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Liyan Zhang [a] & Darshini Mahadevia [b]

[a] Centre for Innovation and Entrepreneurship, Tianjin University of Finance and Economics, Tianjin, China

[b] Centre for Urban Equity, CEPT University, Ahmadabad, India

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Institutional architecture for grassroots innovations: a case of Hua County, China

Liyan Zhang[a*] and Darshini Mahadevia[b]

[a]*Centre for Innovation and Entrepreneurship, Tianjin University of Finance and Economics, Tianjin, China;* [b]*Centre for Urban Equity, CEPT University, Ahmadabad, India*

In the context of growing disenchantment with modern technologies in agriculture, it is often argued that the grassroots innovations play a significant role in rural development in general and improving agricultural productivity and incomes of farmers in particular. But our understanding on the institutional architecture needed for promoting grassroots innovations in developing countries like China at best remain rudimentary. The present paper address this issue by an analysis of the institutional arrangements evolved overtime for the promotion of GRIs in Hua County and its outcomes in terms of increased number of patents and their commercialisation. The study highlights the constructive role of the triad of governance, the CPPCC, along with the CPC and the government in the observed performance in the sphere of GRIs. The case study also shows that there is a fourth pillar in the institutional architecture for the promotion of GRIs. This is manifested in the formation of the Association of Inventors as an NGO nurtured by the Government. The analysis in the paper therefore, highlights the significant role of institutions in general as well as the co-evolution of institutions with changing environment to promote innovations and their commercialisation.

Keywords: grassroots innovations; institutional architecture; Hua County; China

1. Introduction

Remarkably high rate of economic growth in the People's Republic of China since 1980 notwithstanding, more than half the country's population lives in rural areas and depend on agriculture for their livelihood.[1] Hence, like in many other developing countries, improvement in agriculture productivity, farmers' income and rural development in general still remain challenges for China. These challenges are far more severe for the poor and less developed regions of central and west China and remote areas. While the development and diffusion of modern agricultural technologies are often considered as the solution, their relevance has been questioned in addressing locally specific problems and the adverse effect on environment, leading to ecologically unsustainable production (Vaidyanathan, 2010) on the on the one hand and low purchasing power of the local people for such new technologies on the other. In this context the role of grassroots innovations (GRIs) in rural China as well as in other developing countries like India has been highlighted (Zhang and Liu, 2011; Biggs, 1990; Chambers et al., 1989). Grassroots innovators have experience and knowledge about what works in their localities, and what matters to local people. In resource-poor and ecologically fragile areas, an endogenous development approach is

*Corresponding author. Email: liyan_zhang_666@hotmail.com

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more promising and sustainable than a development model exogenously introduced. This calls for evolving innovations from within, through utilisation of intrinsic dynamics and potentials of the local population (Wu 2003, p. 9). Therefore, supporting and promoting the GRIs and through that facilitating local production are often considered as a strategic option for poverty alleviation in the rural areas.

But the key issue relates to the institutional architecture needed for the development and diffusion of GRIs. The present paper addresses this issue by analysing the structure and evolution of the institutional arrangements for GRIs in Hua County of China and its effect on promoting GRIs as manifested in patenting by grassroots innovators and their commercialisation.

The paper is organised in four sections including this introduction. The second section presents a conceptual and analytical background. The third section examines the evolution of the governance structure for innovation in Hua County and its outcomes are discussed followed by the last section where the concluding observations are presented.

2. Analytical background

Similar to innovations in the formal sector, GRIs are in the sphere of technologies, organisations, institutions and so on. The grassroots innovators include small farmers, artisans, mechanics or self employed entrepreneurs. These are undertaken with a view to addressing problems that are specific to certain contexts and with a view to improving their livelihood. As the name suggests, grassroots innovation refers to 'indigenous innovations by farmers using local biodiversity for developing non-chemical sustainable technologies for agriculture, livestock, fisheries, agriculture and food processing, etc.' (Gupta, 1980, 1981). Such innovations are possible because, very often, the grassroots, despite being poor economically, are very rich in knowledge (Gupta et al., 1995). Grassroots innovators innovate, test and try new methods of conservation or production, on their own initiative, often using ideas from various sources. Innovators tend to be curious, creative, proud of their innovations, willing to take risks and are skilful in blending their own ideas with ideas picked up elsewhere (Critchley et al., 1999). Following Critchley et al. (1999) we use GRI to mean innovations by individuals on their own initiative and by their own efforts. However, in China, learning also comes from experiments in innovations supported by government policy. Another term used for GRI is 'farmer innovation', which, according to the World Bank (2005), refers to the dynamics of indigenous knowledge, i.e. knowledge that grows within a social group, incorporating learning from own experiences over generations while internalising externally generated knowledge within the local ways of thinking and doing. Promotion of farmer innovation fosters individuals or groups to discover and develop better ways of managing resources, building on and expanding the boundaries of their indigenous knowledge through interactions. Wu (2003, p. 9) argues that farmer innovations are broadly related to the introduction, adoption or creation of either or both elements of 'new knowledge' (ideas, skills or experience) and 'new organisation' (principles, forms, networks or mechanisms).

