

The Diffusion of the Internet and Rural Development

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Abstract / This study explores the applicability of the diffusion of innovations theory to internet development in rural China by examining internet diffusion and usage patterns in two rural areas of China's Gansu Province. Its ethnographic research design allowed the researchers to interact with the rural people under study and obtain first-hand data on their adoption and usage of the internet. The results show that in the context of rural China, where the local economy and infrastructure can hardly sustain such an advanced technology as the internet, the diffusion and usage of the internet are determined not much by the will of individuals, but by the change agency. As the weakest social class in terms of their share and control of social resources, Chinese farmers as individuals do not play an important role in the adoption of the internet, which tends to be the result of organizational initiatives.

Key Words / diffusion of innovations / farmers / internet adoption / internet usage / rural development / western China

Introduction

New information and communication technologies (ICTs), with the internet as their chief embodiment, have radically changed the modes of production and organization of work at a global level and precipitated the transition from Fordism to Gatesism (Tremblay, 1995). The non-hierarchical architecture, interactivity and liberating nature imbedded in internet technologies have provided unprecedented opportunities for human development.

The Millennium Declaration of the United Nations (UN) sees ICTs as tools with the potential to achieve the Millennium Development Goals (MDGs)¹ set by the historic UN 2000 Summit. Target 18 of Goal 8 calls upon the UN member states to cooperate with the private sector to 'make available the benefits of new technologies, especially information and communications' (UNDP, 2003: 3). In the light of this, developing countries have been urged to harness the full potential of the information revolution to alleviate poverty and seek sustained growth. The danger of not participating in the development of ICTs is highlighted by the World Bank in addressing African issues:

The information revolution offers Africa a dramatic opportunity to leapfrog into the future, breaking out of decades of stagnation or decline. Africa needs to seize this opportunity, quickly. If African countries cannot take advantage of the information revolution and surf this great wave of technological change, they may be crushed by it. (World Bank, 1995, summary, paras 3–4)

Since China's first full-function linkage with the internet in 1994, it has witnessed a phenomenal growth of the internet. After a modest beginning in the mid-1990s, China now boasts the world's second largest population of internet users,² which had reached 103 million by 30 June 2005 (about 7.9 per cent of the national population), a big jump from 620,000 users in 1997 (CNNIC, 1997, 2005). There are 45.6 million computer hosts, 622,534 domain names registered under 'CN' and 677,500 websites in China.

Internet penetration in China, however, is basically an urban phenomenon that excludes the majority living in its rural and remote regions (Wacker, 2000). The number of rural internet users is about 1.2 million, accounting for approximately 1.2 per cent of users in China and 0.15 per cent of the rural population (CNNIC, 2005). The poor communication infrastructures, low levels of knowledge and limited incomes have put the rural people in a disadvantaged position, resulting in a huge digital divide between the urban and the rural and between the more developed coastal areas in the east and vast rural areas in the west.

Despite its low penetration in these huge rural areas, the internet is generally perceived as a new engine for rural empowerment and quite a number of experimental projects have been launched in recent years to test such an assumption. Two such projects, Jinta and Yellow Sheep River in western China's Gansu Province, were examined by this study to explore the diffusion patterns of the internet as well as its impact on the social and economic development of the rural areas. In particular, we attempt to see how the diffusion of innovations theory applies to internet development in rural China and explore factors that may have a bearing on internet diffusion and usage among the rural population.

Literature Review

The diffusion of innovations theory was formulated and developed on the basis of observing and analysing the practices of American agricultural extension (Severin and Tankard, 1997). Rogers (1983) defined diffusion as 'the process by which an innovation is communicated through certain channels over time among the members of a social system' (1983: 5). Therefore, the concepts of diffusion and innovation, the communication channels, the time dimension and the social system are considered five main elements involved in diffusion research.

The available diffusion studies basically fall into two categories: the extension of new ideas and practices at the aggregate or the individual level. Ryan and Gross (1943) conducted a seminal study on the diffusion and adoption of hybrid corn among 259 Iowa farmers in two rural communities. They discovered that when the cumulative frequencies of adoption were measured over the lapse of time, the adoption rate followed an s-shaped curve. When the number of adopters reached the critical mass, the diffusion started to take off. The curve levelled off after 50 per cent as fewer and fewer farmers remained to adopt new ideas. Ryan and Gross's findings were further validated by subsequent

diffusion research on agricultural, consumer and other innovations conducted in the USA, India and other places (Rogers, 1983).

