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Review

Understanding actor innovation behavior: The application of network governance theory in agricultural innovation platforms

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Innovation platforms are increasingly being used as a means of operationalizing innovation systems thinking. Agricultural innovation platforms are intended to bring together a number of stakeholders to promote an identified agricultural innovation. This is done through exchange of knowledge and other valuable resources to solve common problems. However, given the relatively new nature of innovation platforms, there is still limited conceptual knowledge on the mechanism within the platforms that leads to the implementation of innovations by different stakeholders who often have conflicting interests. This conceptual paper intended to review and unearth the intermediate processes that influence the actor innovation behavior by using the network governance theory. The review shows that the generation and implementation of ideas in an innovation platform is a process that involves structural, relational and social mechanisms. This review provides a foundation for future empirical studies in innovation platforms and particularly how they influence actor innovation behavior.

Key words: Innovation platform, innovation behavior, network governance, agricultural innovation platforms.

INTRODUCTION

Innovation platforms are considered to be a new and dynamic mechanism that brings together farmers and diverse service providers for knowledge generation, sharing and diffusion for purposes of social learning (Cullen et al., 2014). They are generally viewed as a component of wider participatory approaches that were promoted since the mid-1980s to integrate farmers' indigenous knowledge within the knowledge provided by agricultural extension workers (Swaans et al., 2013). Whereas some innovation platforms emerge through spontaneous processes, others may emerge through facilitation and direction by external forces (Consoli and Patrucco, 2011). Innovation platforms have been defined differently by different scholars. However, all definitions allude to the fact that innovation platforms bring together different stakeholders to identify solutions to common problems or to achieve common goals, joint conflict resolution, negotiation, social learning and collective

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decision making towards concerted action (Cadilhon, 2013). In the context of agriculture, Homann-Kee et al. (2013) define an innovation platform as a forum for learning and action involving a group of actors with different backgrounds and interests such as 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.

In the agricultural rural systems, innovation platforms are a means of addressing complex biophysical, technological, socio-cultural, economic and institutional challenges thereby contributing to structural and long-term engagement among different actors (Sumberg et al., 2013). The engagement of various stakeholders in exploring innovations to address these complex agricultural problems is essential for establishing whether the type of innovations are acceptable and feasible (Schut et al., 2014) and establishing the need for interdependency in overcoming challenges (Leeuwis and Aart, 2011; Messely et al., 2013). In addition to connecting and managing interfaces between multiple actors, innovation platforms perform a multiplicity of functions such as demand articulation, institutional support, network brokering, capacity building, innovation process management, and knowledge brokering (Kilelu et al., 2011). Innovation platforms are also referred to as multi-stakeholder platforms, innovation networks or learning alliances that offer a potential approach for implementing the agricultural innovation systems (Cullen et al., 2014). It is indeed argued that innovation platforms increase collaboration, exchange of knowledge and influence mediation among multiple actors such as farmers, researchers and policy makers thereby enhancing their capacity to innovate and scale up the innovations (Hermans et al., 2017).

Although innovation platforms are seen as a potential tool for addressing coordination and communication between stakeholders, power dynamics within the network can potentially influence platform processes. Power dynamics in platforms affect the innovation behavior of actors especially the marginalized groups such as farmers who quite often perform dormant roles in policy arena (Nederlof and Wongtschowski, 2011). 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). 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).

Faysse (2006) argues that even when an innovation platform is widely considered to be a forum of inclusive participation and innovation, it often provides an imperfect negotiation process due to challenges such as power imbalance and information asymmetries between actors which may hinder platforms from realizing the envisaged innovations (Swaans et al., 2013). Extant literature has cited network governance as a critical component for dealing with the challenges of opportunistic behavior, inadequate adaptation and coordination among the actors in a network (Jones et al., 1997; Edmunds and Wollenberg, 2002; Nederlof and Pyburn, 2012). Therefore, studies in the antecedents of innovation behavior require a framework that integrates network governance theories. Network governance involves a select, persistent, and structured set of autonomous actors engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges (Jones et al., 1997). The theory is a synthesis of transaction cost (Williamson, 1975) and social network theories.