In the case of formal innovations, scholars have analysed the process by which a complex set of institutions co-evolve with the emergence of new technologies and the industries that emerge around those technologies (Nelson, 2005). Nelson argued that the manner in which these institutions evolve may have a profound influence not only on the competitive dynamics of the firms involved but also on the organisation of the new industries that emerge. The relevant issue here is whether old institutions can evolve to meet the needs of emerging and new innovations or that a new set of institutions is needed to support the growth and diffusion of new technologies. An answer to this issue could be seen in the techno-economic paradigm of Freeman and Perez (1988) where the central argument is that the core technologies underlying new technological eras are supported by the emergence and diffusion of a compatible set of institutions. Drawing

mainly from the experience and empirical evidence from developed countries, scholars dealing with national (Lundvall, 1992) regional (Asheim and Gertler, 2004) and sectoral (Malerba, 2004) systems, deviating from the conventional linear approach to technological progress, placed institutions at the centre stage of the innovation process at micro, meso and macro levels. Attempts towards characterising and understanding the driving forces of innovation have also distinguished between the STI (Science-Technology-Innovation) mode as compared to the DUI (Doing-Using-Interacting) mode with key role for institutions (Lundvall, 2011) However, in developing countries where rural, informal and agricultural sectors dominate and GRIs are crucial for sustaining rural livelihoods, our understanding of the role of institutional architecture and its co-evolution with rural innovations at best remain rudimentary.

In China for example, as in other developing countries, the institutional arrangements in general have largely supported the formal innovations, although the GRIs form a large proportion of patents applied for. According to the 'Patent law of the People's Republic of China', 'inventions-creations' mean inventions, utility models and designs. Terms such as 'petty patent', 'innovation patent', 'minor patent', and 'small patent' are considered to fall within the definition of 'utility model' (Mott, 1963). Since the Patent Law of the People's Republic of China was promulgated in 1985 there has been an increasing incidence of individual patents of which a major proportion, going by the available evidence, is likely to be GRIs. For example, in the Cangzhou City of Hebei province out of the total 800 patent applications filed in 2008[2], 300 were filed by the farmers. Similarly 55 out of the 230 patents applied for during 2004 to 2008[3] in Handan County of Hebei Province were also by the farmers. Take Hua County, whose case study is presented here as an example, only 14 (4.8%) of the total 288 patents granted from 1985 to October 2007, belonged to the service sector (Hua County Government Office, 2007).

Like elsewhere, the emphasis of S&T applications in agriculture in China has been for the large and wealthier farmers. Research on innovations has largely been restricted to the formal sector; manufacturing sector and formal agriculture sector (Cao, 2002; Chang and Shih, 2004; Huang et al., 2004; Liu and Jiang, 2001; Liu and White, 2001; OECD, 2007). Moreover, the official policy-making is attributed as top-down. The Organisation for Economic Cooperation and Development (OECD, 2007, p. 56), after reviewing China's S&T programme and policies, states that the entire system is characterised by a top-down approach, which is the 'picking-the-winner' approach: the government decides on programmes and sets priorities with little involvement of other stakeholders, and programmes are often too general to take into account sector-/subject-specific needs in terms of the duration and amount of funding. Zhang (2011) has pointed out different dimensions of problems with policies in general; wrong policies are made because of the ignorance of the policymakers themselves and policies often emerge from self-interest of the government officials. Most policymakers are senior administrative officials and policy experts, who do not always have real and in-depth knowledge of all aspects of people's lives and the latter's need for S&T. Hence the relevance of a policy framework and institutional architecture to support GRIs in China cannot be overemphasised.

It is against this background that the present study is situated in Hua County, Henan Province in east-central China, because here farmers have been historically innovative, particularly so in the last decade, when they have taken to registering patents for their innovations through catalytic intervention by an individual and his NGO Association of Inventors (AOI). Reasons for selecting this county as a case study are: (i) It has an innovative grassroots institution for supporting GRIs, the Hua County Association of Inventors (henceforth referred to as AOI), which is the only one of its kind at county level in China until now. The AOI concentrates on promoting the knowledge of innovation and patents among the grassroots, helping grassroots innovators to apply for patents and connecting the grassroots innovators with the potential investors. Although the AOI is an NGO, it has been playing an important role in promoting GRIs in Hua County since its

establishment in 2001. Its role has become more important during 2001–2004, which led to the selection of the County as one of the top 20 innovative counties and the experimental-patent county by the Henan Intellectual Property Rights (IPR) Bureau in 2004[4]. (ii) The majority of the patents in the county have been granted to individual farmers, as already mentioned above, and these pertain to technologies for reducing their work burden or improving productivity. Therefore, it could be argued that the GRIs have become an important driving force for the local economic development in this county because many local entrepreneurs in Hua County have been through the 'farmer-innovator-entrepreneur' process. (iii) The local government strongly supports the AOI and its leader. (iv) The county has a tradition of innovation.