While innovation studies focusing on the aggregate level take the time dimension of adoption within a social system as an important variable, studies examining the individual level centre on the innovativeness prediction and the decision-making process. A large part of the literature focuses on the relationship between socio-economic status, personality, communication behaviour and innovativeness (Cancian, 1967; Rogers and Kincaid, 1981). Rogers (1983) listed 32 generalizations about the correlations between these independent variables and innovativeness based on the extant findings of innovative-prediction research. In terms of socio-economic status, earlier adopters tended to have more education, higher level of literacy, upward social mobility, larger farms, commercial rather than a subsistence economic orientation, and more favourable attitudes towards credit, and practice specialized operations more often than late adopters.

Rogers (1983) conceptualized that five steps were involved in the innovation decision-making process as far as individuals were concerned – knowledge, persuasion, decision, implementation and confirmation. The knowledge step took place when an individual first became aware of the functions of an innovation. It was followed by persuasion when the individual developed a kind of attitude either favourable or unfavourable towards the innovation. Then it was time for the individual to arrive at a decision to accept or reject the innovation.

In terms of communication channels, Rogers and Shoemaker (1971) held that mass media were the most efficient means of generating awareness of an innovation among the potential adopters, while interpersonal channels were more potent in persuading individuals to accept or reject an innovation.

As an extension of the multistep flow model, the diffusion of innovations theory was based on generalizing American farmers' individual behaviours within a context of a well-developed market system (Zhao et al., 2005). Though innovative ideas or changing forces are introduced, the decision of adoption or rejection is more often determined by the will of individuals. Therefore, most diffusion research endeavours focus on the social and individual traits of adopters and the roles that mass media and interpersonal communication play at different stages of the decision-making process.

As for methodology, diffusion of innovation studies have been dominated by quantitative approaches, with results generated from statistical analysis. The dominance of one-shot surveys goes against the conceptualization of communication as a process as surveys can only yield recall data about past adoption behaviours collected at a single point in time and fail to predict the trend of adoption and consider the existence of other viable alternatives (Melkote and Steeves, 2001). Another weakness with the survey method lies in its inability to control the time-order sequence of independent and dependent variables. According to Melkote and Steeves (2001), in innovative-prediction studies, the measurement of the dependent variable was based on the recall data on the past adoption behaviour whereas the independent variable was measured according to the present. This leads to the inversion of occurrence between the two variables in time sequence.

The literature review prompts us to question the applicability of the diffusion of innovations theory to rural China, where the socio-economic system and rural population

are strikingly different from their western counterparts. Moreover, the extremely low internet penetration in rural China does not lend itself to a quantitative examination. The explorative nature of the study prescribes a qualitative approach.

Research Design

In view of the exploratory nature of this study, the ethnographic research design was adopted to enable the researchers to interact with the rural people under study and observe the daily activities. The research sites were Yellow Sheep River Town and Jinta County in western China's Gansu Province. The two places represented different approaches to internet diffusion. At Yellow Sheep River, farmers' access to the internet was the result of investment by a Taiwan-based company. In Jinta County, the local government played a decisive role in promoting the ICT project.

The data were collected in April 2005 through in-depth interviews, participant observations and documentary analysis. The strategies of maximum variation and snowball sampling were employed to recruit interviewees. At each site, government officials in charge of the ICT projects, technicians and village administrators were first interviewed. In turn, these people recommended other candidates for interviews.

The field observation focused on the everyday experiences of the local internet users and the daily activities at the rural information centres. Particular attention was paid to internet access mode and usage patterns, the frequently used functions and visited websites, and the impact the internet could possibly have on farmers' lives. Documents on local development and indigenous publications were analysed to complement the information obtained from interviews and personal observations.

Findings

The Story of Yellow Sheep River Town

Yellow Sheep River is a remote and impoverished mountainous town in Gulang County, bordering the desolate Gobi desert. Gulang is one of the 41 counties in Gansu Province that are recognized as the underdeveloped counties in the nation. In Yellow Sheep River Town, 23,000 people live in its 81 rural settlements in an area of 175 km². With traditional farming and livestock breeding as their major occupations, the local people have a per capita annual income of less than US\$200 (*Gulang Gaikuang*, 2005).

