SOCIAL EMBEDDEDNESS AND INNOVATION BEHAVIOR OF INNOVATION PLATFORM ACTORS

ªWilly Turyahikayo*, ᵇFrank B. Matsiko, ᵇRichard F. Miiro, ᵇJohn J. Okiror, ᵇBernard B. Obaa
ª Makerere University Business School, Department of Economics and Energy, Uganda.
ᵇ Makerere University, Department of Extension and Innovation studies, Uganda.

ARTICLE INFO

ABSTRACT

Agricultural innovation platforms are increasingly being used as a means of mitigating agricultural value chain challenges through enabling the co-evolution of different elements in the innovation process. Given a number of actors and their different interests, governance dynamics and institutions are likely to play a fundamental role in the attainment of this objective. This study employed network governance theory to establish the influence of structures and relations in innovation platforms influence on actors' innovation behavior. Using a sample of 319 randomly selected farmers and key informant interviews, it was established that the direct effect of embeddedness on innovation behavior was positive but insignificant (β=0.005, p= 0.953). The effect embeddedness on adaptation, coordination and safeguard of exchanges was positive and significant at (β=0.339, p<0.01), (β=0.239, p<0.01) and (β=0.262, p<0.01) respectively. The role of adaptation in influencing innovation behavior was positive and significant with (β=0.264, p<0.05). The study also finds that the indirect role of adaptation and safeguard of exchanges enhances the relationship between embeddedness and actor innovation behavior. The study recommends that to increase agricultural innovations, members of the networks should have adaptive measures through continuous search for new processes, new markets, reliable inputs and take advantage of new opportunities in their operating environment so as to be adaptive to this new work arrangement.

*Corresponding Author: Willy Turyahikayo
Email: wturyahikayo@mubs.ac.ug*

INTRODUCTION

Smallholder agriculture is the dominant economic activity for sub-Saharan African economies and is likely to remain so in the near future (Gollin *et al.*, 2013). Smallholder farming provides food for a substantial proportion of the global population and has been the main instrument for reduction of rural poverty and hunger in most Sub-Saharan countries in the past two decades (FAO, 2013; Magingxa *et al.*, 2009; Diao *et al.*, 2010; Anríquez and Stamoulis, 2007; World Bank, 2008). It has been established that growth of smallholder farming is four times more effective in reducing poverty than growth in other sectors (World Bank, 2008). In Uganda, smallholder farming constitutes over 75% of the farming community with farm size of about 2.5ha (Salami *et al.*, 2010).

Despite the importance of smallholder farmers in Uganda's economy, the sub-sector continues to be characterized by production and productivity constraints such as limited capacity to manage risks, accessibility to markets and market information, production credit, land and other agricultural inputs and

extension services (Salami *et al.*, 2010). A key characteristic of these challenges is their complexity and multiple dimensionalities and their embeddedness across different levels and actors (Dixon *et al.*, 2003; Adeleke, 2010). Some of these challenges are inherent in the structure of the farming systems while others are dynamic and contextual in nature (Thamaga-Chitja and Morojele, 2014; Hermans *et al.*, 2017).

As a means of mitigating smallholder challenges, innovation platforms are increasingly being used to actively engage different players and the rural smallholder farmers in agricultural innovation processes (Swaans *et al.*, 2013; Cullen *et al.*, 2014). The innovation platforms are a dynamic mechanism involving farmers and a diversity of service providers that interact for purposes of knowledge generation and implementation, sharing and diffusion through social learning (Cullen *et al.*, 2014). Although innovation platforms are used in different domains of life such as healthcare, natural resource management and infrastructure, this paper adopts an agricultural context definition by (Homann-Kee Tui *et al.*, 2013) who define an innovation platform as a forum for learning and action involving a group of actors with different backgrounds and interests: farmers, agricultural input suppliers, traders, food processors, researchers, government officials, etc. who come together to identify common challenges and develop common ways to mitigate them through social learning. Whereas innovation platforms often emerge through spontaneous processes, others may emerge through facilitation and direction by external forces (Consoli and Patrucco, 2011). The use of innovation platforms in agriculture is premised on the assumption that by bringing together various actors, innovation platforms are able to identify and address existing challenges to innovation among the stakeholders (Swaans *et al.*, 2013; Schut *et al.*, 2018).

Innovation platforms are part of wider group of participatory approaches that were promoted since the mid-1980s as a means of supporting the agricultural innovation systems (Cullen *et al.*, 2014; Swaans *et al.*, 2013). An agricultural innovation system is a network of different stakeholders from farmers, research, extension, policy, and markets focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their innovation behavior and performance (Hall *et al.*, 2009). The innovation systems framework

presupposes that innovation is not just about bringing new products and processes. It is a systematic, interactive and evolutionary approach where individuals, networks or organizations, together with the institutions and policies influence innovative behaviors and performance of the economic and social life (Hall *et al.*, 2009). Indeed, Kilelu *et al.* (2013) argue that the agricultural innovation systems approach emphasizes the collective nature of innovation and stresses that innovation is a co-evolutionary process that should align the technical, social, institutional and organizational dimensions. Interventions in commodity innovations are therefore increasingly redirecting their attention toward setting up innovation platforms and networks as mechanisms for operationalizing agricultural innovation systems.

In Uganda, a number of commodity focused innovation platforms have been started in the recent past. The Kiboga-Kyankwanzi innovation platform (KKIP) was initiated in 2013 by Humid Tropics with the aim of changing the lives of the rural farmers in the districts of Kiboga and Kyankwanzi. Humid tropics is a research program by the consultative group for international agricultural research (CGIAR) led by the international institute for tropical agriculture (IITA). The KKIP was formed as a commodity-based platform to promote the commercialization of hybrid maize and soybean through adoption of high yielding varieties in the two districts. This was after the realization that the two districts face crosscutting constraints in form of unstable and low agricultural commodity prices, poor storage and value addition infrastructure, declining soil fertility, high post-harvest losses, expensive agricultural inputs and inadequate extension services.

In order to mitigate these challenges, the IP was initiated to help farmers generate and implement new ideas in the crop value chain. The IP initially sought to increase production and marketable quantity of improved crop varieties but subsequently diversified into value addition, promotion, multiplication and supply of high-quality varieties to meet the challenges of the farming communities. Although the IP started with a few stakeholders, the number has since increased to include farmers, researchers, extension workers, policy makers (local government), training institutions, Non-governmental organizations (NGOs) and the private sector all with different but at times overlapping roles in the platform.

By nature, innovation platforms are social networks and informal partnerships that are guided by informal social systems rather than by bureaucratic structures and formal contractual relationships (Hall *et al.*, 2009). They are emphasized in agriculture because they are seen as a promising avenue for finding solutions to complex social, economic and environmental problems that necessitate the engagement of farmers, development practitioners and policymakers (Schut *et al.*, 2014). Their importance is seen in their ability to increase collaboration and exchange of knowledge between multiple actors thereby enhancing their capacity to innovate and scale up the actor innovation behavior (Hermans *et al.*, 2017). Innovation behavior is a multi-dimensional concept that refers to the sum of all work activities carried out by individuals during an innovation process (de Jong and den Hartog, 2010; West, 1990). It is a knowledge management process that involves recognizing a problem, creating solutions for the problem and creating support for the solutions (Subramaniam and Youndt, 2005). In the context of agricultural innovations, it involves all activities from the exploration and generation of new ideas to their promotion and implementation such as exploring and searching for new farming methods and their promotion, use of improved varieties, improved agronomic practices, appropriate post-harvest technologies and value addition along the supply chain.

