

The background of the page is a light, monochromatic image. It features a hand at the bottom, cupping a small plant with several leaves growing out of a mound of soil. In the upper right quadrant, a satellite with two long solar panels is depicted in orbit against a pale, hazy sky. The overall aesthetic is clean and conceptual, linking agriculture and technology.

***Rural Economies and ICT Policies
for Rural Development***

Using the Sustainable Livelihoods Framework to Analyze ICT Applications for Promotion of Agricultural Livelihoods of Rural Community in China

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ABSTRACT

This paper provided a contribution to theorizing ICT applications and rural development by applying a sustainable livelihoods approach. It is found to provide the basis not only for an information-centered understanding of ICT but also a means for broad analysis of rural development. The specific development issue analyzed is the role of ICT for farmers' livelihoods because it represents a viable route of increasing farmers' income and promoting the quality of farmers. This is reflected through increased and more diversified income streams for rural households. A case study of rural information project in Ningxia of China was presented to demonstrate what is the impact of ICT and how the ICT can impact on farmers' livelihoods. Under the analytical framework of sustainable livelihoods, the vulnerability of rural households of Ningxia, the changes of the capital assets including human, financial, physical, natural and social capital, the transformation process of social relations, institutions and organizations were analyzed. The functional role of ICT by using these assets within livelihood strategies and the livelihood outcomes were illustrated. The analysis of this paper was based on survey data from 628 households in nine counties of Ningxia. The results suggested that ICT may bring direct and indirect benefits for promotion of rural livelihoods.

Keywords: ICT application; livelihoods; benefits; rural development

Introduction

The ICTs (Information and Communication Technologies) application in rural areas has long been acknowledged as a major content for development and today's drive forward information society. It has been seen as an important task for pushing forward the construction of Socialist New Countryside in China. It may contribute to the integrated development of urban and rural areas by resolving the problem of farmers, agriculture and rural areas. To date, there has been vast majority of marco analysis on the initiatives of ICTs applications in rural areas in terms of their long-term development impact. For instance, DFID defined ICT as 'technologies that facilitate communication and the processing and transmission of information by electronic means. An ICT is a tool for poverty reduction when it is applied to meet the information and communication needs of the rural poor. Because ICT applications may only bring marginal direct benefits for poverty reduction [1], the various specific ICTs are integratedly applied in rural areas that is more relevant to social and economic impact and sustainability.

There are also evidences that ICTs play an important role in addressing major challenges of

enhancing agricultural production and uplifting the livelihoods of the rural poor [2]. The role of ICTs to enhance food security and support rural livelihoods is increasingly recognized and was officially endorsed at the World Summit on the Information Society (WSIS) 2003-2005. The potential contribution of ICTs to the livelihoods of small-scale farmers and the efficiency of the agricultural sector in developing countries has been illustrated by Jac Stienen with Wietse Bruinsma and Frans Neuman, International Institute for Communication and Development (IICD). ICTs increase economic and social opportunity for farmers, which mainly include enhancing agricultural production, improving market access, capabilitybuilding and empowerment, and so forth. But the potential of ICTs are yet to be harnessed to address the challenges faced by rural development. They can be broadly classified as infrastructural constraints, cultural constraints and institutional constraints. So far, most development agencies have failed to effectively mainstream strategies to harness the potential of ICTs. Thus the real role of ICTs to rural livelihood development should be investigated.

The Rural Information Project (Integration of Network for Telecom, TV and Internet or "Three-Network" Integration) of Ningxia in China represents

a useful case study for livelihood analysis of ICTs application in rural areas because it made more rural population have access to Internet-based information; made a rapidly expanding ICT infrastructure in rural areas. This project mainly included the construction of callcenter, rural comprehensive information website and village information centers (VICs). It was the key structure considered in terms of potentially transforming farmer's livelihood strategies. This research will attempt to answer the following questions: whether there is an overall impact of the rural information project on livelihoods of the rural community? And if there are impacts, what are the impacts and the reasons that cause these impacts.