NETWORK GOVERNANCE THEORY

Literature has cited two main forms of governance; the bureaucratic and network forms (Kooiman, 1993; Lynn et al., 2001). These different types of governance are often a result of socio-economic and political process under which various social actors interact to achieve their set goals (Kim, 2006) and the effectiveness of each of the different types of governance (Rhodes, 1997). The bureaucratic governance also known as the central-rule model posits that there is a central steering agent (CSA) amongst numerous actors and assumes that the CSA has all information about all problems, preferences and solutions to problems facing the network. The model has its foundations in the conventional bureaucratic management approach that neglects the values and interests of the individual actors in the network and hence fails to utilize their intellectual capacities in management (Hanf and Toonen, 2012). It therefore postulates a top-down approach in the management and governance of innovation platforms. In terms of organizational structure, an innovation platform governed under this model is mechanical, formalized and specialized. Under the central-rule model, the level and variety of participation in strategic decisions, accountability and monitoring and evaluation is done by a small number of people usually at the higher levels of the hierarchy (Tsai, 2002). Critical knowledge and information sharing is also a preserve of this small number of individuals (Gigone and Hastie, 1997). The central-rule model has been criticized for limiting participation of the majority in decision making which reduces communication, commitment and involvement in tasks among members (Damanpour, 1991; Rogers, 2003; Sivadas and Dwyer, 2000). Bureaucratic governance is a traditional mode of governance that follows the rules and procedures and relies on supervision of stakeholders in the network (Considine and Lewis, 2003). The formal rules and procedures are imposed by higher authorities and this as

argued by some scholars enables bureaucratic governance to achieve a high degree of coordination and cooperation among the very many actors (Peters and Pierre, 1998). This however, is achieved at the expense of institutional flexibility and innovation (Lowndes and Skelcher, 1998). Because of this centralized and unified command of decision making structure, bureaucratic governance is also referred to as vertical or hierarchical governance form (Kim, 2006).

Network governance on the other hand has gained much attention in the last two decades with numerous scholars advancing theories and definitions of network as the starting point. Dubini and Aldrich (1991) and Kreiner and Schultz (1993) have described a network as a collaboration among individuals and organizations. Networks emphasize long-term exchanges that are based on trust and mutual interests of the actors (Larson, 1992; Liebeskind et al., 1996). According to Borgatti and Everett (1997), network governance refers to the coordination that is characterized by organic or informal social systems as opposed to the hierarchical and formal contractual relationships between the actors. This definition is however, criticized on the grounds that it assumes that there are no interactions between actors under the hierarchical form of governance. Provan and Kenis (2008) view all networks as having interactions but the focus on governance enables the critical analysis of rules, sanctions and structures of authority that are used to allocate resources, coordinate and control decisions in the entire network. Although, the concept of network governance is defined differently by different authors, all definitions allude to the fact that it is a pattern of interaction in exchange and relationships and flows of resources between independent units (Powell, 1990; Gerlach, 1992; Larson, 1992). Thus, network governance is composed of autonomous individuals and organizations that operate like a single entity in their tasks which require joint activity. To maintain networks, the network form of governance employs social control measures such as collective sanctions rather than relying on legal authorities (Jones and Hesterly, 1993). It is argued that an actor's decision to join a network is determined by among other factors the actors involved, contents of the network, efficiency and effectiveness of the network (Hay and Richards, 2000). The network governance theory is a synthesis of transaction cost theory and social network theory provided by Jones et al. (1997). The integration of transaction cost theory in social network helps to identify the conditions that facilitate the emergence of network governance (Jones et al., 1997).

According to the transaction cost theory, there are four conditions for the network form of governance to emerge-environmental uncertainty, asset specificity, task complexity and frequency. These conditions are also referred to as exchange conditions and that without them, there would be no need for the network form of governance (Williamson, 1991; Jones et al., 1997).

Environmental uncertainty is a result of the unstable and unpredictable environment within which individuals and organizations work (Williamson, 1991). This may be a result of unpredictable supply and demand which necessitates individuals to integrate with a number of other actors in production processes (Helfat and Teece, 1987). The main sources of demand uncertainty are generated by unknown and rapid shifts in consumer tastes and preferences, seasonality, rapid changes in knowledge and technology and lack of information about past, current and future states in the environment (Jones et al., 1997). Uncertainty further arises from the inability to identify actors in a network who are likely to behave opportunistically (Williamson, 1994). Asset specificity refers to the extent to which an asset can be redeployed to alternative uses and by alternative users without a substantial sacrifice of its productive value (Williamson, 1989). Asset specific also known as customized exchanges involve unique equipment, processes, or knowledge developed by participants to complete exchanges and may take various forms including site specificity, physical asset specificity, human asset specificity, dedicated assets, brand name capital and temporal specificity (Williamson, 1989). Customized or asset-specific exchanges create dependency between different stakeholders thus increasing the need for coordination and raising concerns about how to safeguard these exchanges. Indeed, customization combined with uncertainty requires intensification of coordination between members within a given social setting to safeguard exchanges by reducing behavioral uncertainty (Hesterly and Zenger, 1993).