Although innovation platforms are seen as a potential tool for generating and implementing new ideas by stakeholders, they often provide an imperfect negotiation process due to challenges such as power imbalance and information asymmetries between actors (Hounkonnou *et al.*, 2018; Swaans *et al.*, 2013; Schut *et al.*, 2018; Faysse, 2006). Extant literature cites structures and relations between actors as critical component for dealing with the challenges of opportunistic behavior, inadequate adaptation and coordination among the actors (Jones *et al.*, 1997; Edmunds, 2002; Nederlof and Pyburn, 2012). It has also been argued that structures and relations in networks facilitate exploration, generation, promotion and implementation of new ideas because of the mediating influence they have on sharing information and documentation, experiences and problem solving, collaboration, coordination and adaptation (Hassall, 2010; Loubser, 2008).

On another strand, it has been noted that bringing together a group of stakeholders with diverse needs, interests and objectives can lead to tensions, conflicts, with each group trying to advantage and exclude other groups from policy space. This undoubtedly hinders their original collective action towards generating and implementing agricultural innovations (Hinnou *et al.*, 2018; Kilelu *et al.*, 2013; Kilelu *et al.*, 2017). It therefore becomes necessary to have effective interactions, collaboration so as to achieve their agreed objective (Tenywa *et al.*, 2011). However, the role of effective structures and relations in fostering actor innovation behavior in networks has received scanty attention in agricultural innovation studies (Faysse, 2006; Gaventa and McGee, 2013; Nederlof *et al.*, 2011). The purpose of this study was therefore to establish the effect of structures and actor relations on innovation behavior of actors in an innovation platform.

Theoretical framework
The study is anchored on the network governance theory by Jones *et al.* (1997). The theory explains how actor structures and relations influence actor innovation behavior within a social network. The theory is a synthesis of transaction cost theory and social network analysis. According to the theory, embeddedness is a foundation for adaptation and coordination necessary for network performance. The concept of embeddedness refers to the extent to which economic behavior is determined by social structures and relations between actors in ways that mainstream economic theories and price mechanism are assumed to have minimal effect (Granovetter, 1985; Uzzi, 1996). According to Nahapiet and Ghoshal (1998), embeddedness can be divided into structural and relational dimensions. Structural embeddedness has been defined by Simsek *et al.* (2003) in terms of the overall architecture (absence or presence) of ties in the network. Other scholars such as Gulati (1998) and Burt (1992) have gone beyond just the layout of a network in terms of ties between actors to include the analysis of the structural position of each of the actors in the network. This is because the structural position measures the actor's involvement in decision making processes and consequently the flow of resources and innovation (Burt, 1992). According to Burt (1992), structural embeddedness can be described by density, centrality, betweenness and centralization.

Density is the actual number of ties in a network, expressed as a proportion of the maximum possible number of ties. However, the use of density to measure structural embeddedness is limited by the fact that it is sensible to the number of network nodes. Therefore, it cannot be used for comparisons across networks that have different number of actors (Scott and Carrington, 2014). Centrality is the number of ties that a node has with other nodes. The higher the number of ties, the more central the tie is. There are two types of centrality- Local centrality and global centrality. Local centrality looks at only direct ties i.e. the ties directly connected to that node as expressed in terms of the number of ties whereas global centrality looks at indirect ties i.e. those that are not directly connected to that node as expressed in terms of the distances among the various nodes. Like density, centrality depends on the size of the network and therefore may not be used to compare networks that differ in size. Betweenness on the other hand is the extent to which a particular node lies "between" the various other nodes in the network. This is because a node with few ties may play an important intermediary role and so be very central to the network. Although it is a meaningful measure of structural embeddedness, it is the most complex of the measures of centrality (Burt, 1992). Centralization provides a measure on the extent to which a whole network has a centralized structure. It is measured by looking at the differences between centrality scores of the most central node and those of all other nodes. Theory suggests that the diffusion of knowledge and subsequent performance of a network are dependent on the density of the network (Boschma and ter Wal, 2007). In the context of agricultural innovation platforms, performance may be manifested in the generation and implementation of new ideas. In addition, previous empirical studies have shown that actors are unevenly embedded into networks which results into differences in the accessibility and sharing of information (Giuliani, 2007). It has indeed been evidenced that actors in a network are very different in their degree centrality and density (Giuliani and Bell, 2005). The more structural embeddedness there is in a network, the more information each player knows about all other actors (Burt, 1992). This then results into adaptation, coordination, trust and joint problem-solving arrangements within the network (Uzzi, 1996). Relational embeddedness shows personal relationships developed through history of interactions while cognitive embeddedness relates to the shared representations and intellectual capital that result from the network.

In innovation networks, Gilsing and Nooteboom (2005) have provided scope, duration, frequency and trust as dimensions for measuring relational embeddedness. They introduced scope to be able to establish a wide range of activities that exist between the actors in a network. They further argue that the frequency and duration of interaction between actors are an important ingredient for mutual understanding and trust which result into innovation performance. Relational embeddedness has also been looked at in terms of tie strength, stability and quality (Li *et al.*, 2013). They argue that networks with higher levels of trust (tie strength) and longer periods of interaction (tie stability) lead to improved network performance through adaptation, coordination and safeguard of exchanges. It has also been argued that the strong and long-lasting relationships between actors enable the development of strong social rules which in turn leads to the creation of routine, common languages and a common culture that are essential for innovation performance (Nelson, 2009). This is because such networks are effective in information transfer and finding joint problem solutions (Uzzi, 1996). However, Uzzi (1997) suggests that over-embeddedness can reduce the flow of novel information into the network because over-reliance on strong ties tends to develop tight, relatively isolated cliques that are not well integrated with the rest of the network actors. Despite this weakness however, embeddedness provides the basis for adaptation, coordination and safeguard of exchanges as well as enhances the likelihood of the network performance through diffusion of information. Structural embeddedness further facilitates the development of innovations because actors who are socially embedded tend to share perception and understandings of the same phenomenon (Pfeffer, 1988; Turyahikayo *et al.*, 2017). Based on the above literature, we hypothesize that embeddedness positively influences actor innovation behavior and that the interaction effects of adaptation, coordination and safeguard of exchange have an indirect role in these relationships as shown in Figure 1. Figure 1 represents the conceptual model of this study for social embeddedness and innovation behavior.
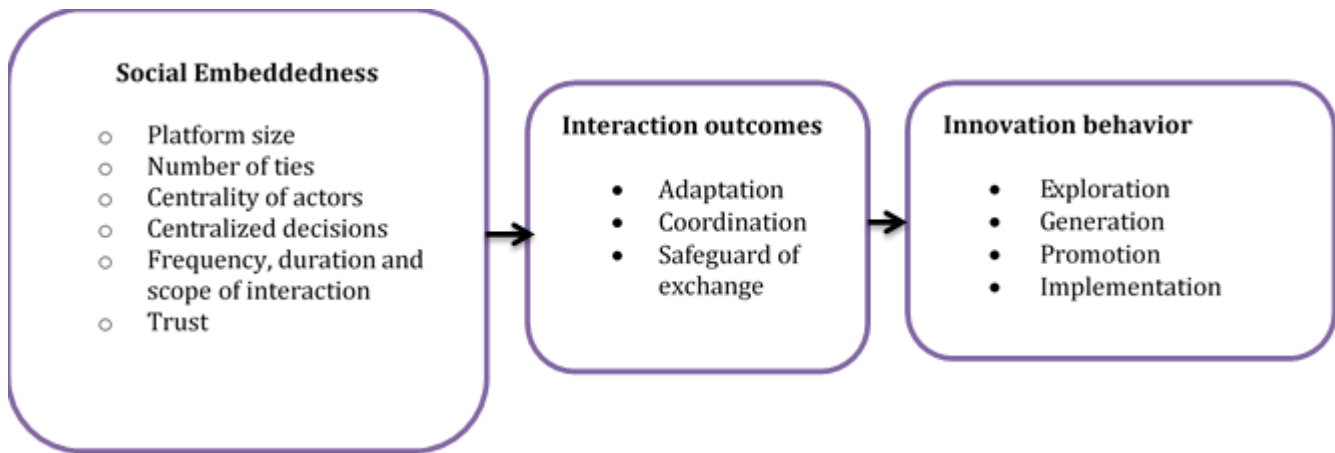
Figure 1. The conceptual model for social embeddedness and innovation behavior. [Adapted from network governance theory by Jones *et al.* (1997)].