Methodology

The evaluation of impacts of ICTs on livelihood development in this paper was analyzed based on Sustainable Livelihood Development Framework. The study undertook literature review firstly, to analyze the basic status on farmers' vulnerability context and current livelihood strategies in rural Ningxia, as well as the technology application of "three-network" integration. Based on the better understanding of baseline situation, a set of evaluation indicators system was proposed, covering five assets of sustainable livelihood framework. Through one-shot survey, one-to-one interviews and focus group discussion, all relevant data was collected.

A survey of 628 rural households in 9 counties of Ningxia provided basic information, including information about gender, age, education level, the occupations of household occupants and their opinion on rural information project as well as their history of internet and computer use. This also included information about how their internet and computer use, if any, related to their livelihood activities. Information about the organizational context in which rural information project operated was through key informant interviews with relevant personnel (mainly village leaders) as well as reviews of all project-related reports and other related papers. The public internet access site for rural information services was interviewed (<http://www.nxnc.gov.cn>; <http://www.12346.gov.cn>). Based on the survey data, a statistical analysis was carried out.

Analysis and Results

A. Background to the agricultural livelihoods of Ningxia

According to China statistic Yearbook, there are 3.16 million rural populations in Ningxia in 2008. Among which, the amount of agricultural labors are

more than 2 million. The majority of population distributed in central and southern regions. Especially the population density in southern mountainous is higher than the critical standard for dry and semi-dry areas, which is proposed in the United Nations Conference on Desertification in 1978. For example, the population density in Longde County reached 129 people per square kilometers, which is several dozen times of critical standard. Due to large population, the economic development of central and southern regions is slower. In these regions, per capita GDP only account for 26 percent of the total in Ningxia. In 8 poor mountainous counties, per capita pure income of farmers is about CNY 2900, lower than the average CNY 4000 of the region. The poor population in 6 counties of Tongxin, Yuanzhou, Xiji, Longde, Jingyuan, Haiyuan is reducing in 2008 compared with 2007, while increasing in Yanchi county and Pengyang county. The number of poor peoples in Yuanzhou and Pengyang County is larger with 39 thousand and 15 thousand respectively, and higher proportion of 9.8% and 6.4%.

In terms of the natural conditions and economic development of Ningxia, there include three parts of plain, dry belt and mountain. In the northern plain area, the agricultural activities are mainly grain cropping and animal breeding. In central dry belt, the development of special dry farming and water saving agriculture is focused on. While southern mountainous area is suitable for developing the ecological agriculture. Ningxia owns resource advantage for agricultural development, including land, pasture, labor, light and thermal resources, and water resources in selected area. The agricultural products of Ningxia are characterized by medlar, sheep with long-staple wool, liquorice root, long date, selenium-content watermelon and potato as well as wine grapes. Due to the different natural conditions, the agricultural livelihoods varied in different areas.

B. Assessing the vulnerability context

As the aforementioned, the low income and poverty is the main faced issues. The saving amount of urban and rural residents is CNY 794.1 in 2008, only accounting for 4.8% of the national average of CNY 16407. The larger household scale, the higher poverty incidence. The average family scale is 3.57 persons each household in Ningxia, while the mean household scale in poverty counties is 4.9 persons. Due to the national population policy of non family plan for the minor nationalities, the area where Hui nationality inhabited has relative large household scale. The average scale of poor household is 6.1 persons. Rural labor force is abundant in these areas,

while deteriorated soil fertility inhibits their livelihoods improvement. Therefore, the surplus labor export is the main measure for increasing farmers' income. In general, the education level of farmers in Ningxia is relative lower. Farmers graduated from primary school account for 31.2 percent, while that graduated from junior middle school 40.4%, proportion of illiteracy is 18.7%. In addition, the education level of women is lower. Therefore, farmers urgently need technological knowledge to improve their agricultural production and skills for job opportunities.