The research is entirely based on qualitative methodology. The authors, along with the team of researchers from Tianjin University of Finance and Economics (TUFE), Tianjin, visited the County for a week, interviewing the innovator and more than 10 local government officials from the County Science and Technology Bureau, its Intellectual Property Rights Office, the Association for Science and Technology (AST) of the County Association of Science and Technology (CAST) official and about 20 grassroots innovators. This County was discovered as one with special characteristics through internet search. Before going to field, secondary data available from the net were also compiled.

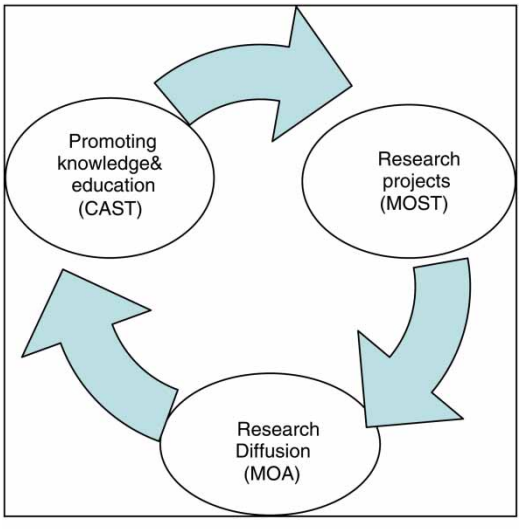
3. Institutional involvement for GRIs in Hua County

Hua County is located in the north plain of Henan Province, which is one of the important grain producing areas of China. Hua County has a land area of 1814 km^2, an agricultural acreage of 130,000 hectare and a total population of 1.21 million, of which 85% (1.03 million) are engaged in agriculture. The climate is humid with abundant rainfall, which is suitable for the growth of wheat, corn, soya bean, peanut, cotton and sweet potato. With a total food-grain production of 13.05 million tons in 2009[5], Hua County is the leading county of the province in terms of food production. From 2001 to 2010 when Henan topped in wheat production in the whole country with the total production of 30.91 million tons in 2010[6] the contribution of Hua county therein has been significant.

Thanks to various factors, Hua County has a tradition of being innovative. Hua people had to be innovative enough to manage the periodic floods caused by the Yellow River. In addition, during wartimes, high dikes of the Yellow River were occasionally deliberately broken in order to flood the advancing enemy troops. All this meant frequent disasters and prolonged economic hardships. The local people, therefore, survived through innovations in agriculture implements and production methods. Secondly, the long stretch of winter (October to March) and periods of heavy rain when the farmers could not work in the fields, were utilised by them to carry out innovations. Thirdly, Daokou town, the site of Hua County government at present, was historically a ferry port on the Yellow River and on account of its location became a prosperous trading town. The local population made use of the exposure to the world to learn new ideas and became more innovative.

In China, the governance structure for GRI includes three parallel set of institutions for: (i) spreading scientific knowledge and education, (ii) funding research projects and (iii) funding diffusion of research achievements. These three together form a 'closed policy loop' (Figure 1), in which firstly support is given to promotion of Science and Technology (S&T), which then leads to S&T research and support for it, and finally research results are diffused for further promoting knowledge among the masses.

The China Association for Science and Technology (CAST), which is under the Chinese Communist Party Central Committee (CCPCC), and all the local Associations of Science and Technology (ASTs)[7] take the main responsibility for promoting S&T knowledge and improving