MATERIALS AND METHODS

To answer the research hypothesis, a cross sectional survey research design was used in this study. The Kiboga-Kyankwanzi innovation platform was selected purposively because of its diverse activities along the value chain in the maize and soy bean production. The IP has a wide membership in terms of gender and multiple actors which gives an opportunity to study actor relationships. The study population was all members of the IP who include farmers, private business sector, researchers, non-governmental organization, IP executive committee members, farmer group leaders, local policy makers, members of training institutions and extension workers who constituted the units of observation. Since the IP stretches to two districts, sampling was done from the two districts. In Kyankwanzi district, Tukolele Wamu group with a population of 486 farmers was selected whereas Twezimbe with a population of 262 farmers was selected in Kiboga.

Lists of registered farmers were obtained from the IP leadership. A sample size of 214 and 155 farmers were determined from Tukolele Wamu and Twezimbe Farmer Groups respectively using Krejcie and Morgan (1970). Simple random sampling was then used to select the farmers whereas purposive selection was used to select IP executive committee members, private business operators, researchers, NGOs, IP chairpersons, local policy makers, training institutions and farmer group leaders. This triangulation helped to improve on the validity and reliability of the instruments (Verschuren *et al.*, 2010).

Measurement, data collection and analysis

Actor embeddedness was assessed using two sub-themes i.e. structural and relational embeddedness as proposed by Nahapiet and Ghoshal (1998); Burt (1992); Li *et al.* (2013). This operationalization is also in conformity with network governance theory by Jones *et al.* (1997). Innovation behavior was assessed using four sub-themes i.e. idea exploration, generation, promotion, and implementation as used by Messmann and Mulder (2010), Kleysen and Street (2001); Scott and Bruce (1994) and Woodman *et al.* (1993). However, these were modified to suit the activities of the platform as agreed at the inception level of the platform. Previous work by Burt (1992) and Li *et al.* (2013) was used to capture items such as perceived structure of the platform, number of ties, degree of centrality, betweenness, scope, duration and frequency of interaction. Sample question under relations for example read as "The number of meetings/interactions with other members is appropriate for learning under structures and relations". In this study, interviewer administered questionnaire technique was used to collect quantitative data from farmers after translating the questionnaire into the farmers' language. A questionnaire consisting of self-reported items was developed to measure the perceived embeddedness and innovation behavior. Multi-item scales were then used and captured using a five-point Likert scale (ranging from 1=strongly disagree to 5= strongly agree) to test the level of agreement as recommended by Vagias (2006). Sample item on idea exploration for example reads as follows: "I try to explore opportunities in the maize value chain". In-depth

interviewing and focus group discussions were also used to collect qualitative data from IP executive committee members, private business operators, researchers, NGOs, IP chairpersons, local policy makers, training institutions and farmer group leaders so as to improve the validity and reliability of the information. To establish the relationships between the study variables, correlations were done. To determine the effect of embeddedness on actor innovation behavior, we used structural equation modelling (SEM) with Analysis of Moment Structures (AMOS) version 18 and Med graphs (Jose, 2013). This was done to incorporate the mediation effect of open-ended contracts of adaptation, coordination and safeguard of exchanges. SEM as an extension of the general linear model (GLM) helped in testing a set of regression equations simultaneously.

Prior to analysis, data was checked for linearity, missing data as well as outliers. It was important to test for missing data that may have resulted from either non-response of the respondents or errors during entry. One of the challenges of missing data is that statistical results such as regressions computed based on data with non-random missing data may increase item non-response rate which may eventually result into reduction of sample size when the affected cases are deleted or excluded from the analysis. Moreover, a number of statistical approaches such as SEM and programs such as AMOS work on assumptions of complete data. On the other hand, outliers are observations which are uniquely or distinctly different from the majority of the sample responses (Hair, 2010). Outliers are not representative of the population and negatively affect the statistical tests (Hair, 2010) and bias the mean and inflate the standard deviation (Field, 2009). It was therefore important to examine the data set for the existence of such outliers before being subjected to parametric analysis. Using box plots, data showed no indication of outliers.

Validity and reliability
Validity for quantitative data was ensured by computing the Pearson product moment correlation coefficient between the scale items and the total score of each construct while reliability was assessed using Cronbach's Coefficient alpha in the SPSS. The Cronbach's coefficient above 0.8 was preferred but 0.7 was also accepted for reliability of the construct (Hinkin, 1995). For validity, all items that were significantly correlated with the total score of the items were retained. For Qualitative data, reliability was achieved by using more than one person to collect the data for comparison of notes. Validity on the other hand was achieved by ensuring that the intended data was actually captured and reported exactly as captured. Probing more in-depth information as well as triangulation also helped to validate data.

RESULTS AND DISCUSSION
This section presents key findings on the effect of IP structures and actor relations on actor innovation behavior. The overall response rate for the two districts was 86%. In Kyankwanzi district, one hundred eighty-nine (189) respondents participated in the study while one hundred and thirty (130) respondents in Kiboga responded to the questionnaire representing 88% and 84% respectively as shown in Table 1.

Table 1. Response rate.

District/IP	Sampling frame	Sample	Response rate
Kyankwanzi/TukoleleWamu	486	214	189 (88%)
Kiboga/Twezimbe	262	155	130 (84%)
Total	748	369	319 (86%)

Demographic characteristics of respondents
The majority of the respondents were females (53.3%) as compared to males (46.7%). This is probably because most of the small holder farmers in Uganda are women. However, Kyankwanzi district had more males in the sample. Majority of the farmers in the sample were married (71.8%) while 17.2% were not married. In terms of formal education, majority (44.5%) had stopped at primary school level while only 1.6% had attained post-secondary school education. About 74.9% of the sample had either not attained formal education at all or had stopped at the first level of Uganda's formal education system. About one in three (35.4%) were in the age bracket of 50-59. Only 1.9% was below 20 years of age, mostly these were cases from child headed households. The chi-square test for all participants

indicated a significant difference in age ($\chi 2$ (5) = 125.545, p = .000), marital status ($\chi 2$ (3) = 385.589, p = .000), and level of education ($\chi 2$ (4) = 192.458, p = .000. This might partially explain the variations in perceptions about the role of innovation platforms in mitigating the transaction cost challenges. However, the Chi-Square reveals that there was no significant difference in gender of the respondents ($\chi 2$ (1) = 1.382, p = .240).

Correlation between Embeddedness and innovation behavior

Table 2 shows that although not significant, most of the constructs of embeddedness were positively correlated with innovation behavior. This implies that structures and actor relations may not adequately explain the generation and implementation of ideas within the platform. The degree of perceived centralization of decisions indicated a negative correlation with innovation behavior (rho=-0.022, p≥0.05). This means that if actors perceive that most of the decisions and policies are centralized in a few of the actors, their innovativeness reduces.

Results further showed that the structure of a network as measured by its perceived size, number of ties and the degree of perceived betweenness and centralization are positively correlated with network relations such as trust, frequency and duration of interactions. However, there was positive but insignificant relationship between trust and betweenness (rho=0.090, p≥0.05), trust and centralization (rho=0.097, p≥0.05) and between frequency of interaction and centralization (rho=0.100, p≥0.05) as indicated in Table 2. This implies that the structural position of an actor in a network and the levels at which decisions are made though important may not necessarily explain trust levels in the platform. The most important issues as regards trust seemed to be the platform size, number of ties and the scope of interaction as evidenced by significant positive correlations. This is a signal that trust in platform activities increases with an increase in actor connections and increased scope of interactions. Increase in the scope of interactions means that platform activities should go beyond just production and include marketing, storage and other value chain activities.

