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Identifying and Mapping Linkages between Actors in the Climate Change Innovation System

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Abstract

Promoting innovations in climate change requires innovation partnerships and linkages and also creating an enabling environment for actors. The paper reviewed available information on the identification and mapping of linkages between actors in the climate change innovation system. The findings showed different linkage types and mechanisms that could exist in the climate change innovation system. Actor linkage map, actor linkage matrix, actor determinant diagram and actor time lines were identified as ways of mapping linkages between actors in the climate change innovation system. For effective innovations in the system, it is recommended that linkages between actors be identified and mapped and enabling environment for innovations provided.

Key words: climate change, climate change innovation system, linkages, actors

Introduction

Innovation is defined as the development, adaptation or imitation and the subsequent adoption of technologies that are new within a specific context (CTA/UNU – INTECH/KIT, 2005). This specific context could be climate change. In the neoclassical economics tradition, innovation was understood to be induced by the relative scarcity (hence, price) of factors (Rogers, 1995). It follows that there is a lineal, input/output relationship between research, development of technology and its dissemination, and at the end, its adoption leading to economic and social effects and impacts (Hall; Bockett; Taylor; Sivamohan and Clark (2001).). This paradigm of lineal technology diffusion, was criticized for its failure to understand the source, nature, and dynamics of most innovations processes (Berdegué, 2005), as well as for failing to pay sufficient attention to the distributional or equity issues related to innovation (Hall *et al*., 2001).

The concept of innovation system emerged because the conventional economic models had limited power to explain innovation, which it viewed conventionally as a linear process driven by research (Berdegué, 2005). The innovation systems

framework sees innovation in a more - systemic, interactive and evolutionary way, whereby networks of organizations, together with the institutions and policies that affect their innovative behaviour and performance, bring new products and processes into economic and social use (Freeman, 1987; Edquist, 1997). World Bank (2006) defined innovation system as a system comprising the organisations, enterprises and individuals that demand and supply knowledge and technologies, and the policies, rules and mechanisms which affect the way different agents interact to share, access, exchange, and use knowledge. Daane, (2009), stressed that just as with other human activity systems, innovation systems do not exist 'out there' as objective entities or realities – they only exist 'in the minds of those who define them', i.e. as social construct, or as a heuristic device for analytical purposes. An implication of this definition is that innovation systems are defined in relation to a particular domain of human activity. Thus, one can e.g. define a system for innovation in a specific commodity, value chain or business cluster, or in specific (agro) eco- or farming systems hence the climate change innovation system.

Climate change innovation system could be defined as comprising the organizations and individuals that together demand and supply knowledge and technology needed for climate change adaptation and mitigation, and the rules and mechanisms by which these different actors/agents interact. Climate change innovation system emphasizes the need to nurture the demand for knowledge and technologies among a range of actors/stakeholders, including farmers, researchers, extension officers, policy makers, private-sector companies, entrepreneurs, agro-processors, non-governmental agencies and other organizations. It also provides a useful paradigm for the collaboration of actors/stakeholders in climate change, through a network focused on bringing new products, processes and forms of organization into economic use. The system features the interactions between these organizations and institutions, as well as policies that affect their behaviour and performance.

The climate change innovation system concept therefore focuses not merely on the science suppliers but on the totality and interaction and linkages of actors involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of new and existing knowledge in novel and useful ways such as (1) key actors and their roles, (2) the actors' attitudes and practices, (3) the effects and characteristics of patterns of interaction, and (4) the enabling environment for innovation.

In effective innovation networks, different actors need to bring resources and capabilities that are valuable to the rest and that contribute to the common goal (Hall, 2004). While networks of actors are important in climate change innovation system, the qualities of the actors' interactions and linkages, and, in particular, of the social learning processes that occur during the innovation process, are most essential (Woodhill, 2005). Research issues that also need to be examined in climate change innovation system include: review of existing policies, acts and initiatives for the commodity or issue under examination, key actors, their roles,

attitude and technological capabilities, linkages-level and mechanism, and learning.

In tackling the challenges as those posed by climate change, there is the need for effective communication and working relationship among actors. It is therefore a worthwhile exercise to identify and map linkages between actors in the climate change innovation system in Nigeria. The pertinent questions are; who are the actors in climate change innovation system? Are there any linkages between these actors? How does one identify and map these linkages if any? The paper aims at:

(i) review the concept of linkage and

(ii) identifying and mapping linkages between actors in the climate change innovation system

The concept of linkage

The concept of linkage implies the communication and working relationship established between two or more organisations pursuing commonly shared objectives in order to have regular contact and improved productivity (Agbamu, 2000). It is also defined as the coordinated channels for exchange or flows of technology, information and resources between organizations in an agricultural innovation system (Peterson, Gijsbers and Wilks 2003).

