 increase towards 1, it is a collinearity of explanatory variables. The larger the value of VIF, the more troublesome or collinear is the variable X_i. As a rule of thumb, if the VIF greater than 10 (this will happen if R^2 is greater than 0.80), the variable is said to be highly collinear (Gujarati, 2004). Multicollinearity of continuous variables can also be tested through tolerance. Tolerance is 1 if X_i is not correlated with the other explanatory variables, whereas it is 0 if it is perfectly related to other explanatory variables. A popular measure of multicollinearity associated with the VIF is defined as: VIF $(X_j) = \left(1 - R_j^2\right)^{-1}$

where R_j^2 is the multiple correlation coefficients between explanatory variables, the larger the value of R_j^2 is, the higher the value of VIF (X_j), causing higher collinearity in the variable (X_j).

CC is used to check multicollinearity of discrete variable. It measures the relationship between the raw and column variables of a cross tabulation. The value ranges between 0 and 1, with 0 indicating no association between the raw and column variables and value close to 1 indicating a high degree of association between variables. The decision criterion (CC ≤0.75) is that variables with the CC is computed as follows

CC = $\sqrt{\frac{\chi^2}{N+\chi^2}}$, where CC is contingency coefficient, χ^2 is chi-square test and N is total sample size. As stated by Paulos (2002), if the value of CC is greater than 0.75, the variables are said to be collinear. Statistical package SPSS version 18 was used to compute both VIF and CC. The analysis result from multicollinearity test indicated that there are no cases of collinearity among the variables entered in the models for the analysis.

The quantitative data collected were statistically analyzed using SPSS computer package to generate means and percentages as well as *t*-statistics of the above study variables. To assess the skills learnt and perceptions of the training on group development, only the treated respondents were considered while both treated and untreated were considered to determine the combined effect of socioeconomic characteristics on productivity. Qualitative data from FGDs were analyzed using summative thematic content analysis (Hsieh & Shannon, 2005) to generate the relevant themes to explain or support the quantitative results.

5. Results and discussion

The demographic and socioeconomic characteristics of the respondents for this section are the same as presented already in Section 4 of this article. This article thus details only the findings on the effect of the entrepreneurial training on the farmers' knowledge, organizational competences and yield.

5.1. Knowledge and skills acquired from the training

The study established the kind of knowledge and skills that the farmers report to have gained through the training. With the great possibility of farmers having been trained not only by Makerere University, farmers also stated other organizations from which they may have received similar training. Table 1 shows the knowledge and skills that farmers reported to have acquired and practiced individually or as a group. In the farmers' perspective, the training enhanced their competences in soybean and groundnut value addition (87%), farming as a business (75%), on-farm production practices (74%), record keeping as well as marketing. Postharvest handling (30.4%), soil fertility management and group dynamics were least reported. There were also other organizations from which farmers got exposed to some of the competences that were

Table 1. Areas of competence learnt by farmers

Knowledge/skill area	Frequency	Percentage	Also provided by other organizations
Agronomy	68	74.4	Yes
Soil fertility management	42	45.7	No
Farming as a business	64	75.0	Yes
Record keeping	58	63.0	Yes
Group dynamics	45	48.9	Yes
Postharvest handling	28	30.4	Yes
Value addition	80	87.0	No
Marketing	55	59.8	Yes

provided by Makerere University as well. The findings show that only Makerere University provided training on soil fertility management and value addition for soybean and groundnuts.

The knowledge and skills the farmers acquired through the training fall within the catalog of entrepreneurial and organizational skills relevant for enhancement of farmers' competence (Golnaz et al., 2011; Holster et al., 2008; Jarkko, Anderson, & McLwee, 2006; Morgan et al., 2010). The training enabled farmers to improve existing skills while acquiring new knowledge and skills for better competitiveness. In this training, farmers were able to acquire competences in value addition and marketing which is important in making farming more paying (De Lauwere, Malak-Rawlikowska, Stalgiene, Klopcic, & Kuipers, 2014). The findings also show that there are other actors engaging in providing capacity building to farmers that universities can partner with to enhance synergies in farmers' competence development.