Table 2. The correlation between structures, relations and innovation behavior

Variables	1	2	3	4	5	6	7	8	9
Platform size (1)	1								
No. of ties (2)	.324**	1							
Betweenness (3)	.894**	.286**	1						
Centralization (4)	.186**	.115*	.186**	1					
Scope (5)	.929**	.306**	.854**	.171**	1				
Trust (6)	.121*	.177**	.090	.097	.111*	1			
Frequency (7)	.689**	.185**	.583**	.100	.649**	.147**	1		
Duration (8)	.846**	.298**	.831**	.169**	.820**	.099	.547**	1	
Innovation behavior (9)	.032	.052	.032	-.022	.061	.098	.054	.053	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation between duration of interaction and trust was also established to be positive implying that higher duration of interactions increases trust in platform activities. This therefore implies that short durations of interactions are likely to lead to mistrust and therefore actors tend to think that the network is not reliable and dependable for joint problem solving. These findings can be collaborated with findings from a FGD where one participant said *"We don't attend meetings. It is our representative who goes for the*

meetings and we follow what they decide but we don't have enough information to do everything they decide…..These people are not reliable….."(KII, July 4th 2017).

This implies that actors are not able to implement all the activities in the value chain due to mistrust and lack of enough information due to the perceived poor representation in policy decisions and mistrust. The relationship between duration of interaction and trust, though positive, was not significant. The correlation

between duration of interaction and trust was also established to be positive implying that higher duration of interactions increases trust in platform activities. This therefore implies that short durations of interactions are likely to lead to mistrust and therefore actors tend to think that the network is not reliable and dependable for joint problem solving. These findings are endorsed with findings from a FGD where one participant said *"We don't attend meetings. It is our representative who goes for the meetings and we follow what they decide but we don't have enough information to do everything they decide.....These people are not reliable....."*(KII, July 4th 2017). This implies that actors are not able to implement all the activities in the value chain due to mistrust and lack of enough information due to the perceived poor representation in policy decisions and mistrust. The relationship between duration of interaction and trust, though positive, was not significant.

Structural equation model estimation

Using structural equation modeling, a regression was performed to establish the effect of social embeddedness on innovation behavior and the indirect role of adaptation, coordination and safeguard of exchanges was established. Prior to the analysis, data was made ready by checking for outliers, missing values and testing for statistical assumptions of normality and linearity to ensure model robustness (Hair, 2010). An examination of data indicated no missing values as shown in the Figure 2.
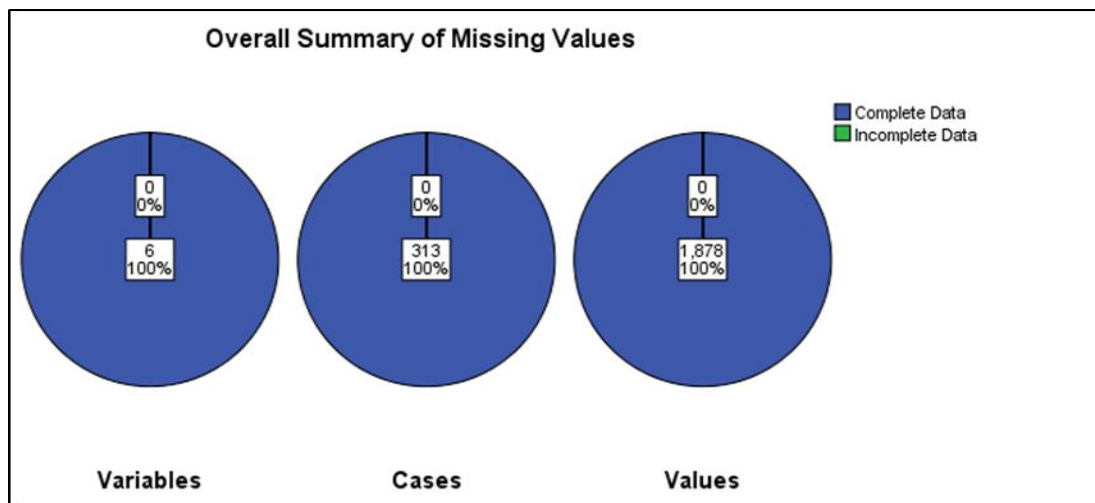

Figure 2. A graph showing complete and incomplete data.

Data was also found to be fairly normaly and linearly distributed and therefore fit for parametric tests. Confirmatory factor analysis (CFA) was performed for purposes of establising the measurement model for all the variables in the study. Only items which were found to measure the variables of the study were retained for further structural equation modeling. For example, only two items were retained for idea exploration; three items for implementation and three items for generation.

In order for a measurement model to be fit, it must meet the goodness of fit indices such as the Normed Fit Index (NFI). Other indices include the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Squared Approximation of Error (RMSEA). CFI is used to control for sample errors (Hoe, 2008), while RMSEA is used to measure the differences in covariance matrices per degree of freedom for the hypothesized and observed model variables (Garver and Mentzer, 1999; Steiger, 1990). Generally, a model is fit if NFI>0.9, TLI>0.9, CFI > 0.9 and RMSEA < 0.08 (Hoe, 2008; MacLean and Gray, 1998; Joreskog and Sorbom, 1993). Consequently, the measurement model fit indices for all the variables were established and found to be within the acceptable range as shown in Table 3.

Although the RMSEA of less than 0.05 is the criterion for model fit, a RMSEA between 0.05 and 0.08 is acceptable especially if reported with other indices (Schumacker and Lomax, 2004). There are a number of model fit indices, this study emphasized TLI, CFI and RMSEA in

reporting since they are less affected by sample size (Schermelleh-Engel *et al.*, 2003). More than one index was used as recommended by Hair (2010), as he asserted that goodness of fit of the model is better tested

and confirmed when more than one index is used. The model fit results show that the parameters of the structural model of the variables do not violate the assumptions of estimation procedure.
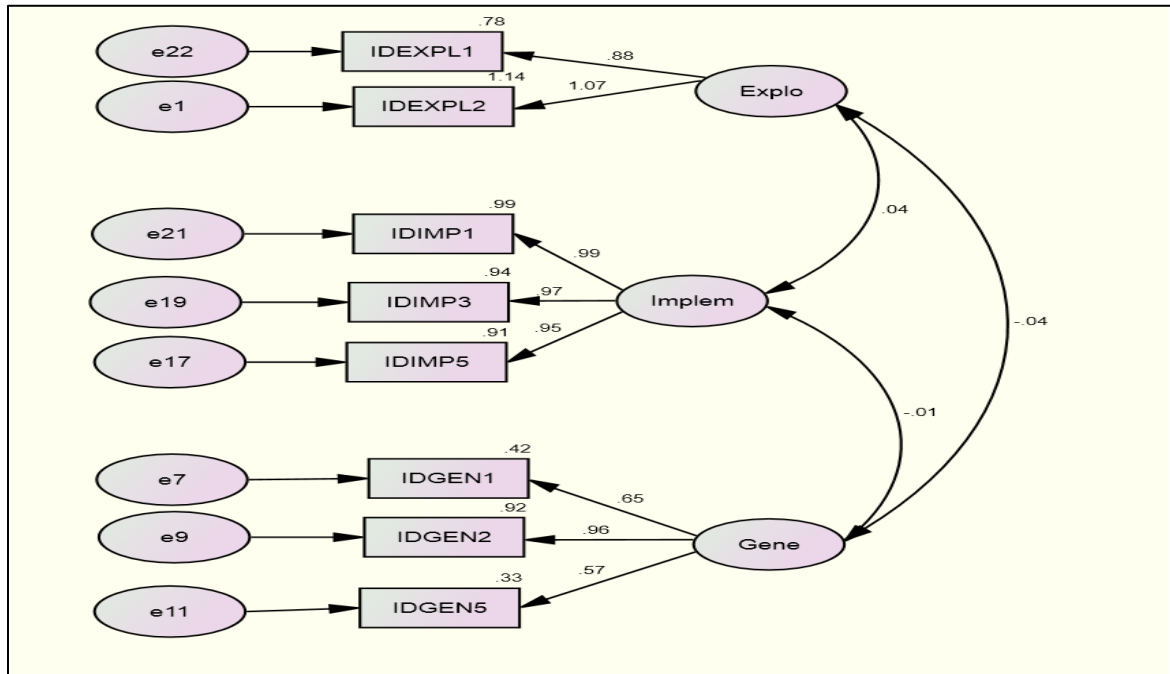

Figure 3. Measurement model for innovation behavior.