Source: Authors' own construction

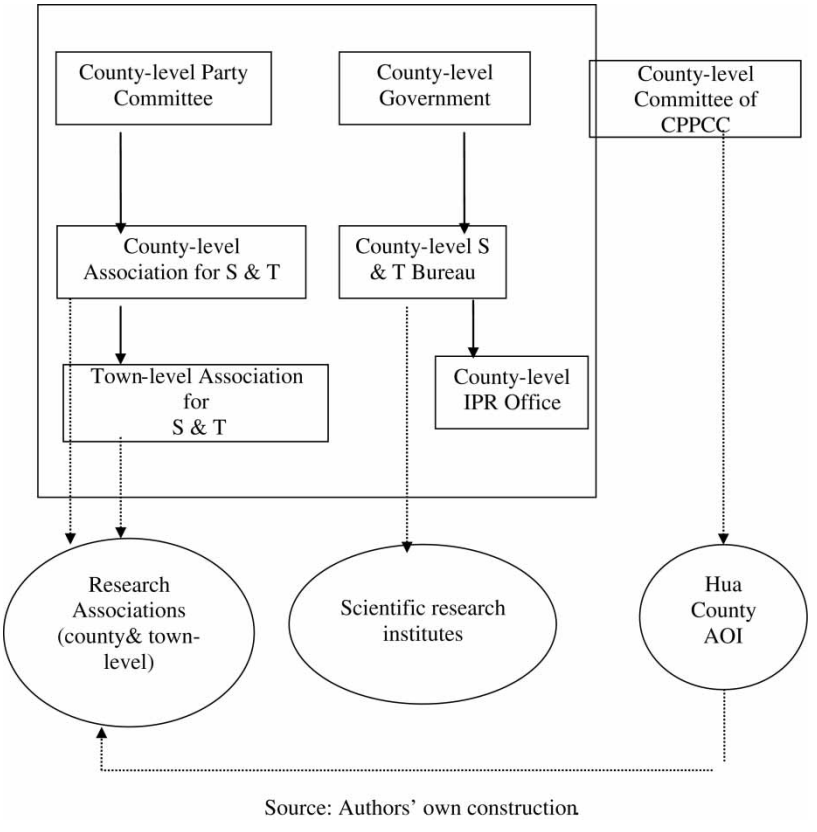
Figure 1. Governmental system for GRIs.

scientific and technological literacy at the national level.[8] They also offer operational guidance to the research associations organised by the farmers and others. In China, such associations are registered with the Bureau of Civil Affairs and have the status of an NGO. The ASTs are '*Shi Ye Dan Wei'* or public institutions and not government departments.[9] The Ministry of Science and Technology (MOST) of China, which falls under the State Council, and its local offices, have the main responsibility of supporting research. The county level S&T Bureau generally plays the role of providing assistance for getting research project funds. The Ministry of Agriculture (MOA) of China, under the State Council, and its local offices, play the key role in the diffusion of research findings related to agriculture and rural development. While other government organisations are also involved in the above three areas, there is a clear division of tasks among the three streams of GRI governance.

In Figure 2, the CAST is an entity linked to the CPC. The MOST and MOA and their local level offices are part of the government structure. Below the County level S&T Bureau is the IPR Bureau. In Hua County, there is a third important component in the governance structure – the County level Chinese People's Political Consultative Committee (CPPCC) (Figure 2).

The CPPCC has delegates from a range of political parties and organisations as well as independent members who deliberate on policy issues and advise the government. Its functions are political consultations, participation in the deliberation of state affairs and democratic supervision. It has power to influence policy decisions at the respective level and hence has an important role in the governance system.[10]

Before 1985, Hua County AST and the S&T Bureau were the 'same people under two different organisation names'. Since 1985, Hua County AST broke away from the County S&T Bureau and came under the leadership of the County CPC. By the end of 1982, the 'Family Contract System' also known as the Household Responsibility System came into force. The original S&T diffusion system, a four-level diffusion of 'County-Town-Production Brigade-Production Team', became inoperative in rural China due to the disintegration of the production team system. When this system was operational, it was easier to arrange for the education of farmers in S&T. With the introduction of the 'Family Contract system', each family had its



Source: Authors' own construction.

Figure 2. Governance structure for GRI in Hua County.

own land to grow produce for the market. As a result, the village leaders lost their authority to keep farmers together and thereby lost an institution at the grassroots that was valuable for various agriculture education and extension activities as well as for some collective efforts of the farmers. In this context, the first farmer research association, the 'Yuanluo Green Onion and Garlic Research Association', came into being in March 1983 to share among them the best agricultural production practices. This model soon became popular in China. The Hua County IPR Bureau was founded in 2006 to spread IPR knowledge and protect the patent holders. Not all the counties in China have an IPR Bureau and the work is done by the S&T Bureau only. But given the culture of innovations in the study region, all the counties of Anyang City, including the Hua County, have an IPR Bureau. There is no town-level IPR office in Hua County and this is the case in the whole of China.

In order to promote S&T development, including GRI, the Hua County government has set up a 'Leading Group of S&T, which comprises the heads of all the relevant departments at county level as members of the group and is led by the County Governor. This indicates the importance of innovations in the County. Further, in 2006, the County Party Committee and Hua County government together introduced a new criterion for the evaluation of the county and town officials.[11] The targets of patent applications and granting were introduced to the evaluation criteria, which in essence meant internalising the emphasis on innovations and scientific thinking in county government's activities.