Task complexity refers to the number of different specialized inputs together with human resources needed to complete a product or service (Jones et al., 1997). Task complexity creates behavioral interdependence and heightens the need for coordinating activities (Pfeffer and Salancik, 1978). The different tasks and inputs are a result of increased scope of activities, number of products created, or number of differing markets served and the need to reduce costs in a rapidly changing environment which increases time pressures (Killing, 1988). Task complexity in conjunction with time pressures leads to team coordination where diversely skilled members work simultaneously to produce a good or service (Faulkner and Anderson, 1987). On the other hand, frequency concerns how often specific parties exchange with one other (Jones et al., 1997). It transforms the orientation that actors have toward an exchange because repeated personal contacts across organizational boundaries support some minimum level of courtesy and consideration between the actors and the amount of informal controls that can be exerted over exchanges (Granovetter, 1992). Frequency is important because it facilitates transfer of implicit knowledge and establishes the conditions for relational and structural embeddedness which provide the foundation for engaging social

mechanisms to adapt, coordinate, and safeguard exchanges effectively (Williamson, 1985). As the frequency of interactions increases, the need for the network form of governance becomes increasingly important. The degree of frequency may range from occasional to recurrent interactions (Williamson, 1985).

In addition to exchange conditions, Hay and Richards (2000) have provided resource dependency as another important reason for the emergence of networks. They stipulate that for networks to emerge there must be the recognition of potential mutual advantage for enhancing strategic capacities through pooling strategic resources together. This emerges from the fact that no single actor possesses all the necessary resources such as information, skills and inputs needed for enhancing production. This argument comes from resource dependency theory which presupposes that by engaging in a network, it is possible for actors to obtain the resources they need and be more effective than working individually (Hay and Richards, 2000). Although the unit of analysis associated with resource dependence theory has traditionally been the organization, its theoretical arguments can be applied to the analysis of the individual level social behavior (Johnson, 1998). It is argued that in order to manage interdependence with either sources of inputs or markets for output and diversify operations, individual actors no longer work alone in a closed environment but rather seek external resources through network formation which allows adaptation to external environment (Donaldson, 1995). A fundamental presumption of resource dependence theory is that in a network, dependence on other actors influences the actions and decisions pursued by a single firm (Nienhüser, 2008). The main thrust of exchange conditions and the need to pool resources together is that they drive actors toward embedding their transactions both structurally and relationally (Jones et al., 1997).

SOCIAL EMBEDDEDNESS

The exchange conditions discussed earlier constitute a fundamental foundation for social embeddedness which further determines the behavior of actors in a network (Nahapiet and Ghoshal, 1998; Rutten and Boekema, 2007). The concept of emebeddedness refers to the extent to which the economic behavior of individuals is determined by social relations between actors in ways that mainstream economic theories and price mechanism is assumed to have minimal effect (Granovetter, 1985; Uzzi, 1996). The concept of social embeddedness explains how the overall structure of relationships between actors affects economic action and outcomes in a network (Granovetter, 1973). Embeddedness is essential for easy communication and access to inputs due to social networks (Coleman, 1990; 1988). According to Nahapet and Ghosal (1998), social embeddedness has been divided into three major dimensions: structural, relational and cognitive; although, literature in management often merges cognitive embeddedness into structural since both are concerned with qualitative dimensions of network relationships.

Structural embeddedness has been defined by Simsek et al. (2003) in terms of the overall architecture 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 described by density, centrality, betweenness and centralization. Density is the actual number of ties that an actor has, expressed as a proportion of the maximum possible number of ties in the network. 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 members (Scott and Bruce, 1994). Centrality is the number of ties that a node has with other nodes. Accordingly, a node with many ties is considered to be more central than other ties. There are two types of centrality: local centrality and global centrality. Local centrality looks at only direct ties, that is, the ties directly connected to a certain node as expressed in terms of the total number of ties in the network whereas global looks at indirect ties, that is, 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 some nodes play important roles because they act as a link between other nodes in the network. Although, it is a meaningful measure of structural embeddedness, it is the most complex of the measures of centrality (Burt, 1992). Centralization is the extent to which the entire network is centralized. It is measured by looking at the differences between centrality scores of the most central node and those of all other nodes. Structural dimension of embeddedness is rooted in Granovetter's (1973) work on the strength of social network ties.