The internet came to this rural town as an experiment known as the 'Town and Talent Project' initiated by Wen Sailing, the late vice chairman of a Taiwanese company. Wen decided to invest in the local internet project when he heard about the local people's plight of impoverishment from one of his employees, who had spent a year there as a volunteer teacher in 1999.

With an investment of US\$50m, Wen set up the Town and Talent Technologies Corporation in 2002 with the ambitious goal of transforming the impoverished local communities from an agricultural society to an information society through the popularization of computers and network technology and fostering knowledge-based economic development there.

The planners envisaged seven steps to achieve the ultimate goal of elevating the level of knowledge, income, and living standard in the west to that of eastern coastal China. The steps included employing local schools to promote local economic development, expanding e-business, improving the agricultural and pastoral economy, establishing internet villages, encouraging relocation from rural settlements to the internet villages, developing the service industry, and enacting a system of remote employment and service.

As every rural village has at least one secondary school with relatively better-educated teachers, schools are perceived as leaders in promoting the use of new ICTs in rural areas. Therefore, the project chose the vocational middle school in Yellow Sheep River to play a leadership role in the experiment. It was hoped that the format would be applied in other parts of western China through the involvement of 100 secondary schools so that the local rural communities would be modernized within 10 years.

At Yellow Sheep River Town, the internet technology was diffused mainly through training two groups of people: students and teachers on campus, and people from scattered farming households (see Figure 1). As the first school involved in the project, the vocational middle school at Yellow Sheep River had received 140 donated computers since 2000. A computer classroom and an e-commerce centre were set up on campus to improve e-literacy among the students and farmers nearby.

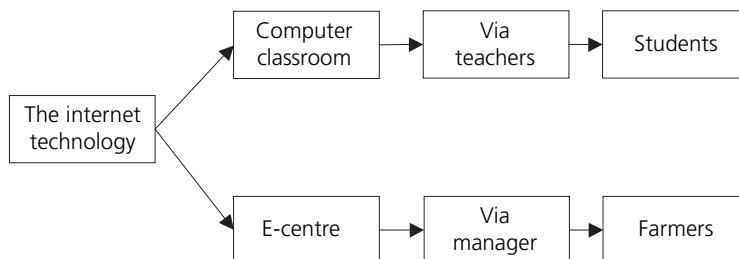
In addition to providing computer hardware, the project helped the school install software to enable students to learn how to use the internet and set up websites. Despite the easy access, students were forbidden to log onto the internet directly as the teachers worried that they might access undesired information online. As a result, students were only allowed to access the school network, where only carefully selected information was displayed.

The local farmers could learn how to use a computer through the e-commerce centre, outside of which information on farming skills, land policies and prices of seeds and fertilizers were posted on the walls when the weather was fine. People would usually stop and read the information when they came for the regular town fairs.

The e-commerce centre, equipped with 25 computers, a printer, a digital camera and a fax machine, was registered and financed as a business under the project. Town and Talent Technologies supervised the daily operation of the centre and offered technical support whenever necessary. The chief administrator of the centre was Hu Wanlong, a history teacher at the vocational middle school. A college graduate himself, Hu became

FIGURE 1

The Internet Diffusion Pattern at Yellow Sheep River Town



the first person in town to master some computer skills. With additional training by the company, Hu served as a part-time administrator and manager of the e-commerce centre, whose job included searching information for farmers, offering technical support, maintaining the hardware and keeping the centre financially viable.

The centre was frequented by both teachers from the school and local farmers. The teachers often came to the centre to search for teaching software at the websites of elite schools in Beijing and Shanghai. The centre did not charge teachers for their internet use because the internet service was considered part of the teaching facilities.

The off seasons for farming (summer and winter) were the busiest periods for the centre. Since its opening in 2000, it had organized 24 internet training courses for farmers as well as 36 training sessions tailored to the special needs of the village chiefs, entrepreneurial farmers, and students from the schools nearby. The most-often taught content included basic knowledge about computer hardware, frequently used office software and internet surfing.