The distinguishing characteristic of the institutional architecture of Hua County is the emergence of the Association of Inventors (AOI) as an NGO like many farmers' associations and its key role as a catalyst in GRIs. Technically the AOI works in coordination with and under the guidance of the County AST. But in Hua County it works very closely with the County CPPCC. Thus, CPPCC of Hua County is closely involved in the GRIs and becomes a third parallel level institution of governance of GRI in this county.

Individual leaders play a central role in shaping the destiny of many NGOs. Their role and effectiveness is in part determined by the environment in which they operate (Kelleher et al., 1996; Fowler, 1997; Hailey et al., 2004). The emergence and growth of the Hua County AOI is in a sense closely associated with its founder, who was himself an innovator,[12] under the facilitating environment provided by the County Government. The Hua County government extended full support to the expansion of the activities of the AOI. Besides offering the founder of AOI a regular job, he was appointed as a junior leader in charge of culture, education and health issues in the County Committee of CPPCC in 2005. Thereafter, he was also elected as a member of Anyang City CPPCC in 2006. In fact his office in CPPCC is also the office of AOI. The County government also provided support for publicising the inventions of the AOI members through its own channels. Further, it gave financial assistance to the tune of Yuan 30,000 in 2009 and Yuan 20,000 in 2010 for the AOI's activities. The County Committee of the CPPCC also helped the AOI with policy suggestions and solved some practical difficulties of AOI and its members.

At this juncture it may be instructive to examine the various initiatives by AOI towards promoting GRIs and its outcomes in terms of patenting in Hua County. During the early stage of the establishment of AOI (2001–2004) people were not familiar with inventions and patent knowledge. In order to create an environment conducive to innovation and attract more people and organisations to apply for patents the AOI supported any innovation and innovators who approached them. The AOI also went out of its way to provide all-around services to those wanting to innovate and apply for patents. The AOI used various media like television, newspapers, radio and other publicity materials for spreading awareness, encouraging innovations and patent application. As a result, the term 'innovation' was demystified and the Hua people gained knowledge of the process called innovation and the entity called patent. The awareness of innovation along with the culture of innovation and confidence spread to the entire County and then to nearby counties, leading to a remarkable increase, as will be evident from the discussion at the end of this section, in patent application through the AOI for both old and new innovations.

The AOI educated the Hua people on the concept of patents and the process of patent application and then helped the innovators to apply for patents. Thus, what the people did on their own begun to get noticed through patent application and registration. Many of the local innovations were modifications of the traditional ancestral knowledge such as secret herbal remedies or food ingredients, which the innovators did not want to divulge while registering for patents. They feared losing their monopoly over this knowledge and hence did not apply for patent registration. Similarly, in the case of companies, their leaders and technicians were concerned about the leakage of their technical secrets. The AOI also advised them on the extent to which and how they should divulge the technicalities of their innovations when applying for patents, so that they could protect their specialised knowledge. To illustrate, for herbal recipes, the quantity of the ingredients has to be mentioned. The patent applicants mentioned an approximate quantity of each ingredient and thereby protected their technical secrets. The innovators then began to apply for patents.

The AOI's work began to be known in society in general and along with it knowledge of inventions and patents of the County began to spread. The County, as a result, gained reputation of an 'Innovative County' and 'Experimental Patent County' of Henan. The County was selected as one of the top 20 innovative counties in the country. This recognition encouraged the County

government to give financial support to the innovators to apply for patents. At this stage, the AOI was turning to 'casting his net quite wide to catch the key fish'. In other words, the AOI was turning its attention to supporting those innovators whose inventions had a high probability of commercialisation, and thereby expanding the activities from just assisting in patent applications to patent commercialisation as well. After the AOI became stable and well known as an NGO, more and more innovators came to the AOI seeking help in patent applications, which enabled the AOI to become financially sustainable. At this stage, the focus of the AOI shifted from assisting with patent application to patent commercialisation. What is more, the AOI sought to expand its influence in other counties through massive advertisement and setting up branches. Accordingly two branches were set up; one in the neighbouring Neihuang County in 2008 and the other one in No. 2 Middle School of Daokou town in 2010.[13]

Since its founding, the AOI has made a remarkable contribution to induce the innovators to participate in National and International Innovation Exhibitions which are organised by the China Association of Innovators (CAI).[14] Each year, CAI organises a national innovation exhibition and every four years, an international innovation exhibition. The AOI carefully selects the innovations for such exhibitions so that they get awards. Table 1 shows that at all such innovation exhibitions the innovators of Hua County won no less than 15 Gold, 25 Silver and 40 Bronze medals between 2001 and 2010.