On the other hand, 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, Nooteboom and Gilsing (2004) 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. It has also been argued before that the strong and long lasting ties 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 (Coleman, 1990; 1988; Nelson and Winter, 1982). This is because such networks are effective in information transfer and finding joint problem solutions (Uzzi, 1996). Nevertheless, as noted by Uzzi (1997), too much embeddedness can be disadvantageous in a network. He argues that it reduces the flow of new information since actors with strong ties tend to isolate other actors from network information. There is therefore a need for optimal level of embeddedness where actors are neither too tightly connected nor too loosely connected for effective information flow (Jones et al., 1997). In general, social embeddedness leads to network performance through vertical and horizontal linkages between the actors (Granovetter, 1985). According to Giedraitis et al. (2009) vertical links result from specialization of actors along the supply chain while horizontal links lead to competition and rivalry among the actors.

SOCIAL MECHANISMS

Social embeddedness as discussed earlier enables the use of social mechanisms for coordinating and safeguarding exchanges (Jones et al., 1997). Social mechanisms are the institutional mechanisms such as restricted access to exchange, collective sanctions, macro-cultures and reputation that help to control the behavior of the social system and its components (Jones et al., 1997; Coleman, 1990; 1988; Nelson and Winter, 1992). Restricted access to exchanges refers to a reduction in the number of actors who can freely enter the network (Jones et al., 1997). It reduces coordination costs by eliminating some actors which eases interaction for knowledge sharing (Faulkner and Anderson, 1987). It also facilitates identification among the actors which helps create strong ties among them (Granovetter, 1973). Collective sanctions on the other hand help to punish members of the network who violate norms, values or goals of the network. This may involve ostracism or exclusion from the network for either short periods or indefinitely (Jones et al., 1997). Collective sanctions define acceptable behavior by demonstrating the consequences of non-compliance to the rules in the network.

Macro-culture on the other hand refers to shared values and norms that are specific to a network (Jones et al., 1997). The value and norms are shared by all members of the network and they specify the roles, role-relationship and the generally accepted approaches for solving complex problems in the network (Granovetter, 1992). Due to behaviors that are accepted by all actors, macro-culture allows efficient coordination and information flow among actors in the network (Faulkner and Anderson, 1987). Reputation on the other hand refers to the actor's attributes in terms of character, ability and trust that are important to safeguard exchange conditions. These attributes are particularly important because actors often have imperfect information about the behaviors of other actors (Fombrun and Shanley, 1990). Thus, the presence of these attributes and intermediate processes help to deter deceptive behavior, which enhances cooperation, adaptation and safeguard of exchanges which are key issues in assessing the effectiveness of social mechanisms (Figure 1) (Jones et al., 1997; Kilduff and Krackhardt, 1994).

ACTOR INNOVATION BEHAVIOR

The social mechanisms that result from social embeddedness improve the network performance. For example, restricted access to exchanges in the network leads to a reduction in the number of exchange partners within the social network (Jones et al., 1997). This reduces coordination costs through fewer partners who interact more often and allows actors to learn about each other and to establish routines for working together to adapt and safeguard exchanges (Faulkner and Anderson, 1987; Jones et al., 1997). The end result of these interactions is improved network performance as measured by actor innovativeness. Innovative behavior is an act of generating and implementing new ideas for purposes of improving performance (Scott and Bruce, 1994; Woodman et al., 1993). The idea generation stage constitutes of idea exploration and generation (Mumford, 2000; Janssen 2000). At exploration level, individuals begin to look for ways of improving production processes and try to solve problems by themselves (Kleysen and Street, 2001). In agricultural innovation systems, this stage involves the recognition that current agricultural practices such as traditional crops that take long to mature and low yielding are a hindrance to agricultural progress. In this stage, questions relating to whether individuals pay attention to new and improved crop, look for opportunities to improve their farming systems, consider innovative opportunities and explore new crop varieties are essential (Messmann and Mulder, 2011). Idea exploration and generation constitute what has been termed as creative stage of innovation.