In addition to managing the centre, Hu also served as an informal adviser to local farmers on issues ranging from a new type of tractor they saw in a neighbouring village to the latest government policies on land and agriculture. Despite the training, few local farmers could actually operate the computers and access the internet by themselves. As a result, Hu became the gatekeeper of information from the internet to the local farmers. Users were charged 2 yuan per hour to use the services provided by the centre. The running costs of the centre, such as internet access, electricity, phone calls, and hardware replacement, were covered by tuition fees for the training sessions, fees from daily users and the 1 per cent commission charged for every transaction completed via the e-commerce service.

The benefits of the internet experienced by the local residents mainly revolved around the e-commerce centre and its manager, Hu. By posting information online about local farm produce, Hu helped the villagers sell their green peas, yams and celery, the total transactions of which amounted to 1.3m yuan within five years. Publicity over the internet also enabled the town to attract investment to build a potato processing plant. As a major product for the mountainous areas, potatoes were sold at a low price because of their high yield. The new potato processing plant allowed the farmers to raise their income by turning potatoes into fried chips, which fetched a higher price on the market.

The e-commerce centre also managed to provide farmers with job opportunities through business contact between Town and Talent Technologies and a shoe-making factory in the coastal Guangdong Province in south China. All the would-be assembly line workers from the town underwent training at Hu's centre before setting off. They were taught to send and receive emails and chat online so that they could still keep in touch with their family members.

As far as individual farmers were concerned, those who benefited most from the internet services were Hu's acquaintances. The internet proved to be an efficient means to empower the villagers, especially those in a relatively weak position and therefore in greater need of support. To these people, Hu functioned as a bridge between the virtual world and the real world. One of the boys in the village was handicapped due to a bad surgical operation in a city hospital. The family turned to Hu for help. By surfing on the internet for information regarding medical compensations, Hu and the victim's family

became knowledgeable about the legal process of suing hospitals. The family finally won the case and used the compensation to help the boy recover through a second operation.

Li Xingjiang, a community teacher in a neighbouring town, had a daughter who had been diagnosed as having a brain tumour at the age of 12. Hu posted the girl's story on the school website and called for donations. This soon attracted attention from both Town and Talent Technologies and officials of the provincial government. The girl finally had successful surgery with donations to the account listed by her father on the school website. Hu also helped Li communicate online to learn about her daughter's illness and maintain contact with brain surgeons and friends who showed concern for the young girl.

Wu Zhenzhou, who ran a clinic at a neighbouring town, used to sell medical herbs collected from the mountains to some middlemen, who often cheated him by not paying. With the help of Hu, Wu managed to contact a few pharmaceutical companies in the province through the internet and sold out his herbs at a higher price.

There is no question that Hu plays a pivotal role in promoting the use of the internet among the local farmers, whose general knowledge as well as computer skills may not be sufficient to enable them to successfully use it for their practical purposes. As the change agent, Hu has not only helped the farmers use the internet to solve their problems, but also shaped their perceptions of it in terms of what it means to their lives and what it could accomplish for them. Without Hu, the digital divide would have continued to exist even though the farmers were provided with internet access.

The Story of Jinta County

Jinta County is located in the north-western part of Gansu Province. With a population of 130,000, its annual per capita income stood at US\$520 in 2004. Agriculture and pastoral economy contribute to a large portion of the local revenues. Jinta is one of the national commodity grain production bases and the second largest cotton producer in Gansu Province (Niu, 2005).

The rapid diffusion of the internet in Jinta County owed much to Shen Juntao, former head of the county. When investigating the issue of rural informatization, Shen found that with a better computer network, the local governments at both the municipal and county levels had access to large amounts of up-to-date agricultural information. However, farmers, who made real decisions on agricultural production and management, were left ill informed due to their low social and economic status, limited knowledge and geographical constraints.

Shen (2004) believed that rural development would be more influenced by the market economy after China's accession to the WTO and the demand for farm produce would fluctuate with market changes both at home and abroad. Therefore, updated information on agriculture and farming technologies would play a critical role in helping farmers to adapt quickly to the market mechanism. After conducting door-to-door surveys in two villages near the county seat, Shen and his staff at Jinta Information and Network Centre decided to carry out an ICT project called 'Networking the Villages and Informing the Farming Households', which aimed to achieve last mile connectivity by providing farmers with information from the internet.