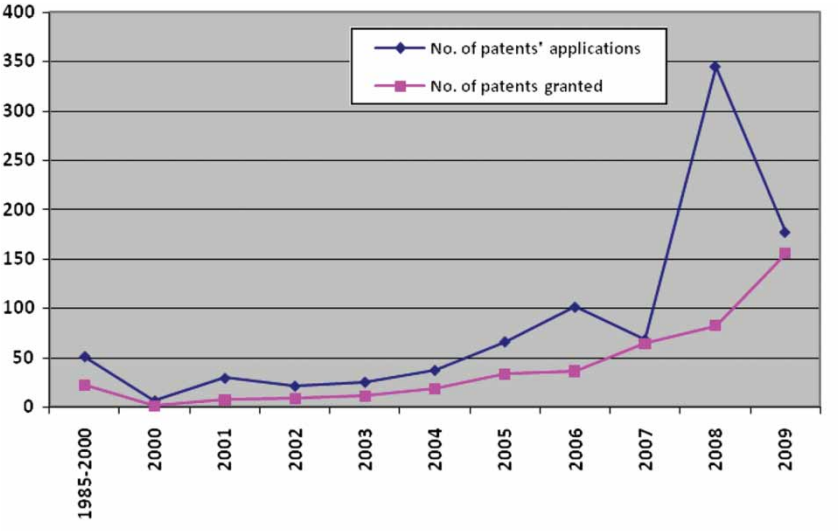
Apart from the awards won, another important indicator of the influence of the AOI is evident from a remarkable increase in the number of patent applications from Hua County (Figure 3). As is evident from Figure 3, since the implementation of China's Patent Law, patent applications in the Hua County have undergone three different phases: (i) Phase I from 1985 to 2000; (ii) Phase II

Table 1. Awards received by the innovators from Hua County (2001–2010).

		Gold Award	Silver Award	Bronze Award	**Honorary Award**	Special Award
2001	13th National Innovation Exhibition	2	1	3		
2003	14th National Innovation Exhibition	1	2	3		1
2004	5th International Innovation Exhibition			5		
2005	15th National Innovation Exhibition		1	4	3	
2006	16th National Innovation Exhibition	5	4	1	2	1
2007	17th National Innovation Exhibition		2	2		
2008	6th International Innovation Exhibition	1	5	9		
2009	18th National Innovation Exhibition	3	5	6		
2010	19th National Innovation Exhibition	3	5	7		
	Total	15	25	40	5	2

Source: the Hua County AOI.

Note. Both the national and international innovation exhibitions are approved by the MOST of China. In the exhibitions, 5% of the participating projects get gold medals, 10% are given silver awards and 15% bronze awards. Each year, 10 special awards are selected among the gold medals winners. The honorary awards are given sometimes depending on the nature of innovation.



Source: Hua County AOI (for 1985–2000 period) & Hua County Intellectual Property Rights Bureau (for the remaining years).

Figure 3. Number of patent applications filed and granted, Hua County (1985–2009).

from 2001, when the Hua County AOI was founded, up to 2004; and (iii) Phase III from 2005 until now on.

During the first phase (1985–2000), although the local population was engaged in innovations, only a few individuals and enterprises applied for and were granted patents, as they were not familiar with the concepts of innovation and patenting. As a result the total patents applications filed during this 15-year period were only about 50 and fewer numbers among them were actually granted patents. Since 2001, when the County AOI was set up, the number of patents applied for and granted has increased every year.

From Figure 3 it is further evident that since 2004 there has been a remarkable increase both in the number of patent applications and patents granted. As already indicated, during this period the GRIs of the County and AOI gained very wide publicity in the national, provincial and local television channels and also in newspapers such as Science and Technology Daily, Henan Daily, Anyang Daily and others. The dramatic increase in the number of patent applications from 2005 also could be attributed to the government policy of offering financial support to patent applicants. The subsidy policy was announced in 2005, which led to a large number of patent applications in 2006, which also included applications for earlier innovations. In the following year, the patent applications dropped as new inventions took time. In 2008, there was again a massive jump in patent applications. Granting of patents takes time and hence an increase in the number of patents granted could be observed from 2007 onwards.

For GRIs to have their developmental impact, it is important that the patented innovations are commercialised and diffused on a larger scale. The available evidence from the selected case studies (see Box 1) tends to suggest that the AOI has been successful not only in helping to get the inventions patented but also in their commercialisation. Here it is also worth noting that there has been an explicit commercial consideration in the promotional initiatives by the AOI in the form of commission from the patent office for every patent application filed. From our discussion with the officials concerned, it was discerned that the AOI also has been able to generate a steady stream of income through its promotional efforts that involved patenting and

commercialisation of innovations. Such commercial consideration which in turn resulted in a substantial revenue flow has also made the AOI a financially sustainable venture.