The farmers observed the need to increase networking with other organization (value chain actors) as well as exposure visits to other areas for purposes of learning. Bridging linkages between farmers and other public and private sector agencies serves to expose farmers to knowledge and ideas beyond their own horizon (Abeyrathne & Jayawardena, 2014; Berggren & Silver, 2009). Indeed, the project was observed as a step forward in strengthening engagement between Makerere University and farming communities. A farmer stated during the FGD thus "once in a while, also invite farmers for a workshop/meeting/study tour to Makerere University and other places so we get exposed". This is possibly an indication of an increase in interest or demand for university information and technologies. This could be attributed to the improved information, knowledge and skills as well as the appropriate approaches used by the project. Comparatively, the baseline study findings of the same communities reported by Ebanyat, Ekere, and Walekhwa (2012) showed that there was some level of collaboration with Makerere University (95%) and Gulu University (3%) as entirely university-driven initiatives. The areas of collaboration were, however, limited agricultural production practices, on-farm research and climate change issues. The SUFACE project training and information activities included higher crop value chain and organizational development.

From the findings, and as reflected in Section 4 as well, there is presence of other value chain development actors from the government and private and civil society sectors working with the farmers. As Buys and Bursnall (2007) observe, effective partnerships between universities, government agencies, private businesses and residents are a vital element of community development. The other actors present in the communities during the time of the study included the District Local Governments (public extension services), NGOs CARITAS, Kubere Information Center (KIC) of WOUGNET and USAID—LEAD and Mt. Meru (private business). At the time, these were all involved in different activities (own projects) within the communities on different segments of diverse value chain development or community capacity building. There was, therefore, no apparent partnership formed around promoting university–farming community engagement. Apart from KIC which had

a "coordinating" nature of partnership (VicHealth, 2011), all the other actors were only identified as potential partners, but no joint discussions or activities had been initiated by the time of the study. Avenues for developing and strengthening partnerships with the relevant value chain actors will be critical in the drive for a responsive university–community engagement. This is important considering that university core functions are teaching, research and outreach. Other partners then have business in the generation and/or supply of technologies and information for enhancing agricultural inputs, value addition, marketing and financing. Through training in value addition, farmers learnt how to process their produce from the two crops into various products as shown in Table 2. When farmers processed their produce, they were able to sell at relatively higher prices than the unprocessed products.

Through marketing processed products, middleman were cut off, and with their marketing knowledge, they identified different market outlets where they sold at better prices than the unprocessed produce. As a result of developing different products from soybean and groundnuts and proper marketing, farmers were able to increase their earnings ranging from 33% to 80% on average. The increase in farmers' income (Okot, 2016—in press; Rukani, 2016—in press) was due to not only value addition and marketing skills but also combined with yield increases observed from the use of improved agronomic (use of improved seed, row cropping, soil fertility management and pest and disease control) and postharvest handling practices. Farmers reported an increase in production per acre ranging from 25% to 50%. This is in line with the findings in Uganda that show a yield difference of over 60% between well-managed crops and for the subsistent farmers (Ministry of Agriculture, Animal Industry and Fisheries [MAAIF], 2010). The entrepreneurial competences thus enabled the farmers to increase production, reduce on harvesting and postharvest losses and through value addition, develop various products that attracted better prices and subsequently enhance their income. The findings attest to the notion that possession of entrepreneurial skills enables farmers to produce and market more (Abeyrathne & Jayawardena, 2014) by exploiting new growth pathways through production intensification, product innovation, diversification and pursuing profitable market opportunities (Diaz-Pichardo et al., 2014; Hennon, 2012; Lans, 2009; Okpara, 2009).