The vulnerability context of livelihoods in rural Ningxia differs according to a wide range of variables. The location is highlighted because it decides the type of activity undertaken by farmers. In the northern regions, farmers mainly plant grain crops, cash crops and raising cow. Due to agricultural advantages, the production level is higher. With the integration development of market economy, more and more products need be marketed outside. The difficulty in sale is the main issue faced by local farmers. In central dry areas, the majority of crops planted mainly are used to feed themselves. Except for the sale income of maize and selected animals, farmers need to do part-time jobs for supplement income. The key constraint in these areas was serious water shortage; the dry farming and water saving technology, disease and pest control technology are essentially required to response to the shock effects of drought. Unlike the ecological vulnerability of the middle regions, the ecological environment is better in southern mountainous area with large poverty population. The agricultural livelihoods concentrated on grassland animal husbandry, potato planting and labor export. In order to protect the ecological environment, the production of special produce, such as coarse cereals, Chinese medicine, mushroom etc., is developed. Therefore, the lack of special agricultural technologies and skills is key constraint for their sustainable livelihoods.

C. Assessing the impacts on livelihood assets

Information and communication activities are a fundamental element of any rural development activity. Rural areas are often characterized as information-poor and especially, the rural poor typically lack access to information vital to their lives and livelihoods. Information provision has always been a central component of rural development initiatives. The vulnerabilities arising from location, income group in Ningxia impinge directly on access to information. However, through the implementation of the rural information project, more rural populations have equal access to internet-based

information. This transforming of structure by the project brought the impacts on livelihood assets, especially on human capital, financial capital and social capital, while less on natural capital and physical capital. The following section presented a brief assessment of capital asset impacts that have been investigated in the field survey and key informants interview.

Human capital

In this respect, the qualitative analysis was conducted because human capital is hard to value. It is well known that the roles of ICTs relate to long term capacity building through education, training. Through this project, 72.9% of respondents have participated in distance learning and skill training. Through which, they learned crop planting and animal breeding techniques and other skills for driver, welder, computer operator, motor vehicle repairer, cooker, tiler, electronic engineer, grass weaver and so on. Through the education and training function of the project, it helps farmers to increase agricultural income by promotion of output and quality, as well as self-operating income and outside employment income. For example, farmers are educated to how to use new technology for better farming practices, 63.5% of respondents have developed large-scaled animal raising and vegetable culture in green house. In general, the project has provided opportunities for farmers for education. The survey also indicated more than half of respondents acknowledged this.

Except for through education and training, healthcare is also important for human capacity building. In rural areas, the medical care and health promotion infrastructure is commonly limited, thereby with expensive costs in outside hospital. Meanwhile, farmers lack healthcare information and knowledge. Through the implementation of this project, it has created convenience for farmers' seeing a doctor mainly through related hospital information search, making an appointment to see the doctor in big cities etc. In addition, internet-based information on health would greatly enhance the hygienic and health knowledge of farmers. Through the related information service delivered by the project, farmers' concept for healthcare changed for a more healthy life. According to the survey, 71.9 % of respondents recognized this make a contribution to their healthcare. Moreover, 67.1 % thought that the main reason was that they can better understand and learn health knowledge via the Internet, which greatly facilitated their health promotion.

In the spiritual and cultural respect, there are large gap between urban residents and rural residents.

Entering into information era, entertainments via computer bring a new way. The project has made farmers enjoying that provided by the new technology. According to the survey, 84.3% of respondents recognized that they had more options for entertainment. At present, watching television is still the main leisure activity in rural Ningxia. But surf of Internet has become the second leisure activity. In addition, watching a movie is becoming more and more popular due to related service delivered by the project. Because of diversified entertainments, unhealthy gambling is eliminated, which is popular in the past years.

Financial capital

Income is an important financial capital for farmers, which help to achieve livelihood objectives. As a result of better farming practices from online agriculture advice and price information, farmers' income can be increased. There are evidences that ICT can improve livelihoods of farmers by the way of increasing their access to potential markets. In this area, use of ICTs facilitate contact between sellers and buyers, promote agricultural exports, facilitate online trading, and make producers aware of potential market opportunities including consumer and price trends in domestic markets. By increasing awareness among producers on consumer trends and new production techniques, ICTs can contribute to the diversification of production, which is in favor of food security. Potential areas are production of high value crops such as vegetables and special commodities like medicinal plants. The farmers benefit from an enlarged market and upto- date information on market prices. Large scale buyers benefit from the efficient organization of supply and transport.