Table 3. Model fit results for the measurement models.

Variable	NFI	RMSEA	CFI	TLI
Adaptation	.991	.085	.996	.987
Safeguard	.994	.017	1.000	.999
Embeddedness	.991	.064	.995	.989
Innovation behavior	.984	.066	.991	.984

Estimation of the effect of embeddedness on innovation behavior

After testing for outliers, missing values and fitting the measurement models, a structural model for innovation behavior was constructed to test the research hypothesis. The principal proposition for this study was that embeddedness positively influences actor innovation behavior and that this relationship is mediated by adaptation, coordination and safeguard of exchanges. The model generated a χ^2/df <5, normed fit index (NFI) = .926, Relative Fit Index (RFI) = .906, Goodness of Fit Index (GFI) = .936, Comparative Fit Index (CFI) = .960, Tucker Lewis Index (TLI) = .989 and Root Mean Square Error of Approximation (RMSEA)

=.058 indicating very good and acceptable model for innovation behavior. In order to draw a conclusion for the stated hypothesis, the direct and indirect effects were examined. This is in line with Zhao *et al.* (2010) who argue that proper interpretation of data should be based on both direct and indirect paths.

Path estimates show that the independent variable (embeddedness) had a direct positive relationship between the perceived embeddedness and actor innovation behavior. This means that actor interactions and relations have got a positive impact on actor innovation behavior. However, this relationship is not significant (β= 0.005, p>0.05). This also explains why the correlation between embeddedness (structures and

relations) and innovation behavior within the network was not significant. Results also show that embeddedness significantly influences adaptation (β= 0.339, p<0.05) coordination (β=0.239, p<0.05) and safeguard of exchanges (β=.0.262, p<0.05). This implies that actor interactions and relations result into adaptation to new products and processes, coordination of activities and safeguarding actor exchanges. The estimates further show that the direct effect of adaptation on innovation behavior is positive and

significant (β =0.264, p= 0.032) implying that actors are more likely to be innovative as they adapt to the platform.

The major adaptation issue as established from the measurement model of adaptation was the ability of the platform to continually identify new challenges and solutions facing the crop value chain. This therefore means that as actors adapt to new processes in terms of identifying new opportunities, challenges and solutions, they become more innovative.
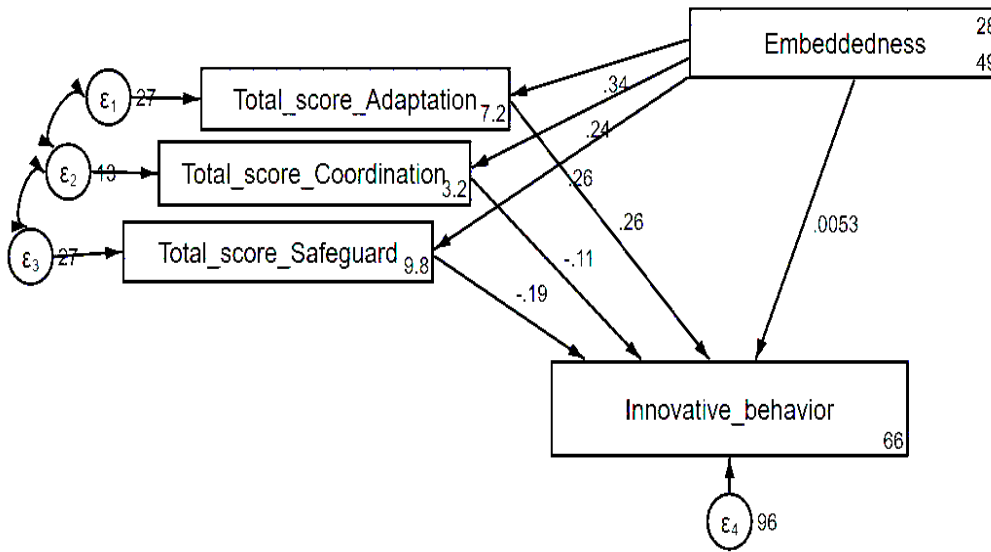

Figure 4. Structural model for embeddedness and innovation behavior.

Results from the model imply that as platform structures and relations between actors become increasingly appropriate for their interaction and social learning, they participate in innovative activities in the crop value chain (Table 4).

From the measurement models, the major issues regarding embeddedness were the duration of interaction and the size of the platform. As actors perceive that the platform size is appropriate for interaction coupled with effective time for interaction, actors tend to be more innovative.

Testing for mediation effects

The study employed the use of Med graphs to test the mediating role of adaptation, coordination and safeguard of exchanges in the relationship between embeddedness and actor innovation behavior. According to Baron and Kenny (1986), for mediation to exist, the

direct paths between independent, mediating and dependent variables must be positive and significant. However, Hayes (2009) dismisses this requirement arguing that an independent variable can exert an indirect effect on a dependent variable through a mediator in the absence of an association between an independent and independent variable. This is possible if you consider that a total effect is the sum of many different paths of influence, some of which may not be part of the formal model.

Hayes (2009) therefore argues that we should never prematurely end the hunt for evidence of indirect effects if there is no evidence that the variables under consideration are not significantly associated. MacKinnon *et al.* (2007) also argues that Baron and Kenny (1986) requirement substantially reduces power to detect real mediation effects and that the overall relationship between variables carries important

information and therefore, it may be useful to require overall relationship between the variables as theorized in a particular study.

The mediation procedure therefore involved establishing the correlation coefficients between the study variables as shown in Table 5. Using a product of coefficients approach, also known as the Sobel test (Sobel, 1982; Sobel, 1986) the resulting changes as a result of introducing mediating variables in the med graph then give an indication of the indirect role of mediating variables in influencing the dependent variable which in this case was innovation behavior.

Table 4. Direct Path Estimates for the Model.

		Coef. (β)	Std. Err.	z	P>z
Adaptation	Embeddedness	0.339	0.041	8.230	0.000
	_cons	7.231	1.197	6.040	0.000
Coordination	Embeddedness	0.239	0.029	8.180	0.000
	_cons	3.199	0.850	3.760	0.000
Safeguard	Embeddedness	0.262	0.041	6.350	0.000
	_cons	9.792	1.201	8.150	0.000
Innovation behavior	Adaptation	0.264	0.124	2.140	0.032
	Coordination	-0.105	0.169	-0.620	0.533
	Safeguard	-0.193	0.134	-1.440	0.150
	Embeddedness	0.005	0.090	0.060	0.953
	_cons	65.843	2.510	26.230	0.000

Source: Field survey, 2017

Table 5. Correlation between embeddedness, innovation behavior and the mediating variables.