To enhance entrepreneurship practices among farmers requires that farmers' attitudes are reoriented by building their knowledge and confidence in applying improved farming practices (Ezeibe et al., 2012). An assessment was therefore made of the farmers' understanding of the

Table 2. Soybean and groundnut products sold by farmers through different market channels

Product	Middlemen (%)	Mean price (UGX)*	Neighbors (%)	Mean price (UGX)*	Established buyer (%)	Mean price (UGX)*	Town market (%)	Mean price (UGX)*
A. Soybean								
Unprocessed soybean	8.0	1,000	2.2	1,200	13	1,500	28	1,400
Soy coffee	–	–	7	6,000	5.7	8,000	31.4	7,500
Soymilk	–	–	25	7,000	11.9	10,000	49.1	11,000
Soy pancake	–	–	33.3	2,500	–	–	40	2,500
B. Groundnuts								
Unprocessed	15	3,500	1.1	3,500	18.5	4,000	34.8	4,500
Groundnut paste	–	–	26.8	10,000	22	12,000	35.4	12,000
Roasted, salted and unpacked groundnuts	–	–	37.9	5,000	6.1	6,000	36.4	6,000
Roasted, salted and packed groundnuts	–	–	17.1	6,000	24.2	7,000	38.7	8,000

Note: *UGX 3,400 = 1 USD.

benefits of applying and plausible reasons for not applying the various skills learned from the training through FGDs. Farmers appreciated the benefits of the good agricultural practices all through the value chain and organizational practices in enhancing their productivity and incomes. The knowledge of the benefits of applying the good practices is a motivation to learn and positively take risks towards experimenting with innovations. Similarly, the farmers were able to identify the critical limitations to their ability to apply the desired practices ranging from inadequacies in knowledge and skills to issues of high cost of inputs required at every stage of a given value chain. These issues do constrain agricultural value chain development among smallholder farmers in sub-Saharan Africa (Anandajayasekeram, 2011; KIT, Faida MaLi and IIRR, 2006; MAAIF, 2010; Yuan, 2010). These are issues which are common and persistent among smallholder farmers and thus require continuous training and investment support. Ways of addressing them while designing interventions for smallholder farmers need to be looked into.

In this regard, entrepreneurship training empowers farmers to venture into new practices and assessing innovations while highlighting the challenges that they on their own can overcome or call for external support. Ezeibe et al. (2012) and Rudmann (2008) support this perspective while emphasizing the importance of training in enabling farmers to think in an entrepreneurial manner. Motivation to learn and ability to reflect on challenges with a positive attitude are some of the characteristics that are prerequisites for entrepreneurship (Hennon, 2012). In making positive contribution to farmer development, universities' role in developing farmer entrepreneurial knowledge and skills is important. Enabling farmers to appraise innovations and identify areas of weakness in effect ensures that the trainings are customized to the farmers' needs at a particular time. However, given the short-term nature of university projects in relation to time required for attitudinal change, strategies to ensure sustained engagement need to be explored.

6. Contribution of the training to strengthening farmers' organizational capacity

Farmers' views on the usefulness of the training in developing their organizational capacity meant to enhance their market competiveness are presented in Table 3. The findings show a highly significant statistical mean difference ($p < 0.001$) in the opinions of the farmers who

Table 3. Farmers' opinion on the usefulness of the training on group development

Statement on benefit of training to the groups	Agree		Disagree		*t*-Statistics	
	M (SD)	*n*	M (SD)	*n*	*df*	*t*
Improved leadership	1.55 (0.50)	88	3.00 (0.00)	4	90	−5.78***
Supported development of constitutions	1.60 (0.60)	83	3.44 (0.73)	9	90	−8.53***
Enhanced accountability	1.54 (0.50)	83	3.22 (0.44)	9	90	−9.65***
Improved communication among members	1.53 (0.50)	81	3.27 (0.47)	11	90	−10.88***
Strengthened sharing of roles and responsibilities	1.56 (0.50)	81	3.46 (0.69)	11	90	−11.28***
Instilled interest in group marketing	1.59 (0.52)	87	3.20 (0.45)	5	90	−6.81***
Better bargaining power	1.69 (0.47)	83	3.56 (0.53)	9	90	−11.27***
Improved networking with other farmers and organizations	1.70 (0.46)	83	3.56 (0.53)	9	90	−11.31***

Notes: M = mean; SD = standard deviation; *n* = number of respondents; *df* = degrees of freedom; *t* = *t*-test value.
***t value is highly significant at 95% confidence interval for mean difference.

agreed and those who disagreed that the training positively influenced the groups' development.