Box 1: Selected cases of commercialisation and diffusion of GRIs

Zhang Yusen from Konglintou village, Chengguan town, Hua County, had a large number of innovations but had not applied for patents. In 2006 the AOI assisted him in patenting his inventions such as an automobile energy-saving device, a wind-driven electric water-pump and an energy-saving advertisement lamp. A private fire-fighting company in Handan, Hebei Province, came to know of Zhang's patents through the internet and invited him to join his company. Although Zhang did not use his own innovations, he used his son's patent, a drilling machine for making holes in the wall, which was produced and sold on a larger scale in other provinces such as Hebei, Shaanxi, Shanxi, etc.

Farmer Zhang Zhengang, from Huangzhuang village, opened a small textile printing workshop, in which workers printed by hands. Later Zhang invented an automatic flat-screen printing machine controlled by a computer. This machine was very compact, reduced labour-intensity and more efficient. With the assistance of the AOI he exhibited this innovation at the sixth International Innovation Exhibition held in 2008, Suzhou, where the innovation won a silver medal. After he won the prize, many companies came forward to buy this machine. Now, Zhang has graduated to a manufacturer of automatic screen printing machinery from a provider of printing services. The market price per machine is 300,000 Yuan while its production cost is only about 120,000 Yuan,

Based on an ancestral secret recipe, Ming Chaogang, a farmer of Hua County, developed a range of black medical plasters using formulas of his own for the treatment of tendon and bone injury. The ointment in the plaster, when applied on the human body, gets absorbed in the blood vessels and reaches all parts of the body. The traditional plasters stuck to the hair on the body causing pain while removing, whereas the new plaster did not stick. His innovation was taken to an exhibition, the 13th National Innovation Exhibition in 2001, by the AOI, where it won the bronze award. As a result, Ming's reputation enhanced, followed by an increase in his clientele. Before his participation in the exhibition, he operated from a small home-based clinic to treat patients and earned an average annual income of Yuan 30,000 to 40,000 and a maximum of Yuan 50,000. After the award, his products became known and his income increased many-fold to about two to three million Yuan annually.

Su Guokai, from Laomiao town, Hua County, invented a new food from mushroom. Induced and helped by the AOI, he was granted a patent in 2006. Earlier, his company was repeatedly closed for releasing sewerage that did not meet environmental standards. The AOI accepted the help from a local environmental protection bureau to introduce a sewerage treatment facility in Su's company. Subsequently, on the AOI's recommendation, Su's company received many honorary titles and in 2007, Su was elected as a member of the County CPPCC. Moreover, the Association also coordinated with the media to report about Su and his innovation. Su's earlier enterprise was just a small family workshop. Now, it has developed into Hua County Xinda Food Factory, with an area of 9000 m^2 and 86 employees.

4. Concluding observations

The narrative of the institutional arrangements evolved overtime for the promotion of GRIs in Hua County, listed as among the poorest counties of China, highlights the role of institutions in fostering GRIs. The case analysed has been built upon its historically received innovation culture, through mediation of committed local leadership, acknowledged by the local government as well as the local CPC organ and financially supported by the government funds. The local

government has significantly assisted the promotion of innovation activities in the county through mainstreaming innovations in the county development activities. The county government has introduced promotion of innovations as one of the criteria for the evaluation of the local government officials to ensure the enthusiasm of the entire local government machinery about promoting innovations and assisting the farmers.

The triad of governance, the CPPCC, along with the CPC and the government, has played a constructive role here. The case study also shows that there is a fourth pillar in the institutional architecture for the promotion of GRIs. This is manifested in the formation of the AOI as an NGO nurtured by the government. While the structure of governance in Hua County is in tune with that of other counties in China, there is something unique in this county. The CPPCC has a close connection with the AOI and systematically promoted its activities towards the patenting of innovations and their commercialisation. In a sense, the government functions of the Hua County were partly transferred to the AOI to make it an important external force of the government management system. The AOI, in turn, along with its strong social network, is also driven by commercial considerations, which have made it a commercially viable venture. Through these institutional interventions, the historical advantage of the county, in terms of innovative culture, was directed towards the goal of promoting local economic development through institutional innovation.

This is just one example of a success story. There might be many more success stories and probably also many other stories that did not succeed. Nonetheless, this case clearly highlights the significant role of institutions in general as well as the co-evolution of institutions with a changing environment to promote innovations and their commercialisation. Based on this limited experience, we underline the need for such studies to collate the ongoing institutional transformations in rural China through the initiatives of different actors involved. This has been a case study of successful and synergetic collaborations of the three pillars of local government in partnership with a local NGO. There may have been not so successful stories as well. Hence, wide-based case studies on the institutional innovations, their successes and failures, can help in modifying the architecture for promoting and harnessing GRIs for rural development in China and also in other developing countries.