Stoop (1988) identified four major types of linkages based on ways of communication and channels of communication. They are:

- formal versus informal linkages;
- top-down versus bottom-up linkages;
- internal versus external linkages and
- downstream versus upstream linkages.

Formal versus informal linkages - formal linkages refer to linkages that are specified and agreed to by organizations while informal linkages are direct person-to-person contacts based on the need for collaboration between individuals. Asopa and Beye (1997) noted that informal linkages are effective and low-cost method, and should be encouraged along with formal linkages. Top-down versus bottom-up linkages- in top-down linkage, information flows from scientists to extension and then to producers (farmers) whereas bottom-up linkages refers to the flow of information from producers to scientists. Information from farmers is based on their practical knowledge and could help to strengthen the capabilities of the other actors. Internal versus external linkages- internal linkages refer to linkages among scientists working in different disciplines and on different commodities whereas external linkages are linkages with major clients, such as farmers, policy-makers, etc. External linkages help identify gaps in research priority and assess the utility

of research programmes. Downstream versus upstream linkages- these linkages are a part of external linkages while upstream linkages occur between research and policy makers. The aim here is to secure adequate funding and political support for research. Downstream linkages occur between researchers and producers in order to set research agenda and to establish priorities.

Various linkage categories commonly referred to as 'levels of linkage' could be identified among stakeholders. These include weak linkage, strong linkage and medium linkage (Ewell, 1989). Empirical evidences of such levels of linkage/linkage category were shown by Faturoti, (2008); Dauda, (2009) and Faturoti, Madukwe, Igbokwe, and Agwu, (2010) where they identified some levels of linkages that existed among key actors in the banana/plantain innovation system in SouthEast Nigeria, soyabean innovation system in Benue State and plantain/banana innovation system in Nigeria respectively.

Linkage mechanisms are procedures that enhance technology generation and exchange and which enable the flow of information and resource (Gijsbers, 2009). Roling, (1989), defined linkage mechanism as the concrete procedure, regular event, arrangement, device or channel which bridges the gap between components of the system and allows communication between them. Linkage mechanisms are used to channel information between groups and to coordinate required tasks in the process of getting relevant technologies to farmers. In the process, these linkage activities help to improve resource use by avoiding the duplication of effort and ensuring that critical tasks do not fall through the institutional cracks. Examples of linkage mechanisms include joint planning meetings carried out by key partners, memoranda of understanding, contracts between organizations, joint programming and priority setting with partner participation, staff exchanges between organizations (Gijsbers, 2009).

Identifying and mapping linkages between actors in the climate change innovation system

World Bank (2006) definition of Elements of agricultural innovation system and CTA/UNU - INTECH/KIT, (2005) categorization of actors in the agricultural innovation system could be adapted in categorizing actors in climate change innovation system. This is depicted graphically in Figure 1 and Table 1.

Figure 1 illustrates the various elements of a climate change innovation system featuring an interactive process involving players, institutions and processes. It show cases the main actors, their potential interactions with each other, all influenced by the policy context and the overall informal institutions, attitudes and practices that either support or hinder innovative processes. Table 1 also gives an indication of possible groupings of these actors into categories. Some actors may belong to more than one category but their primary role in the particular system should be used as the basis for determining which category they belong to. For example, an input supplier may also be involved in research and / or extension but its primary function is selling inputs to producers involved in the sub-sector and as such, it belongs to the enterprise category. Thus, promoting innovations in climate

change requires innovation partnerships and linkages and also creating an enabling environment for actors.

Biggs and Matsaert (2004) identified some methodologies for mapping linkage between these actors. They include:

(a) The actor linkage map – linkages between the various actors are being depicted by arrows of varying thickness indicating the intensity of the link. Two arrows should be used in order to differentiate the link between ‘a’ and ‘b’ and that between ‘b’ and ‘a’.

(b) The actor linkage matrix – linkages between the various actors can be described in the boxes of the matrix. This can be done with plus and minus signs, colours, or just text. This technique is in particular useful when there are many actors.

(c) The actor determinant diagram – complements the above techniques by further analysing the strengths and weaknesses of a particular link. It can provide more insight into how a particular link can be improved.

(d) Actor time lines – helps to analyse how certain innovations have evolved over time and how different actors have participated in this process.