The respondents were all project group members, most of whom regularly attended the trainings and thus attesting to the positive contribution of the training. For groups to have interest in training, they must find it beneficial (Collet & Gale, 2009). From the FGDs, farmers explained that many positive changes had been realized in their groups as a result of the trainings. In terms of leadership, leaders had adopted more open and consultative methods of work. They asserted that "leaders had reduced making decisions without consulting members". The groups had developed and/or reviewed their constitutions that guided their operations. This they noted had brought about more participation and consultation in decision-making as well as in the use of resources pointing to improvement in accountability.

As a result of continuous interactions and encouragement for openness and participatory discussions, the farmers reported improved sharing of information among members. The good communication and information flow had also made it easy to mobilize members whenever required which also enhanced the sharing of roles and responsibilities. This they perceive enabled faster fieldwork when most members participated in collective work on individual members' as well as group gardens. With the group work, the farmers report of having known the benefits and had initiated ways of bulking their produce and selling collectively, beginning with groundnuts. This they argued enabled them to have a better bargaining power for better prices when selling their produce and products. In the same way, through group engagements, farmers reported an improved level of networking among the different project and non-project groups. As some FGD participants stated: "there is more sharing of ideas and information within and between groups, the ongoing group activities like the village saving and loans associations (VSLA) have been strengthened and the groups are enjoying popularity in their respective areas due to their involvement in the Makerere University project activities".

The findings thus show that the training improved the level of organization among the project groups by making them understand the importance of working collectively for better positioning in the markets. Developing farmer' organizational competences indeed enables them undertake collective actions that bring about enjoyment of economies of scale (Basso et al., 2009). Through training, farmers strengthen social networks which in a given context facilitate development of farm businesses (Alsos, Carter, Ljunggren, & Welter, 2011; Bruton, Ahlstrom, & Obloj, 2008). Farmers can indeed be supported to build sustainable relationships hinged on common interests for mutual benefit as one of the precursors to sustainable agricultural development. Universities then have opportunities to support farmers increase their production, quality of goods and linkages to markets through capacity building.

For farmers to transit from subsistence to viable commercial farming, Shaun et al. (2014) and Vorley, Del Pozo-Vergnes, and Barnett (2012) emphasize the need for skills as a basis for market engagement. Most importantly, group management skills and ability to use social networks give farmers an edge in the market for a profitable and sustainable agriculture. Harnessing such opportunities will promote uptake and diffusion of and leading to increased demand for technologies and best practices developed by universities. Playing a role in training farmers to develop requisite knowledge and skills (Kibwika, 2006) is thus a critical factor in creating a responsive and sustainable university–farming community engagement. As espoused by the social network theory, while strong social networks help farmers attain collective efficiency for market penetration, universities equally have the opportunity to generate new knowledge and identify avenues for making university training relevant to social transformation needs. This is also in tandem with Mugabi (2015) that working with farmers also makes relevant case studies available for improved and experiential teaching at universities.

7. Effect of entrepreneurship training on crop yield

Training alone cannot bring about enhanced agricultural productivity but in combination with other social and economic factors. The study interrogated the significance of training among

other factors in contributing to change in crop yield per acre. Results of the regression analysis of the combined influence of entrepreneurship training and other socioeconomic variables together with the effect of the significant variables on yield are presented in Table 4. The adjusted R^2 value (0.51) indicates that 51% variability in yield (Y) is explained by the variation in the explanatory variables, while the remaining 49% may be accounted for by other variables not explicitly stated in the model such as topography, use of fertilizer, improved seed and soil type. Computed F value (13) shows that the influence of these variables included in the analysis of productivity is significant at the 5% level (critical F is 1.89) and 1% level (critical F is 2.96). The F-statistic was significant at 5% level, showing that the specified model provides a good fit.

The results show that entrepreneurship training had a positive and statistically significant effect on productivity. Respondents who were trained in entrepreneurship increased their crop yield by 47% compared to those who were not trained. The results also show that distance to local trading center and labor had negative and significant effect on productivity. As the distance increased by 1 km and the total number of laborers increases by a person, yield reduced by 12% and 16%, respectively. The results further indicate that using an ox-plough for cultivation and owning radios had positive and statistically significant effect on crop yield. Use of ox-plough and owning radios increased yield by 23.2% and 12.9%, respectively.