Variables(s)	1	2	3	4	5
Adaptation (1)	1.000				
Coordination (2)	.400**	1.000			
Safeguard (3)	.575**	.545**	1.000		
Embeddedness (4)	.405**	.420**	.330**	1.000	
Innovation Behavior (5)	.103	-.022	.003	.054	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5 shows a positive but non-significant relationship between embeddedness and actor innovation behavior (rho=-0.054, p>0.05). Embeddedness was positively and significantly correlated with adaptation (rho=-0.405, p<0.05), coordination (rho=0.420, p<.05) and safeguard of exchanges (rho=0.330, p<.05). Innovation behavior was also positively correlated with adaptation and safeguard of exchanges but negatively correlated with coordination. Following Hayes (2009) and MacKinnon *et al.* (2007), a series of mediation analyses were conducted to test the mediation role of adaptation and safeguard of exchanges. When adaptation taken as a variable, the relationship between embeddedness and innovation behavior changed from 0.054 to (rho=0.114*) as it is indicated in the Figure 5.

We therefore infer that adaptation mediates the relationship between embeddedness and actor innovation behavior. This is because Sobel z-value P is below 0.05 as recommended by the two studies (Jose, 2013; Baron and Kenny, 1986). Further mediation analysis also showed that safeguard of exchanges mediates the relationship between embeddedness and actor's innovation behavior since the relationship between embeddedness and innovation behavior becomes significant as safeguard is introduced in the model.
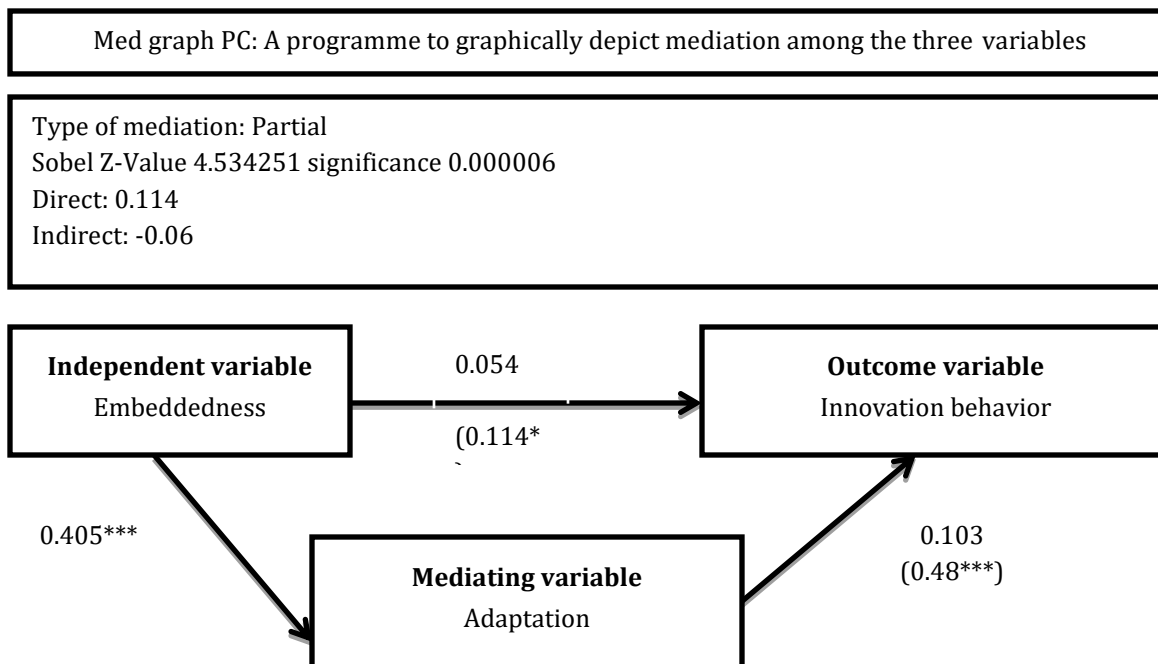
Figure 5. Med Graph for adaptation and innovation behavior.

DISCUSSION

The aim of this paper was to investigate the effect of embedded networks on actor innovation behavior while taking care of the mediating role of adaptation, coordination and safeguard of exchanges. This was accomplished by measuring innovation behavior based on work done by de Jong and den Hartog (2010); Kleysen and Street (2001); Scott and Bruce (1994). Measurement of embeddedness was based on previous work by Jones *et al.* (1997). Results of this study have demonstrated that structures and relations are important in influencing actor innovation behavior in an innovation network. The study also found positive correlations between network structures and relations. In particular, the size of the platform was positively correlated with frequency and duration of interactions. This is partly because as the number of actors increases, the possibility of interacting with many actors increases. This increases knowledge sharing and social learning through adaptation to new methods of farming. This is a pointer to the fact that farmer innovation originates from multiple sources of knowledge sharing such as customers, NGOs, suppliers, research institutions and exchanges between themselves.

According to Burt (1992) and Uzzi (1996), as actor connections increase in a network, more information flows between each of the players which results into trust and joint problem-solving arrangements within the network. The findings are also in agreement with scholars such as Gulati (1998); Li *et al.* (2013); Sartas (2018) who assert that the layout of a network in terms of ties and connections between actors measures the actor's involvement in decision making processes and consequently the flow of resources and innovation. They argue that actors with more connections are more likely to implement innovations than their counterparts. Indeed, other researchers contend that the diffusion of knowledge and subsequent performance of a network are dependent on the number of ties in the network (Boschma and ter Wal, 2007).

The negative correlation between centralization and innovation behavior means that as actors perceive powers to be centralized, their capacity to generate and implement new ideas in limited. This finding is in agreement with recent findings by Sartas (2018) who confirmed that centralization of innovation networks may inhibit innovation and scaling since it crowds out some important stakeholders from policy space. Previous studies by Uzzi (1997) also suggest that over-embeddedness can reduce the flow of novel information into the network because over-reliance on strong interactions tends to develop tight, relatively isolated

cliques that are not well integrated with the rest of the network actors.

In addition to network size, number of ties and the structural position of actors in the network, personal relationships that develop through interactions were noted to be important determinants of innovation behavior. These relationships were noted to originate from different areas of interactions as well as the number of interactions, the period of interaction and reliability of actors. These findings conquer with Turyahikayo *et al.* (2017); Gilsing and Nooteboom (2005) who have argued that the frequency and duration of interaction between actors is an important ingredient for mutual understanding and trust that can result into higher levels of innovation performance. Frequent actor interactions further are instrumental in enabling the development of strong social rules which in turn leads to the creation of routine, common languages and a common culture for dealing with innovation challenges. This assertion is also re-echoed by Li *et al.* (2013); Nelson (2009) who argue that networks with higher levels of trust and longer periods of interaction are more likely to lead to improved network performance than those with weak and unstable ties due to genuine and useful information transfer.

Furthermore, results showed that the correlation coefficients for the relational embeddedness were noted to be greater than those of structural embeddedness. This means that although actor connections are important in influencing innovation behavior, the quality of such interactions as measured by trust, duration and frequency as well as scope of interaction between actors are possibly more important. The quality of interactions could be in terms of how often members interact, what they discuss when they meet and how long the duration of these interactions takes. This assertion is also in agreement with the findings by Li *et al.* (2013) who argue that trust and longer periods of interaction are important ingredients of improved network performance.

Further analysis using SEM showed that the direct effect of embeddedness on innovation behavior is positive though not significant. The effect of perceived embeddedness on adaptation, coordination and safeguard of exchange was significant (P<0.001). Mediation tests showed that adaptation and safeguard of exchanges improve the relationship between embeddedness and innovation behavior. Coordination as

a mediator had a negative impact on actor innovation behavior. This is probably because of the nature of coordination that this study attempted to explore. This study was majorly interested in how bringing together different interdependent actors improves their innovation behavior rather than bringing together their different activities. The current study therefore looked at structural coordination as opposed to process coordination. Whereas network governance theory emphasizes coordination as an important ingredient for network performance, this study recognizes the need to specify the nature of coordination that is required for improved network performance. In reality, actors in an innovation network are more interested in bringing together their activities rather than bringing together the interdependent actors. These activities include; planting, harvesting, post-harvest handling, marketing and processing.