The survey results showed that 83.6% of respondents recognized their income increase through the information project. As for the increased income source, planting is a dominant source, and animal breeding rank second, the next is outside employment. The increment of planting income is mainly caused by the application of new cultivation techniques, promotion of ability to control disease and pest, and the adjustment of planting structure. In addition, it is partly caused by cost saving on chemicals and pesticides, increase sales and higher prices. Breeding income is increased by applying new breeding techniques and increasing capability of disease control. For rural household, wage income is an important supplement. Depending on the skill training provided by the information project, farmers are easy to get employment. 69.3% of respondents have acquired more incomes by skill training.

Because farmers have savings habit in rural China, savings is still a main financing means for farmers in Ningxia. But this project has made a contribution to providing other ways such as insurance, financial products of fund and stock. Among which, the insurance is more widely purchased by farmers. The other ways are now seldom used by farmers because of the limited economic level. Through this project, the convenience of fund collection can be provided for farmers. Rural bank and minor credit organization is main channels of fund collection for farmers. Thereby related information service depending on the information project has been provided.

In addition, there is evidence that ICT has the potential to reduce the transaction costs associated with the exchange of information relevant to agricultural activity. ICT (primarily via Internet and telephony) can reduce the time (and hence costs) associated with receiving market information (such as prices) and the costs of conducting and agreeing to transactions. This also increased farmers' financial capital indirectly. The survey results also indicated that more than half of respondents claimed that the time and transport costs were saved.

Social capital

Telecommunication services are particularly advantageous for farmers because they support real-time communication and two-way flows of information. Telephony and Internet also supports informal information systems and helps to support the social networks. For the rural poor, the decisions are made predominantly through personal contact, interaction. They are usually off the shared information resources. Enhanced communications (facilitated via mobile telephony and Internet, for example) can serve to reinforce the linkage with family members and governors. This can assist farmers to establish new networks which can also help to build sociopolitical assets. There are evidences that the Internet have the potential to support networks of communication between community-based organizations and other support structures that directly serve the needs of farmers.

With regards to this project, it has firstly facilitated the communication between family members. Especially for the households with children for education outside home, it provided a ways of internet talk for high frequency communications. More than 60% of respondents recognized that they now have more contacts with family members than before. Secondly, the project also provided a platform for village affairs management. Through the platform, the statistic reports can be submitted via

Internet so as to reduce time and transport cost. It has information column to post recent government information to let more farmers to know. Meanwhile, officials in some villages used BBS and QQ group to distribute related government information. Thus farmers are easy to have access to participatory management. With regard to the survey results, it showed that 57.9% of respondents acknowledged this impact. More than 40% of surveyed farmers also thought that they now can more smoothly communicate with government departments. Therefore, the government services were more effectively delivered to farmers.

This information project has also a contribution to establish networks of communication between communitybased organizations and other support structures that directly serve the needs of farmers. As you know, for the farmers, sufficient trust to justify decisions is created predominantly through personal contact, and, usually, a shared context and proximity to the information source. However, agricultural cooperatives can play a key role in organizing farmers to deal with market shocks. In Ningxia, some VICs are managed by agricultural cooperatives, through which the important information is effectively delivered to farmers. On the basis of enhancing trust from farmers, more and more farmers have willingness to join the cooperatives for better agricultural practices and market. The survey result showed that 50% of respondents have taken part in farmer cooperatives. It helped to establish new knowledge networks in local community and to support the promotion of social capital.

Natural capital

There are evidences which show that ICTs have little impacts on natural capital. It is true, but ICTs can bring indirect influence on natural capital. For example, information on dry farming and water saving technology and the ability to undertake innovative farming ways help local farmers make better decisions on land use. Better farming practices such as application of new varieties and new technology will help to slow down the degradation of natural resources that is essential for the sustainability of farmer livelihoods.

In this project, farmers can have access to information on dry farming and water saving technology, as well as weather information. Therefore, farmers can undertake better farming practices and take measures ahead to reduce the hazard risk. The survey results showed that more than 60% of respondents recognized the role of ICTs in reducing climate vulnerability. More than 70% of respondents thought that their awareness of

environment protection increased by access to relevant information.