The findings show that acquisition of entrepreneurial competences goes a long way in contributing to enhancing farmers' yield. Becoming innovative and adopting improved practices not only increases production, but the ability to add value to products that earn better prices stimulates increased production. Elsewhere, Anaglo (2014), Kolstad and Wiig (2013) and Ahmad, Wilson, and Kummerow (2011) found that farmer training influenced success of enterprises. Enhancing farmers' entrepreneurial capacity should be an integral element in strengthening university–farming community engagement. However, the results also show that training alone will not bring about

Table 4. OLS regression of factors influencing farmers' yield

Predictor variables	Standard coefficient	Standard error	Significance
1. Entrepreneurship training	0.470	44.40	0.000***
2. Age of the respondent	0.069	1.59	0.236
3. Education level of the respondent	0.028	22.84	0.626
4. Labor (household size)	−0.160	9.08	0.006***
5. Distance to local trading center	−0.120	12.98	0.040**
6. Number of acres of land owned	−0.023	3.17	0.680
7. Own ox-plough	0.232	68.63	0.000***
8. Use bicycle of a mode of transport	0.044	60.94	0.422
9. Non-farm income	−0.058	0.00	0.298
10. Own mobile phone	−0.011	42.24	0.853
11. Owned radio	0.129	94.91	0.025**
12. Distance to district trading center	0.042	8.42	0.448
13. Distance to warehouse	0.045	23.36	0.425
Statistics			
Adjusted R^2	0.51		
Computed F value	13		
Critical F statistic (5%)** and (1%)***	(1.89)** and (2.96)***		
Number of observation	184		

Notes: Dependent variable = productivity; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

the desired transformation such as increased farmer yield. Other context-specific factors have to be taken into consideration.

In this study area, access to markets, especially for value-added products, was an important factor in stimulating increased production. Universally, market access is said to be a production pull factor (Chirwa & Matita, 2012; Nobeji, Nie, & Fang, 2015). In essence, while enabling farmers to produce more and develop value-added products, efforts have to be made to enhance market access that inspires farmers to take up higher value chain production patterns consistent with transformation aspirations of university–farming community engagement. Similarly, while increased labor availability would enhance production, the findings show that large households instead had reduced productivity. This is attributed to the fact that the bigger the number in a household, the more they focus on producing for consumption, thus distracting commercial production. This is consistent with findings elsewhere on the negative influence of large household numbers on their commercial aspirations (Agwu et al. 2013; Chirwa & Matita, 2012; Msuya, Hisano, & Nariu, 2008).

On the other hand, the use of ox-ploughs and ownership of radios ease land opening for timely planting and aid access to production and market information, respectively. In the study area, many farmers were found to use hand hoes (rudimentary tool), yet the household land holding was above the national average of two acres. Therefore, those who had and/or could use oxen could not only open larger pieces of land but also work faster. For smallholder farmers, ox-ploughing increases land preparation as well as soil and water management operations for improved yield (Karuma, Mtakwa, Amuri, Gachene, & Gicheru, 2014). Similarly, radio remains a popular agricultural information channel among smallholder and commercializing households that contributes to improved yield (Nazari & Hasbullah, 2010) through farmer education.

8. Implications for theory and practice

The study has shown the positive contribution of entrepreneurial training to farmers' performance. In their own perspective during the FGDs, they made proposals for a more responsive engagement with the university. Overall, the use of participatory approaches in identifying critical challenges and delivering targeted training enhances university responsiveness to community needs. This is in line with Nancy (2009) on the importance of aligning university goals with community needs/interests. In addition, the project activities had impact on the community in terms of enhancing productivity and market access. The project activities thus demonstrated the potential for moving beyond just outreach to meaningful responsive (mutual) engagement with communities.