Instead of providing every rural household with direct internet access, the Information and Network Centre used the internet in an innovative way to let agricultural information reach the local farmers. The internet diffusion in the county went through several stages. First, the Information and Network Centre launched a newspaper titled the *Jinta Economic Development Herald*, a bi-weekly focusing on market and farming information obtained from the internet as well as government circulars and documents targeted at farmers. An online version of the *Herald* was also carried by the county government's website.

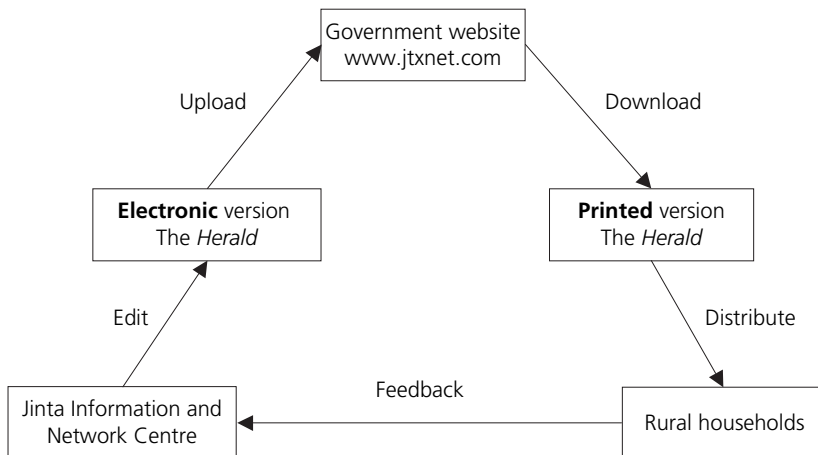
By taking advantage of the existing computers installed in local schools as part of the nationwide modern distance education programme for rural areas sponsored by the Ministry of Education, Shen succeeded in persuading the village schools to play an active role in bringing information to the villagers. Teachers and students were recruited to download the *Herald* and print it out as hard copies, which were then hand-delivered to the farmers by the students. If a villager showed interest in a particular piece of information, he might call the Information and Network Centre directly or let a student bring his request to the teacher in charge of the operation, who would in turn email the feedback to the centre.

The cost sharing operation allowed a village to pay less than US\$100 a year to receive the relevant information from the internet, whose access could not be afforded by the local farmers. With initial success at two pilot villages in 2001, the operation soon spread to 75 villages, covering 90 per cent of the rural households within four years.

Our field observations showed that the printed copies of the *Herald* resulted in vast diffusion of the online information on agriculture and the market. The *Herald* had since become one of the main sources of information for local farmers and served as an important reference for making production decisions (see Figure 2).

By September 2005, Jinta Information and Network Centre published 112 issues of the *Herald*, whose success could be attributed to several factors. First, the *Herald* was

FIGURE 2
The Diffusion of Web-Based Information at Jinta County



very timely in its reports. Much of the information in the *Herald* was selected in accordance with the needs of the changing farming season. During spring sowing, the villagers could read reports on seeds and fertilizers. At harvest time, it offered information on the prices of various items of farm produce at the major markets. For instance, a farmer named Wang Qing reported that the warning of severe weather changes in the paper helped him avoid damage by windstorms and frost to greenhouse vegetables.

Secondly, the *Herald* made great efforts to make its content relevant to the local agriculture. Zhu Xuming, a local farmer, secured a high output of cotton by planting a quality breed of cotton recommended by the *Herald*. As the new breed was quite suitable for the local climate and geographical conditions, Zhu ended up producing a bumper harvest way ahead of other cotton producers who grew the old breed.

Thirdly, the *Herald* was popular because of its professional operation. The information carried by the paper was compiled by two professional editors on the basis of the content over the national and local agricultural websites. In addition to the news, the *Herald* also tried to provide additional contact information for its readers to verify and seek advice from the sources. For example, some farmers were interested in a news item on a special breed of sheep in faraway Shandong Province. With the contact number and the address of the sheep farm printed in the *Herald*, they managed to buy 180 sheep from Shandong, which became highly profitable for the local farmers, effectively turning into business cash cows.

Fourthly, the *Herald* helped to facilitate communication between the government and the farmers. One of the main features of the *Herald* was its columns on national and local policies closely related to rural life, such as taxation reform, subsidies for grain planting, tax relief for natural disasters as well as welfare packages for households with no male offspring. Prior to the existence of the *Herald*, TV had been the only medium for such a purpose. However, during the high farming seasons, villagers were too busy to watch TV, which was not particularly good with details anyway. To meet the farmers' needs, the *Herald* often carried speeches by government officials and government documents of relevance to the farmers in their entirety, thus opening an additional channel of information for farmers on rural policies and improving the transparency of the government.