The role of adaptation in networks has previously been resounded by Scott and Bruce (1994) who argued that it is not enough to interact; instead, networks ought to develop supportive structures and mechanisms for adaptation to innovations and safeguard the reasons against which the network is formed. The non-significant direct effect of embeddedness on innovation behavior also concurs with Uzzi (1997) who noted that too much embeddedness may not necessarily lead to network performance and instead can be disadvantageous in a network. He argued that it may reduce the flow of new information since actors with strong ties tend to isolate other actors from network information. This is probably why Jones *et al.* (1997) contend that there is a need for optimal level of embeddedness where actors are neither too tightly connected nor too loosely connected for effective information flow.

CONCLUSION AND RECOMMENDATIONS
The study used the network governance theory as a lens to establish the relationship between embeddedness and actor innovation behavior. The theory shows that embeddedness enables the use of social mechanisms for adapting, coordinating and safeguarding exchanges in a network. This study attempted to extend the network governance theory by studying the effect of structures and relations on actor innovation behavior while integrating the interaction effects of adaptation, coordination and safeguard of exchanges. In this way,

the study addresses a number of gaps emergent within innovation studies that use linear approaches. Consequently, the results reveal some implications for the body of theory about innovation behavior. This study demonstrates that whereas structures and relations are significant in influencing innovativeness among multi stakeholder platforms, the intermediate mechanisms that involve adaptation and coordination of network actors and activities are critical.

The practical implications of the study relate to the management of networks. To be adaptive, members of the networks should continually seek for new processes, markets, inputs and take advantage of new opportunities in their operating environment. This helps to safeguard the exchanges against which the platform is formed. In terms of coordination, networks ought to implement activities that not only bring all actors together to share relevant information but to mobilize resources for attaining promising options and visions and synchronize the timing and sequencing of activities. This can be done through trust building, frequent and regular interactions and reducing centralization of platform decisions to increase actor participation in policy arena. In this way, there is Safeguard for the availability, accessibility and utilization of markets, resources and information. The study however used a total score for the analysis of innovation behavior. In future, this omnibus concept can be categorized into its multistage constructs of idea exploration, generation, promotion and implementation. In this way, one can use multivariate analysis of variance to be able to establish the effect of structures and actor relations on each of these levels of innovation behavior. The study did not look at the individual characteristics of actors such as their education levels, age and social economic background. Future studies can use these as intervening variables to see whether the established relationships will differ when these variables are introduced.

ACKNOWLEDGEMENTS

REFERENCES

Adeleke, K. 2010. Green Building Codes-A Priority for Sustainable Development Architects Colloquium Organized by The Nigerian Institute of Architects in Abuja.

Anríquez, G. and K. Stamoulis. 2007. Rural development and poverty reduction: is agriculture still the key?. ESA Working Paper 07-02.

Baron, R. M. and D. A. Kenny. 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51: 1173-82.

Boschma, R. A. and A. L. J. ter Wal. 2007. Knowledge Networks and Innovative Performance in an Industrial District: The Case of a Footwear District in the South of Italy. Industry & Innovation, 14: 177-99.

Burt, R. S. 1992. Structural holes Harvard university press.

Consoli, D. and P. P. Patrucco. 2011. Complexity and the Coordination of Technological Knowledge: The Case of Innovation Platforms Handbook on the Economic Complexity of Technological Change. Edward Elgar Publishing.

Cullen, B., J. Tucker, K. Snyder, Z. Lema and A. Duncan. 2014. An analysis of power dynamics within innovation platforms for natural resource management. Innovation and Development, 4: 259-75.

de Jong, J. and D. den Hartog. 2010. Measuring Innovative Work Behaviour. Creativity and Innovation Management, 19: 23-36.

Diao, X., P. Hazell and J. Thurlow. 2010. The Role of Agriculture in African Development. World Development, 38: 1375-83.

Dixon, J., K. Taniguchi and W. H. 2003. Approaches to assessing the impact of globalization on African smallholders: Household and village economy modelling. Proceedings of a working session on Globalization and the African Smallholder Study. Rome: Food and Agriculture Organization.

Edmunds, D., and Wollenberg, E. 2002. Disadvantaged groups in multi stakeholder negotiations. CIFOR Programme Report.

FAO. 2013. Census of Agriculture: Analysis and international comparison of the results 1996–2005. Rome: FAO.

Faysse, N. 2006. Troubles on the way: An analysis of the challenges faced by multi-stakeholder platforms. Natural Resources Forum, 30: 219-29.

Field, A. P. 2009. Discovering statistics using SPSS for Windows: Advanced techniques for the beginner Sage.

Garver, M. S. and J. T. Mentzer. 1999. Logistics research methods: employing structural equation modeling to test for construct validity. Journal of business logistics, 20: 33.

Gaventa, J. and R. McGee. 2013. The Impact of Transparency and Accountability Initiatives. Development Policy Review, 31: s3-s28.

Gilsing, V. A. and B. Nooteboom. 2005. Density and Strength of Ties in Innovation Networks: An Analysis of Multi-Media and Biotechnology. SSRN Electronic Journal.

Giuliani, E. 2007. The selective nature of knowledge networks in clusters: evidence from the wine industry. Journal of Economic Geography, 7: 139-68.

Giuliani, E. and M. Bell. 2005. The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster. Research Policy, 34: 47-68.

Gollin, D., D. Lagakos and M. E. Waugh. 2013. The Agricultural Productivity Gap *. The Quarterly Journal of Economics, 129: 939-93.

Granovetter, M. 1985. Economic Action and Social Structure: The Problem of Embeddedness. American Journal of Sociology, 91: 481-510.

Gulati, R. 1998. Alliances and networks. Strategic Management Journal, 19: 293-317.

Hair, J. F. 2010. Multivariate data analysis : a global perspective. Upper Saddle River, N.J. ; London : Pearson Education: London.

Hall, J. N., S. Moore, S. B. Harper and J. W. Lynch. 2009. Global Variability in Fruit and Vegetable Consumption. American Journal of Preventive Medicine, 36: 402-09.e5.

Hassall, G. 2010. Governance, Legitimacy and the Rule of Law in the South Pacific Passage of Change: Law, Society and Governance in the Pacific. ANU Press.

Hayes, A. F. 2009. Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. Communication Monographs, 76: 408-20.

Hermans, F., M. Sartas, B. van Schagen, P. van Asten and M. Schut. 2017. Social network analysis of multi-stakeholder platforms in agricultural research for development: Opportunities and constraints for innovation and scaling. PloS one, 12: e0169634-e34.

Hinkin, T. R. 1995. A Review of Scale Development Practices in the Study of Organizations. Journal of Management, 21: 967-88.

Hinnou, L. C., R. L. Mongbo, J. Kamanda and S. Sanyang. 2018. Innovation platform and governance of local rice value chains in Benin: Between game of power and internal democracy? Cogent Food & Agriculture, 4: 1433346.

Hoe, S. L. 2008. Issues and procedures in adopting structural equation modelling technique. Journal of Quantitative Methods, 3: 76.

Homann-Kee Tui, S., A. Adekunle, M. Lundy, J. Tucker, E. A. Birachi, M. Schut, L. Klerkx, P. G. Ballantyne, A. J. Duncan and J. J. Cadilhon. 2013. What are innovation platforms?