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Notes

1. According to the 2010 national population census, 50.32% or 674.15 million of total population of 31 provinces, autonomous regions and municipalities of mainland China lived in the rural areas (Source: Communique No.1 of the 6th National Population Census, http://www.stats.gov.cn/tjdt/gjtjjdt/t20110429_402722652.htm, accessed on 21 May, 2011). This proportion was 63.91% in 2000 with 807.39 million living in rural areas (Source: Communique No.1 of the 5th National Population Census, http://www.stats.gov.cn/tjgb/rkpcgb/qgrkpcgb/t20020331_15434.htm, accessed on 21 November, 2010).
2. http://www.cznews.gov.cn/cangzhou/wtdt/userobject1ai18804.html, accessed on 26 July, 2011.
3. http://paper.chinahightech.com.cn/html/2009-01/05/content_8485.htm, accessed on 26 July, 2011.
4. Data from Hua County Science and Technology Bureau.
5. Source: http://www.hnhx.gov.cn/gaikuang/gaikuang.html, accessed on 3 December 2010.
6. Source: http://tech.gmw.cn/2010-09/16/content_1258864.htm, accessed on 4 December 2010.

7. The AST system in China includes the ASTs at each level, from nation-level to town-level. The China Association for S & T (CAST) was founded in 1958.
8. The 'Law of the People's Republic of China on Popularization of Science' is the first legislation for the popularisation of science and technology and is a comprehensive as well as a directive legislation. This is followed by the 'Outlines of the National Scheme for Scientific Literacy (2006–2010–2020) document prepared by the State Council and which is a milestone document. There are two main aims of this document; one, boosting China's scientific power and highlighting the role of science in the country's development, and two, equipping Chinese citizens with the skills needed to apply science and technology in their daily lives. Then follows the document named 'Farmers' Scientific Literacy Action', which has detailed action plans for establishing science education, awareness raising, and a training system; enhancing farmers' science and technology training; initiating science outreach activities; establishing and improving the demonstrations; initiating skill training for the surplus rural workforce; establishing the service network and forming teams for engaging with S&T education and communication; and strengthening the popularisation of S&T through capacity building at the rural grassroots level.
9. '*Shi Ye Dan Wei'* is equivalent to public institutions in other countries, where the institution gets government funds but the employees of the institution are not government employees. Public institutions can have their own flexible rules of working. '*Shi Ye Dan Wei'* generally are for some public services. However, sometimes, the administrative organ of the government and '*Shi Ye Dan Wei'* can have similar names if they address common activities. For example, S&T Bureau at different levels of governance and Association of S&T also at different levels of governance; the former is a government department and the latter a '*Shi Ye Dan Wei'*. Peculiarly, some of these '*Shi Ye Dan Wei'* are associated with the CPC committee at the respective level.
10. In Hua County, the county CPPCC has assumed importance because of the presence of Lü Shengzhan who is a member of the County level CPPCC.
11. China has a system of annual evaluation of employees of all organisations, including government officials, through application of certain criteria. Targets of achievements are set as criteria and the local government officials are required to meet these. They score points based on their achievements of these targets.
12. The founder of AOI, Mr Lü Shengzhan has been innovative since childhood, he now holds over 10 patents and has received many awards. While in high school, Lü invented a seed-drill which could be used with tractors for sowing purposes. By using this machine, seeds were sowed evenly and tidily. Its efficiency was five times higher than that of a traditional wood drill used for manually sowing grain. Lü used 7.5 kg of seeds per Mu (about 666.67 m^2) whilst the traditional wooden drill used 15 kg for a wheat crop. Thus, his invention not only reduced labour intensity and improved working efficiency, but also saved wheat seeds. Lü also invented a hill-drop planter in school. Lü's success evinced the interest of the agricultural department of Hua County. The government provided him with finance to apply for patents on his two innovations. In 1991 Lü was given a stable job by the local government to reward his contribution to the society. Later he was appointed as a science and technology instructor of the Third Vocational High School of Hua County. In 2005, Lü started working at the county committee of CPPCC. Having benefited from his inventions he realised that innovation was easy for anyone if he/she applied scientific know-how. However, patenting and its commercialisationwere difficult, as hardly anyone in the county knew the value of a patent and its application process. Lü realised the need of setting up an organisation to help the local innovators with patent applications. Working at the county AST he set up the AOI, one of the important roles of the County AST was to coordinate the work of all the research associations which were NGOs at county-level. In July 2001, Lü, jointly with Wang, launched the Hua County AOI with an initial membership of 80. So far, the association has taken in 12 collective members and over 200 individual members, mainly from among students and farmers.
13. These authors attended the function when the AOI branch was set up in this school.
14. Founded in 1985, the CAI is now working under the leadership of the IPR Bureau of China. It is the home of innovators.

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