Discussion

In a developing country like China, the internet, whose diffusion requires large investment and advanced knowledge, is yet to be widely diffused in the cities, let alone the rural areas where the access to the internet is handicapped not only by the underdeveloped economy but also by the lack of adequate telecommunication infrastructure and computer skills. As a result, the digital divide and social disparities between the urban and rural areas, and between the coastal and inland areas are widening. Despite the increasing needs for information about the market, scientific farming, education and healthcare, new communication technologies are bypassing the rural areas, especially the inland regions.

It is within such a context that the Yellow Sheep River and Jinta projects become especially significant. What they have achieved or failed to achieve is of consequence not only to the rural areas in Gansu Province, but also to the rest of China's rural areas.

The fact that the two projects have remained unique in the rural development of the internet shows that the existing economy and infrastructure of China's vast rural areas can hardly diffuse and sustain the adoption of such an advanced technology as the internet, whose diffusion in Yellow Sheep River and Jinta was by no means a natural development. While the traditional diffusion of innovations theory focuses on individuals in explaining success or failure in the diffusion of an innovation, the experiences in Jinta and Yellow Sheep River show that the diffusion of the internet is by no means a matter of personal choice. In absolute terms, the adoption of the internet in China's rural west does not rest with the will of individual farmers, who have neither the financial means nor the immediate needs to drive them to the internet. Under such circumstances, the diffusion of the internet could only happen as the result of institutional or organizational efforts.

While farmers may have individual choices in selecting the traditional means of communication for information about the market, scientific farming, health and other issues, the internet as an advanced technology could only come about either as a government initiative as in the case of Jinta or an external investment as in the case of Yellow Sheep River. More importantly, the connection to the internet itself does not accomplish the task of adoption.

The fact that the use of the internet involves a fair amount of technical know-how differentiates this new information technology from the traditional media, whose usage is simple and easy to learn. This determines that information from the internet is unlikely to flow to the farmers in one step. The experiences of Jinta and Yellow Sheep River show that information from the internet needs to go through multiple nodes to finally reach its targeted audiences in rural China. In neither of the two towns did we witness direct interaction between farmers and the new technology on a large scale. Instead, the internet access skills (Yellow Sheep River) or the web-based content (Jinta) had to take multiple steps to reach the end-users. While we would believe that multiple steps would increase the communication costs and reduce the quality of information under normal circumstances, the additional steps in the flow of internet information to farmers in the two rural areas actually resulted in reducing the costs of internet access, overcoming the technical barriers and better processing of the information.

One of the unique findings of the present study lies in the significant role that rural schools play in the diffusion of the internet. The vocational middle school at Yellow Sheep River is selected by the change agency to train the local farmers and help them develop e-commerce. In Jinta, village schools also serve as an important link to relay web-based content to the farmers. In rural China, where the overall education of its residents is inadequate to cope with such an advanced communication technology as the internet, schools as the powerhouses of knowledge in rural areas naturally help to fill in the gaps. On the one hand, schoolteachers tend to be the better-educated people in rural areas and therefore most receptive to new innovations. The students, on the other hand, serve as the best messengers due to their natural links to the farming households. As the internet does not come to the local farmers as a natural step in the development of the rural telecommunication infrastructures, its diffusion and usage are very much influenced by the change agency. The rationale of the change agency for introducing the technology obviously shapes its diffusion patterns, which in turn influence its usage and implications for local development.

The diffusion of the internet at Jinta is mainly a result of a government initiative. Jinta Information and Network Centre is directly affiliated to the county government and therefore has administrative power over village administrators. This determines the group adoption as well as mediated usage of the web-based content via the print media, which greatly reduces the cost of the technology and the dependence on computer skills associated with internet usage.

In Yellow Sheep River, on the other hand, the private investor company plays a significant role in introducing the internet to the local people. As the project was designed to let local schools lead local economic development, the internet was first introduced to the teachers and students. The e-commerce centre managed by teacher Hu took on the task to promote e-literacy among farmers to change the traditional way of farming and selling the produce. Therefore, farmers' adoption and use of the technology was mediated by Hu since they could not effectively apply what they were taught in the classroom without the help of the e-commerce centre.

