

Transfer of Technology and The Dynamics Involved in Adoption of Innovation



Social Science

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ABSTRACT

Since last decade, we have seen many new developments in innovation studies. Discussions do no longer centre around 'adoption and diffusion of innovations'. New themes include the co evolution of social and technical developments, and the survival of different innovation initiatives that are competing with each other and with an 'external' selection environment. It will be argued that we need to broaden considerably our view on the types of intermediation and facilitation that an innovation process includes and requires. Special attention will be given to the implications this has for the role of communicative intervention (including extension) in supporting development and agricultural innovation. Another gap is the fact that "innovation" itself is promoted rather than its embeddedness within a system that in turn operates within certain institutional and policy contexts. Even though there is consensus on the importance of innovation for economic development, the systemic mechanism through which it can be enhanced is not given equal attention. These and other grey areas limit the promotion of innovation system, and in a worst case raises suspicion on its value addition for research and development. Therefore, this paper, attempts to shed some light on dynamic consideration of building innovation capacity, enhancing use of knowledge, creating social and economic change, and propose ways to get innovation system approach work better in agriculture and rural development.

INTRODUCTION:

Communication has been an area of interest in innovation studies for a long time. Earlier, communication was looked upon primarily as an intermediary function between science and societal users. In the last decades, the theoretical understanding of innovation has advanced considerably, and then dominant 'linear model of innovation' has been replaced by other bodies of thought (World Bank, 2007). Clearly, these changes in thinking have implications for how I must conceptualise the role of communicative intervention and research in innovation processes. Building blocks and inspirations for this can be derived from many studies and scholars in the domain of innovation studies, but since most of these authors are not centrally interested in 'communicative intervention', a systematic rethinking of the role of communicative intervention in innovation processes is largely absent (Tesfaye Beshah, 2008). In this context this paper deals with some of the changing views of innovation and the dynamics considerations involved in adoption of an innovation.

CHANGING VIEW OF INNOVATION:

Changes in thinking about innovation:

Over the years, ideas about innovation have evolved considerably. Although there are clearly different strands of thinking, some widely shared shifts are explained below. Numerous studies showed that 'innovations' developed by research are often not adopted, and that successful innovations are usually based on an integration of ideas and insights from not only scientists, but also of users, intermediaries and other societal agents. In the past an innovation was regarded as a new technical device or principle. Nowadays, I recognise that innovations even when considered solely from a technical perspective are not one dimensional, but must be viewed as a combination of technical components. Thus I can conceptualise an innovation as a successful combination of 'hardware' (i.e. new technical devices and practices), 'software' (i.e. new knowledge and modes of thinking) and 'orgware' (i.e. new social institutions and forms of organisation). Not surprisingly, the thinking about innovation as a process has also changed dramatically over the past decades. In former days there was a strong belief in the possibility of planning and predicting change and innovation. In contrast, I now see that change is often affected by complex inter-dependencies, unintended and unforeseen developments and interactions, coincidence and dynamics of conflicts that defy engineering and reductionist understanding. In connection with this, innovation processes are looked at nowadays from an evolutionary perspective. The idea is essentially that a variety of innovations and innovation processes compete in a dynamic selection environment in which the 'best fitting' survives or 'wins' in a given time and space context. Clearly, such 'fitting' does not just involve adaptation to prevailing contextual

conditions, but also the active influencing, re-design or destruction of pre-existing conditions and frameworks, respectively the 'overthrowing' of previously dominant 'socio-technical regimes'.

INNOVATION SYSTEMS:

Innovation system is a network of organizations focused on bringing new processes and new forms into social and economic use, together with the institutions and policies that affect their behaviour and performance (Rogers E.M & Beal 1959). Innovation may address new creations of social and economic significance, improvements in technical and managerial issues, institutional and policy aspects.

How to initiate and facilitate Innovation System?

Smith in the year 2002 gave ten steps on how to initiate and facilitate an innovation system. The steps are as follows,

1. Getting started
 - Understanding of micro and macro environments of intended area of operation, region and country. The focus is on policy and institutional landscape, socio-economic, political and bio-physical environments. This can be achieved partly through secondary data.
 - Density and organizational history of key organizations (commonly known as stakeholders analysis)
 - Organizing awareness creation workshops to engage with potential partners
2. Identification of champion organizations to initiate the network (who are interested, and would align themselves with the purpose of the initiatives)
3. Identification of starter problems or entry point. This may change in the course of interactions among actors and learning, but at least one common issue or problem is required as a learning tool at the beginning.
4. Socio-economic baseline: Information from analysis of these data is to be used as a learning tool to monitor impacts. Changes in the action research process will be tracked through monitoring and learning mechanisms to be developed according to the nature of patterns of organization of a given system. This can also be used to draw a plausible casual link in the course of the process.
5. In depth diagnosis of the identified innovation system
 - Actors (organizations) and their domain of operations
 - Habits and practices of organizations
 - Patterns of interaction among organizations
 - Institutional and policy environments that influences functions of the actors.
6. Planning action research around the starter issue or problem and implementation.

7. Design and implement monitoring and learning system
8. Periodic reflection on learning outcomes based on monitoring and learning system. Monitoring focuses on the habits and practices of the network, while learning at individual and organizational levels, within the network and with the environment in which it is embedded.
9. Redefine actors and actions as required, including interactions with policy-makers through various means.
10. Consolidate lessons and apply the experiences in another domain or scale out within the same domain.