It is apparent that for smallholder farmers' livelihoods to improve, their capacity to seek, assess and utilize information, knowledge and technologies has to be enhanced. Even then, the knowledge or information should be that which enables them to integrate into the higher value chain activities so as to make farming profitable. As key actors in the performance of the agricultural innovation system framework (World Bank, 2012), universities have a significant role in contributing to farmers' competence building while using the same experience to improve research and training (Kibwika, 2006; Mugabi, 2015). The findings of this study have demonstrated the value of university knowledge to community development and also claimed some challenges that should be addressed to enhance relevance and effectiveness of university training.

Farmer training should be continuous and consistent. In terms of training time, the farmers called for frequent trainings and in line with the growing seasons and all stages of the respective value chains. Farmers, as found elsewhere, prefer continuous practical interaction with experts and require comprehensive coverage of the value chains (Anandajayasekeram, 2011; Rimi, Akpoko, & Abdullahi, 2015). This calls for a shift away from intermittent projects to long-term engagement of the universities with farmers. Unique from other development organization with human resource limitations (Mittal & Mehar, 2012), universities can address this need through increased use of

students, especially those at graduate level. Finding mechanisms of extending and/or strengthening the field attachment program at graduate level is important to meet this demand.

With the need to increase the use of students in farmer training also brings about the need to improve the competences of students to work with farmers. The fact that the students who trained farmers in the study project were prepared on entrepreneurship from universities other than their own points to curriculum gaps in some universities. The students need both technical and social competences to deliver training across the entire value chains. Mugisha and Nkwasibwe (2014) and Makerere University Kampala (MAK, 2006) called for curriculum review for development of graduates with practical competences to guide agricultural production, value addition and marketing. However, curriculum review ought to be accompanied with practical teaching methods. This will ensure that students not only know but can do what is required, thereby winning confidence of the farmers in university training. Evaluating the teaching and training approaches in universities so as to enhance experiential and practical learning is a critical element here.

Finally, there is need for strengthening partnerships with other stakeholders as a system approach in agricultural development. Promoting partnerships with farmers and other relevant value chain actors through interactions, information and knowledge sharing and activity coordination is important in promoting evidence-based interventions for improving community livelihoods (Miles, Celeste, Robert, & Angela, 2009; Netshandama, 2010; Shea, 2011). In the agricultural innovation system, the universities' core responsibilities are generating knowledge and supplying competent human resource (World Bank, 2012). For farmers to benefit from the entrepreneurial competences requires that production inputs, extension services, value addition tools, storage facilities and market infrastructure development among others have to be part of the farmer empowerment process. Exploring ways of developing and/or strengthening partnerships with critical value chain actors to foster the role of university in community competence development for agricultural transformation is important.

9. Conclusion and recommendations

In this study, evidence on the use of training programs to build entrepreneurial capacity of smallholder farmers as a contribution to improved livelihoods has been presented. The training had a positive influence on the farmers' entrepreneurial and organizational competencies. Farmers acquired skills and knowledge in improved agronomic practices, business planning, value addition and packaging, branding and marketing in the soybean and groundnut value chains. In addition, the group leadership, accountability, communication, networking and group marketing competencies were strengthened. Collectively, these competencies enabled the farmers to access better markets with improved products that fetched higher prices, leading to increased incomes as well as farmer productivity. The use of university students to train farmers is a unique opportunity for universities to sustain engagement with communities for as long as students enroll in universities. The entrepreneurial training in addition to the use of ox-ploughs and ownership of radios was the factors that positively influenced crop productivity, while limited access to markets and large family sizes negatively influenced productivity. The design of university–farming community engagement, therefore, should always put into consideration the context-specific factors that may play a role in influencing the success and effect of the training interventions. Entrepreneurial training of farmers should be an integral element of the SAS outreach activities to be relevant to sustainable agricultural development. This calls for integration of entrepreneurial training and practice in the SAS undergraduate programs. Integrating technical and scientific knowledge, entrepreneurship, social and environmental awareness, experiential education and values and ethics into the curricula would provide graduates with capacity to promote rural entrepreneurship. This should complement and give more meaning to the leadership, management, communication and marketing among other competences provided to individual farmers. Promoting rural entrepreneurship is seen from the study as critical in contributing to the development of an engagement with mutual impact and agricultural sustainability.

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