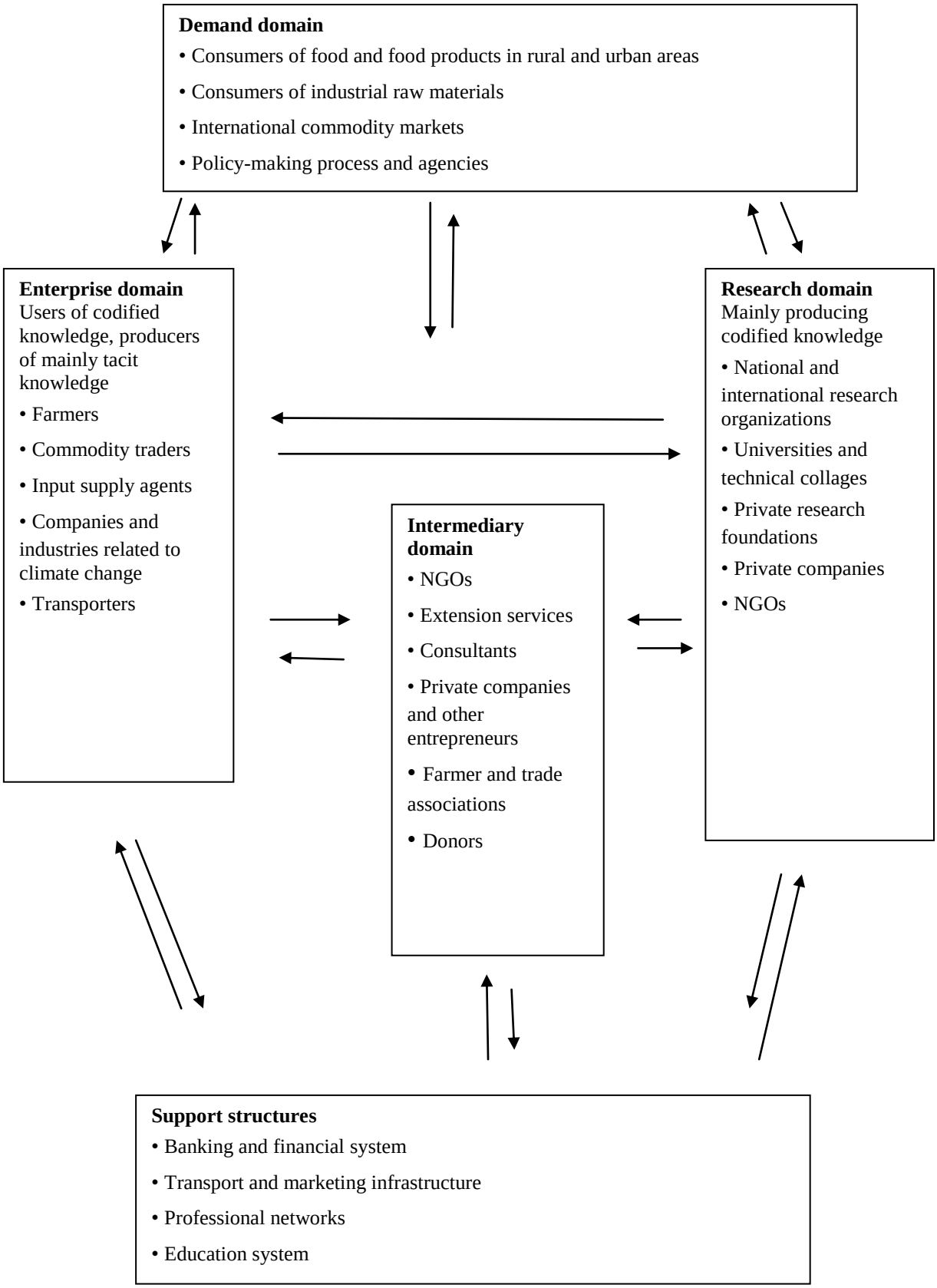

Fig: 1 Elements of a climate change innovation system

Adapted from World Bank (2006)

TABLE 1
Groups and Actors in the climate change innovation system

Groups	Actors
Demand	Consumers/buyers/retailers/wholesalers/middle men, consumers of raw materials for industrial/added value e.g. agro processing industries, restaurants, hotels.
Enterprise	Farmers, Input suppliers (seed/feed, agro-chemicals, machinery)
Intermediary	Extension services (public/private) NGOs and CBOs
Research	National, regional and international research and development organizations (public, quasi-governmental, private), universities, research foundations, NGOs with own research facilities.
Support structures	Policy making agencies (ministries; quasi-governmental agencies/state boards), transport and marketing agencies/commodity boards, information and communication infrastructure

Adapted from CTA/UNU - INTECH/KIT, (2005)

Conclusion and Recommendation

Climate change is one of the most serious challenges facing the world – its people, the environment and its economies. Climate change innovation system entails a network of actors of institutions, public or private, whose activities and interactions initiate, import, modify, and diffuse new technologies. Innovations needed for effective climate change adaptation and mitigation demand an interactive learning process of actors. Such interactive learning process will be facilitated if there are linkages between actors hence the paper recommends that linkages between actors be identified and mapped and enabling environment for innovations provided.

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