DYNAMIC CONSIDERATION:

The outcome of technology adoption changes are affected by dynamic processes that result in changes in prices of capital goods and input, learning by producers and users of capital goods, etc. (Callon et. Al. 1986). Some of these processes have random components and significant uncertainty over time. Some of these dynamic considerations have been introduced to recent micro level models of adoption behavior:

Optimal Timing of Technology Adoption

The earlier threshold models recognized that timing of adoption may vary across production units reflecting differences of size, human capital, land quality, etc. When a new technology is available, at each moment decision makers will consider whether to or not to adopt; when the discounted expected benefits of adoption are greater than the cost, the technology will be adopted (Geels, 2002). Thus, the approach may lead to suboptimal outcomes because decision makers do not consider the possibility of delaying the technology choice to take advantage of favorable dynamic processes or to enable further learning.

Learning by Using, Learning by Doing, and Adoption of New Technologies

Consider a farmer who operates with a traditional technology and is considering adopting a new one that requires a fixed investment. The increase in temporal profit from adoption at time t increases as more experience is gained from the use of this technology. This gain in experience represents learning by doing. Let t_0 be the time of the adoption and assume that self-experience is the only source of learning by doing. When the farmer disregards the learning processes in determining the time of adoption, adoption will occur when the temporal gain of adoption will equal the extra periodical fixed cost. Let r denote discount rate and the economic life of the new technology is assumed infinite, then at t_0 : When the learning processes are taken into account, the marginal reduction in investment cost, because of learning by using, tends to delay adoption and the marginal benefits from learning by using may accelerate the time of adoption. The optimal conditions that determine t_0 in this case are: Extra profit Investment. In cases when the new technology increases the productivity of an agricultural crop with constant returns to scale, where L is acreage, both the extra profit from adoption and the learning-by-using effects will increase with farm size and lead larger farms to be early adopters. Higher interest rates will tend to retard adoption because they will increase the investment cost per period and reduce the learning-by-using effect.

Adoption under Irreversibility and Uncertainty

Adoption sometimes entails irreversible investments with uncertain payoffs. Delay of the adoption decision may enable the producer to obtain more information, reducing overall uncertainty, and increasing expected discounted benefits by avoiding irreversible investment when it is not worthwhile. In many cases, not all the adoption investment is "sunk cost." Some can be recovered. For example, capital goods may be resold, and

added human capital may increase earning opportunities. The delay caused by adoption costs and uncertainties will likely be a shorter if these cost are more recoverable, and institutions that reduce irreversibilities (rental of capital equipment, money-back guarantee agreements) are apt to increase and accelerate adoption. Though real option approach provides new insight, it does not capture important aspects of the dynamics of adoption. It assumes that the decision makers know the distribution of random events that determine profitability, while it is more likely that a learning process is going on throughout the adoption process, and adopters adjust their probability estimates as they go along. Furthermore, while adoption requires a fixed initial investment, it also may entail incremental investments, especially when the intensity of use of a new technology changes over time. Thus, a more complete dynamic framework for analyzing adoption should address issues of timing, learning, and sequential investment. Some scholars have introduced models that incorporate these features, but the research requires much more conceptual and empirical work.

CONCLUSION:

The starting point for this paper was that, despite major theoretical developments in the innovation sciences, this has not resulted in a reconceptualised view on the role of communicative intervention in innovation processes. As a result, explicit attention to communication and communication professionals is still often associated with linear terms such as diffusion and dissemination. Although it is self-evident that communication is an essential process in more interactive, constructive, evolutionary or system-oriented approaches, it is dealt with in a rather implicit way. In this paper I have made an effort to be more explicit, and to systematically rethink the role of communicative intervention in innovation processes. Thus I conclude that we need to think about communication as playing a role in innovation development and design. At a more abstract level, I have argued that we may look at the roles as enhancing the survival chances of existing initiatives for change, by facilitating that they become more effectively adapted and/or linked to their dynamic selection environment than competing initiatives. In practical terms, this involves applying arrangement of process facilitation strategies in the sphere of network building, social learning and conflict management. While in the linear model communication was primarily seen as an intermediary function we now see a much broader range of intermediary roles. Moreover, the intermediary roles happen at a range of interfaces that are situated within and between networks of stakeholders operating in different societal spheres. In terms of substance, such intermediary processes do not mainly address the qualities of given technologies in connection with assumed or proposed problems (as in the linear model), but rather centre on a range of human aspects and attributes that bear relevance to the building of networks and reaching agreement, coherence and congruence. In practice, such broader intermediaries have indeed emerged in present day innovation systems and complement the activities of classical intermediaries that focus on disseminating technology. In the context of agriculture, an important question here is whether agricultural extension organisations are willing and able to play broader roles? These organisations have always had the mandate to play an intermediary role in innovation processes, and could in principle expand their activities. However; this would have to go along with considerable change in terms of staffing and organizational capacities. Hence it is being concluded that Communication loops among the nodes of the innovation system maintain and stimulate the learning of the system. It is through the communication process that the meaning of the system is produced and reproduced in the network to enhance innovation within the system in a dynamic way.

REFERENCE

- Rogers E.M & Beal G.M (1959) The scientists as a referent in the communication of new technology. *Public Opinion Quarterly*, 22, 555-563. | Callon, M., J. Law & A. Rip (1986) Mapping the dynamics of science and technology: Sociology of science in the real world. Macmillan. London | Geels, F. (2002), Understanding the dynamics of technological transitions: A co-evolutionary and socio technical analysis. Twente University Press, Enschede | Smits R. 2002. Innovation Studies in the 21st Century: Questions from a user's perspective. *Technological Forecasting and Social Change* 69 (2002) 861-883. | Tesfaye Beshah. 2008. How to get Innovation System Work in Agriculture and Rural Development? Reflection on methodological issues. A paper presented at APPRI 2008 International Workshop, Ouagadougou, Burkina Fasso, 21-24, October 2008. | World Bank. 2007. Enhancing Agricultural Innovation: How to go beyond the strengthening of research systems. Washington DC, USA: World Bank. |