Hounkonnou, D., J. Brouwers, A. van Huis, J. Jiggins, D. Kossou, N. Röling, O. Sakyi-Dawson and M. Traoré. 2018. Triggering regime change: A comparative analysis of the performance of innovation platforms that attempted to change the institutional context for nine agricultural domains in West Africa. Agricultural Systems, 165: 296-309.

Jones, C., W. S. Hesterly and S. P. Borgatti. 1997. A General Theory of Network Governance: Exchange Conditions and Social Mechanisms. Academy of Management Review, 22: 911-45.

Joreskog, K. G. and D. Sorbom. 1993. LISREL6 – Computer program, Moorseville, IN, Scientific Software.

Jose, P. E. 2013. MedGraph-I: A programme to graphically depict mediation among three variables: The internet version, version 3.0. Victoria University of Wellington, Wellington, New Zealand. Retrieved [date] from http://pavlovpsycvuwacnz/paul-jose/medgraph.

Kilelu, C., L. Klerkx, A. Omore, I. Baltenweck, C. Leeuwis and J. Githinji. 2017. Value Chain Upgrading and the Inclusion of Smallholders in Markets: Reflections on Contributions of Multi-Stakeholder Processes in Dairy Development in

Tanzania. The European Journal of Development Research, 29: 1102-21.

Kilelu, C. W., L. Klerkx and C. Leeuwis. 2013. Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. Agricultural Systems, 118: 65-77.

Kleysen, R. F. and C. T. Street. 2001. Toward a multi-dimensional measure of individual innovative behavior. Journal of Intellectual Capital, 2: 284-96.

Krejcie, R. V. and D. W. Morgan. 1970. Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30: 607-10.

Li, T.-L., Y.-H. Xie, J.-P. Hong, Q. Feng, C.-H. Sun and Z.-W. Wang. 2013. Effects of phosphorus application rates on winter wheat yield and phosphorus use efficiency in drylands of South Shanxi Province. Chinese Journal of Eco-Agriculture, 21: 658-65.

Loubser, M. 2008. Governance Structures in Distributed Problem Solving Networks. Oxford Internet Institute DPSN Working Paper Series No. 16.

MacKinnon, D. P., A. J. Fairchild and M. S. Fritz. 2007. Mediation analysis. Annual review of psychology, 58: 593-614.

MacLean, S. and K. Gray. 1998. Structural equation modelling in market research. Journal of the Australian market research society, 6: 17-32.

Magingxa, L. L., Z. G. Alemu and H. D. van Schalkwyk. 2009. Factors influencing access to produce markets for smallholder irrigators in South Africa. Development Southern Africa, 26: 47-58.

Messmann, G. and R. H. Mulder. 2010. Innovative Work Behaviour in Vocational Colleges: Understanding How and Why Innovations Are Developed. Vocations and Learning, 4: 63-84.

Nahapiet, J. and S. Ghoshal. 1998. Social Capital, Intellectual Capital, and the Organizational Advantage. Academy of Management Review, 23: 242-66.

Nederlof, E. S., M. Wongtschowski and F. van der Lee. 2011. Putting heads together: Agricultural innovation platforms in practice KIT publishers Amsterdam.

Nederlof, S. and R. Pyburn. 2012. One finger cannot lift a rock: facilitating innovation platforms to trigger institutional change in West Africa. KIT Publishers,

Nelson, R. R. 2009. An evolutionary theory of economic change harvard university press.

Pfeffer, J. 1988. A resource dependence perspective on intercorporate relations Intercorporate Relations. Cambridge University Press. pp. 25-55.

Salami, A., A. B. Kamara and Z. Brixiova. 2010. Smallholder agriculture in East Africa: Trends, constraints and opportunities African Development Bank Tunis.

Sartas, M. 2018. Do multi-stakeholder platforms work? : contributions of multi-stakeholder platforms to the performance of research for development interventions, Wageningen University and Research.

Schermelleh-Engel, K., H. Moosbrugger and H. Müller. 2003. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. Methods of psychological research online, 8: 23-74.

Schumacker, R. E. and R. G. Lomax. 2004. A Beginner's Guide to Structural Equation Modeling. Psychology Press.

Schut, M., J. Kamanda, A. Gramzow, T. Dubois, D. Stoian, J. A. Andersson, I. Dror, M. Sartas, R. Mur, S. Kassam, H. Brouwer, A. Devaux, C. Velasco, R. J. Flor, M. Gummert, D. Buizer, C. McDougall, K. Davis, S. H.-K. Tui and M. Lundy. 2018. Innovation platforms in agricultural research for development. Experimental Agriculture, 55: 575-96.

Schut, M., J. Rodenburg, L. Klerkx, A. van Ast and L. Bastiaans. 2014. Systems approaches to innovation in crop protection. A systematic literature review. Crop Protection, 56: 98-108.

Scott, J. and P. Carrington. 2014. The SAGE Handbook of Social Network Analysis SAGE Publications Ltd.

Scott, S. G. and R. A. Bruce. 1994. Determinants of innovative behavior: a path model of individual innovation in the workplace. Academy of Management Journal, 37: 580-607.

Simsek, Z., M. H. Lubatkin and S. W. Floyd. 2003. Inter-Firm Networks and Entrepreneurial Behavior: A Structural Embeddedness Perspective. Journal of Management, 29: 427-42.

Sobel, M. E. 1982. Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models. Sociological Methodology, 13: 290.

Sobel, M. E. 1986. Some New Results on Indirect Effects and Their Standard Errors in Covariance Structure Models. Sociological Methodology, 16: 159.

Steiger, J. H. 1990. Structural Model Evaluation and Modification: An Interval Estimation Approach. Multivariate Behavioral Research, 25: 173-80.

Subramaniam, M. and M. A. Youndt. 2005. The Influence of Intellectual Capital on the Types of Innovative Capabilities. Academy of Management Journal, 48: 450-63.

Swaans, K., R. Puskur, H. Taye and A. Girma. 2013. A monitoring and evaluation framework to assess the performance of innovation platforms in the context of livestock value chains ILRI (aka ILCA and ILRAD).

Tenywa, M., K. Tukarhirwa, R. Bruchara, A. Adekunle, J. Mugabe, C. Wanjiku, S. Mutabazi, B. Fungo, N. Kashja and P. Pali. 2011. Agricultural innovation platform as a tool for development oriented research: Lessons and challenges in the formation and operationalization.

Thamaga-Chitja, J. M. and P. Morojele. 2014. The Context of Smallholder Farming in South Africa: Towards a Livelihood Asset Building Framework. Journal of Human Ecology, 45: 147-55.

Turyahikayo, W., F. B. Matsiko, J. J. Okiror and M. Buregyeya. 2017. Understanding actor innovation behavior: The application of network governance theory in agricultural innovation platforms. Journal of Agricultural Extension and Rural Development, 9: 247-54.

Uzzi, B. 1996. The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. American Sociological Review, 61: 674.

Uzzi, B. 1997. Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. Administrative Science Quarterly, 42: 35.

Vagias, W. M. 2006. Likert-type scale response anchors. clemson international institute for tourism. & Research Development, Department of Parks, Recreation and Tourism Management, Clemson University: 4-5.

Verschuren, P., H. Doorewaard and M. Mellion. 2010. Designing a research project Eleven International Publishing The Hague.

West, M. 1990. Innovation at work. In mA West & JL Farr. Innovation and creativity at work: 3-13.

Woodman, R. W., J. E. Sawyer and R. W. Griffin. 1993. Toward a Theory of Organizational Creativity. Academy of Management Review, 18: 293-321.

World Bank. 2008. World Development Reports'. Available online: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTDRS/0,contentMDK:20227703~pagePK:478093.

Zhao, X., J. G. Lynch and Q. Chen. 2010. Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. Journal of Consumer Research, 37: 197-206.