Farmer innovation system and government intervention: An empirical study of straw utilisation technology development and diffusion in China

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Abstract

In the context of rural sustainability in the developing world, a dilemma facing government intervention is to recognise and properly use local (or indigenous, practical) knowledge. This paper sheds new light on government intervention by introducing a farmer innovation system (FIS), which is initiated by farmer innovator(s) with participation or support from government agencies and other stakeholders for technology improvement and diffusion. In relation to different understandings, attitudes and approaches to farmer innovation, we argue that different government intervention may lead to different project designs and results. The complexity of government intervention in farmer innovation can be seen from an empirical study of the development and diffusion of straw utilisation technology (SUT) in rural China. By analysing and comparing two cases - one successful and one failed - we reveal two types of government intervention, and features and conditions of project success. The major limitation is identified as leaving out other actors such as local business partners and non-government agencies. We suggest a balanced account between farmer innovator(s), government intervention and innovation platform in future research.

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1. Introduction

For rural development, agricultural innovation and environment protection in the developing world, there is a long debate on the nature and role of “state intervention”. Having witnessed many human tragedies of the twentieth century (e.g. Great Leap Forward in China, collectivisation in Russia, compulsory collectivisation in African countries) caused by government’s social engineering schemes, James Scott (1998) views state intervention as a process of extensive control over people and territory which leaves little space for other societal actors to play. Challenging such a dominant approach, nonetheless, there is a call for “beyond the state” (Li, 2005) or “the return of the state” (Cordoba and Jensen, 2014), to improve infrastructure and public services. A key and unsolved issue facing both schools of thought is how to recognise the value of local (traditional, indigenous or practical) knowledge, and identify by what channel or mechanism such knowledge can be integrated into current innovation systems or development programmes which are still overwhelmingly dominated by either governments or professionals (Gupta, 2012; Li, 2005).

This paper attempts to tackle this dilemma by focusing on the interfaces between local knowledge within grassroots innovators and “scientific” knowledge in the formal sector for better using and managing local resources, opportunities and overcoming local challenges. In this regard, farmer innovation system (FIS) is a useful concept for us to observe and analyse the communication, interaction and cooperation between farmer innovator(s), community members, external professionals, government and non-government agencies to improve rural environments and livelihood systems (Quno, 2015).

In relation to the debate on state intervention, we attempt to examine the role of government intervention in farmer innovation diffusion in order to develop our understanding of the balance and interfaces between top-down government intervention and bottom-up development. The necessity and complexity of government intervention can be illustrated from China practices since its market-oriented reform in the 1980s with mixed results:
successes and failures. Compared to a rich body of literature on government intervention on formal agricultural research and extension (Delman, 1991; Sun et al., 2014; Wang et al., 2016; Zhu, 2014), only a handful of researchers have paid attention to farmer innovation and government intervention (Gupta, 2012; Wu, 2003; Wu and Jules, 2004; Wu and Zhang, 2013).

This paper sheds new light on government intervention through a case of Straw Utilisation Technology (SUT) development and diffusion. This case is important because China is rich in terms of biomass resources including a variety of straw and agricultural processing residues, such as those of corn, rice, wheat, cotton, and oil-bearing crops. In theory, there is a total of 820 million tons of straw every year, of which approximately 690 million tons are available to collect. Currently, 350 million tons are used as fertilizer, and for animal feed, materials for food (e.g. mushroom plantation) and industrial (e.g. paper manufacturing) production per year, and the remaining 340 million tons can be transferred for the use of energy including biomass power generation, electricity, biogas, biomass fuel and bi-fuel ethanol which is equivalent to an amount of 170 million tons coal (Liu et al., 2008; SEB, 2012). Regarding the use of straw for energy production, furthermore, only 2.35% has been used in practice, leaving the vast majority (97.6%) unused (SEB, 2012).

The complexity of SUT development and diffusion in rural China can be seen from the uneven process in research and application of semi-gasified stoves. Despite its great potential with clear benefits to both local and wider environments, it is difficult for individuals or commercial firms to initiate this process due to the heavy costs of collecting, transporting and storing straw. Government intervention (including financial subsidies) is important not only for farmer innovators to continue to develop and improve this technology, but also for other stakeholders, such as agribusiness firms and governmental and non-governmental agencies, to work together with farmer innovators and ensure wide dissemination and adoption.

In the past two decades or so, Chinese government has paid increasing attention to the efficient use of straw resources for the purposes of a cleaner sky, beautiful countryside and reduction of CO2 emissions. A series of government campaigns and policies have been issued to stimulate the development and application of the SUT alongside the administrative prohibition of direct burning in the field (Sinton et al., 2004; Wang et al., 2016; Wang and Jiang, 2017; Hong et al., 2016). They include the promotion of new technologies such as straw return back to farmland, and straw-based power stations. Despite the above effort, there is a long way for China to go in full use of straw resources.

We consider the development and diffusion of SUT as a process of establishing and maintaining farmer innovation system, referring to the process of innovation initiated by farmer innovators with participation or support by government and other stakeholders. Based on narratives of two cases of SUT development and diffusion, in particular, this paper aims to address the following questions: How did farmer innovator(s) initiate a process of SUT development and diffusion? What role have government agencies played in establishing and maintaining a FIS? What are variations of government intervention in terms of approaches and styles, leading to differences in SUT development and innovation diffusion?

This paper is organised as follows. The next section reviews the literature on state intervention and the farmer innovation system. Following this, two cases of government intervention are examined. Drawing on the empirical evidence, we discuss two types of government intervention, features of each type and the conditions of the successful intervention (Section 5), and draw our conclusion in Section 6.
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