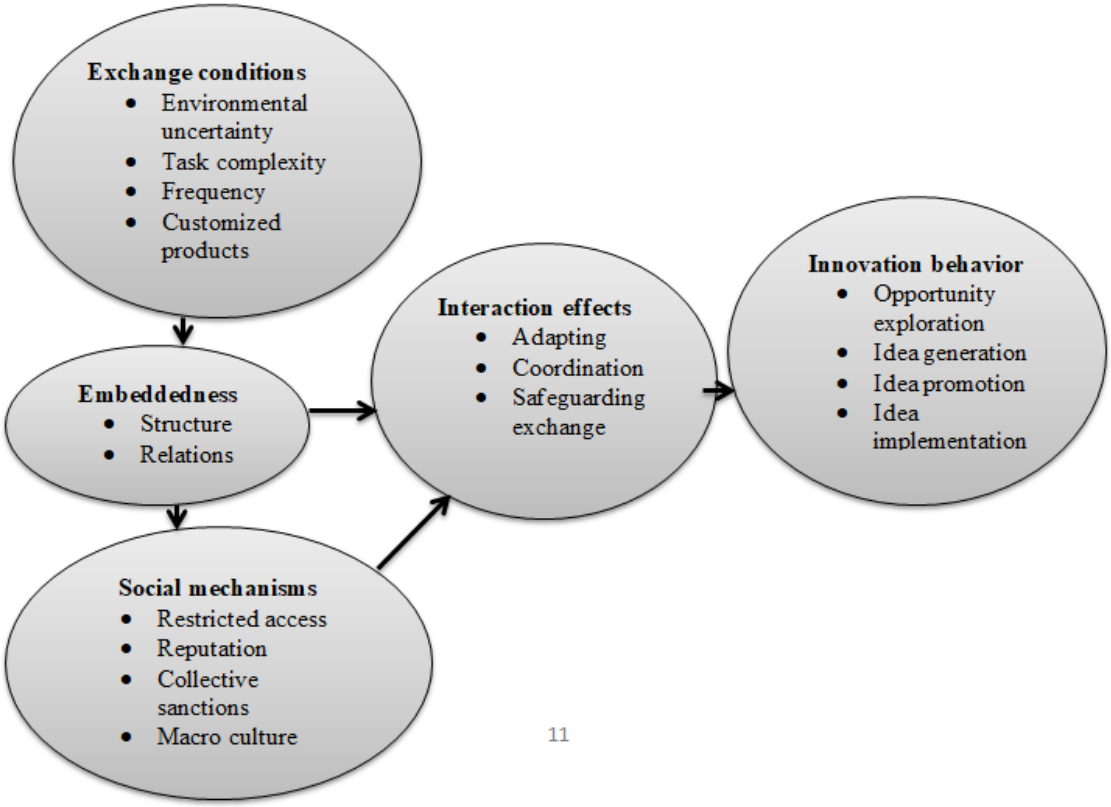

Figure 1. The conceptual process leading to innovation behavior. Source: Adopted from Jones et al.(1997) with modification.

In the implementation stage, innovative ideas are realized and put into practice. Like the generation stage, this stage is reconstructed into two distinctive stages; Idea promotion and Idea implementation. Idea promotion involves mobilizing support for new ideas, acquiring approval for new ideas, making important platform members enthusiastic for ideas and attempting to convince people to support them (Messmann and Mulder, 2011). This may be done by mobilizing resources, influencing and negotiating with a number of stakeholders in an innovation. Under innovation platform arrangement, this stage encompasses championing the ideas by convincing the social environment of the envisioned innovation, and building a coalition of allies that take over responsibility and provide necessary information, resources, and support among the actors. This owes to the fact that the success of an innovation depends on the ability to persuade powerful and influential people of the value of the innovations, and on the ability to access and utilize the actor networks (Dougherty and Hardy, 1996). The implementation stage on the other hand involves experimenting with the ideas and planning strategic integration of new ideas into practice. In this stage, new products, services and work processes are developed, tested and modified (De Jong, 2007). The new ideas such as new crops and farming practices become a regular part of the production processes (Kleysen and Street, 2001). In agricultural innovation platforms, the implementation stage transforms new varieties into useful applications, systematically introduces new varieties into farming systems and puts effort in the development and sustainability of the new crop verities and agricultural practices (Messmann and Mulder, 2011). The stage process of innovation behavior is consistent with the definition of innovation and helps to construct the process of innovation development from the emergence of an idea to its transformation into a practically relevant outcome (Janssen, 2000; Scott and Bruce, 1994).

CONCLUSION

The main objective of this review was to make a theoretical process that explains the innovation behavior of actors within a platform. The paper has made use of network governance theory to explain the reasons for the emergence of networks and how these social networks influence actor innovation behavior. In summary, the exchange conditions of asset specificity, demand uncertainty, task complexity, and frequency drive actors

towards social embeddedness. When actors are both structurally and relationally embeddeded with each other, enforcement of social mechanisms for adapting, coordinating and safeguarding exchanges becomes a reality. As Jones et al. (1997) argues structural embeddedness is a conduit for diffusing values and norms which enhance coordination and diffusion of valuable information among the independent actors. This also facilitates the development and institutionalization of values, norms, and beliefs shared across actors through shared perceptions and understandings (DiMaggio and Powell, 1983). The free flow of information allows the possibility of collective sanctions for non-compliance to norms and values (Jones et al., 1997; Gulati, 1998).

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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