Even though we are unable to obtain solid statistics to show the changes brought about by the internet to the local economy and rural life in Jinta and Yellow Sheep River, there is abundant evidence to show that the internet has indeed benefited the farmers' lives. Take Yellow Sheep River as an example: the internet has broadened the vision of the villagers trapped in their remoteness and isolation. More and more students have gone for higher education after the self-administered exam software was introduced to the curriculum. Girls no longer think of getting married after graduation as the only choice of life. They all have better hopes for life by seeking higher education. The internet functions as a window not only for the villagers to look outside but also to promote themselves to the rest of the world. Through its website, the small town has attracted external attention as well as more and more visitors.

Whereas internet technology diffuses slowly from the middle school to the villagers in Yellow Sheep River, over 90 per cent of the farmers in Jinta can access information from the internet without actually surfing the net themselves. To make the information from the skill-dependent internet easily accessible, the information carrier has been changed from digital media into the traditional print media. This has greatly enhanced farmers' exposure to the information on the internet. The printed words give farmers more leeway in terms of the time and venue to read the information.

The scientific knowledge for farming and price information on farm produce help to reduce the level of uncertainty and risks involved when individual farmers are more closely linked to markets at both the national and global levels. Farming decisions such as what and when to plant and what fertilizers to use are no longer made by rule of thumb or on the basis of unreliable information overheard at the fairs.

Conclusion

The experimental projects at Yellow Sheep River and Jinta have demonstrated how the internet could be embraced by farmers in the less developed western regions in China despite the fact that the internet did not come to the rural areas as a natural stage of the development of local information and telecommunication infrastructures. While the methods of diffusion in these two places may not be universally applicable to other parts of rural China, the experiences of making use of the internet for farming and

marketing may be generalized should the technology reach the rural areas on a wide scale.

The two projects show that when farmers lack both the financial means and technical competence to readily adopt the new technology, institutional forces tend to play a more important role in the diffusion and adoption of the internet. In contrast to the diffusion of innovations theory based on experiences of American farmers, the diffusion of the internet in rural China is by no means the result of individual efforts or personal choices. At the current level of economic development in China's rural areas, the internet could only be introduced to the farmers through planned efforts of the government or other powerful institutions. This means the scale of such a diffusion process can be very limited on an experimental basis. Large scale diffusion and adoption of the internet in rural China can only happen after the agricultural economy grows to a stage when the internet comes as a natural step in the development of the rural infrastructure.

The experiments at Jinta and Yellow Sheep River also demonstrate that ready access to the internet does not necessarily lead to direct usage of the technology by the farmers, who are yet to acquire the intellectual and technical competence needed for processing online information. To bridge the gap between the technology and farmers, online communication is likely to take multiple steps before information from the internet can directly reach and benefit the rank and file of farmers. It is no surprise that rural schools, which serve as the knowledge centres in rural areas, were used in both projects to cross the barriers between the farmers and the internet.

The two- or multiple-step flow model also proves to be a more cost-effective way to promote online communication in the rural areas. In Jinta, for example, the innovative use of the traditional print media proved to be an economical way for online information to reach the farmers, who otherwise would be excluded from online communication despite the technical availability of the internet. Although such an indirect method of online communication is far from ideal for cyber communication, it is the most practical way to allow rural farmers to find their presence in cyber space.

The internet diffusion experiments in the two rural areas in western China provide a unique frame of reference to re-examine the diffusion of innovations theory, which is basically a western approach to explain the traditional agricultural extensions in the rural areas. As far as China's experience shows, when an innovation does not come cheap and is yet to prove its benefits, its diffusion is unlikely to take place in the rural areas whose economic and infrastructural development is unable to sustain such a technology. Diffusion in such a context depends more on institutional efforts than on individual efforts.

Notes

- 1 The MDGs, to which 191 UN member states have pledged themselves at the UN Millennium Summit, are constructed as measurable goals and targets for human development. The eight goals are to 'eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability and develop a global partnership for development' (UNDP, 2003: 1–2).
- 2 China Internet Network Information Centre (CNNIC) defines the internet user as a Chinese citizen who uses the internet at least one hour a week.

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