Physical capital

Like natural capital, the impacts of ICTs on physical capital are also limited. Through this rural information project, all villages in Ningxia can get access to the Internet, IPTV, DVD players and projector that can be used for other purposes like distance learning or for entertainment purposes. Farmers also save on transport and communication finding the buyers for their produce. Farmers no longer need to go to get simple information. They can access related information wherever they are by China Mobile Fetion service done by village messengers. The ICT infrastructure was strengthened with multiply provision of information services. Now the village information center becomes one of popular ways to acquire information by farmers in Ningxia. From the opinion of farmers, 52.4% acknowledged the role of the project in facilitating the construction of ICT infrastructure. Due to the interaction of ICTs with other parts, 29.3% claimed that it also made a contribution to local road construction.

D. Assessing the structure and processes

A comprehensive analysis of structures and processes would be wide-ranging and detailed and would assess a broad range of factors concerning both influence and access. The following analysis of organizations, institutions, and social relations is more limited but illustrates a number of areas from which we can draw evidence. Historically, the agricultural extension services as well as local government have played a key role in direct support to farmers through the information delivery and technology training networks. It is now generally accepted that government—through such top-down extension services—does not represent the most effective body for implementing policy in agriculture sector. It is particularly poor in disseminating information within a market environment and lacks the experienced personnel who are able to deliver information via effective interaction with farmers. Thus, policy changes have been seen a gradual diminution of services delivered exclusively via government structures and, instead, the promotion of partnerships with the third-sector or exclusively private sector solutions for the delivery of information services to farmers. For example, technical training provision, rather than being delivered directly by government agencies, is validated by other independent agencies such as IT corporations. Due to the establishment of callcenter and the introduction of VICs, farmers now can get

their agricultural advice from VICs via the messengers. Therefore, there is a move toward forming market-based structures and processes, involving multiply suppliers and inputs of ICT-based services. The involvement of more departments including private sector in the provision of ICTbased technology and information services has more room to develop as a counterpart of agricultural extension because of the liberalization of the telecommunication sector, Rapid expansion of ICT infrastructure has created considerable potential for the type of value-added network services for farmers. These include providers of collective access to Internet services (callcenter), which act as infomediaries by also providing technology and market information services. Evidence indicated that the extension of such services in rural area is extremely necessary. The survey data suggested that nearly 90% know the VICs and more than 95% have willingness to acquire information services delivered by it.

In addition, these services provision is showed toward services that are in demand within the community. The messengers are able to interface directly with farmers and can offers more potential. They now have local Internet access, computer skills, and more information resources. Farmers can directly get help from messengers to resolve problems arising in their production and life. At present, farmers are free for these services in Ningxia. However, regarding the perception of farmers, 94.8% indicated that they were able to afford information access, mainly for purpose of learning technology and knowledge. Only the minority remain excluded and dependent upon government.

The profiles of messengers will play a decisive role in services providing. Evidence from Ningxia illustrated the limits placed on such infomedaries when extending services into rural poor. Problems arise not only because poor messenger lack passion and positivity for work but also because they will not acquire trust. Therefore, except for regular post of information in village halls, the messenger has to communicate face to face with farmers. They can also use the public broadcast in the village to pass on messages.

VICs has also become a forum for communications of farmers each other. Where farmers not only received training but also gained more contacts with others. Also, new knowledge networks were established that play an important role in knowledge sharing, bringing various stakeholders together, and engaging in production and trade activities.

E. Uses in livelihood strategies

Farmers need to build on their existing livelihood assets in order to provide the resources they need to sustain and improve their livings. Through this project, internet service was used in their livelihood strategies. Three cases were presented in the below section.

Case 1 Support of purchasing agricultural materials

The serious shortage of chemical fertilizers in market supply emerged in late June to earlier July 2008 in Ligang Town of Helan County. The village information center located in farmer's cooperative for agricultural materials service post the demand information on the web of rural comprehensive information of Ningxia. Through it the transaction was smoothly made at reasonable price with the trade amount of CNY 70 thousand. In this case, VIC plays a decisive role in resolving the problems emerged in agricultural production.

Case 2 Income increase by Internet marketing

Pingluo is a large agricultural county in Ningxia. The large-scaled production of dried vegetable is becoming the one of dominant industries. In addition, the production of potato, watermelon, Muslin beef and mutton is also in a lager scale. However, the internal market within Ningxia is limited. How to increase sales in outside markets has become a bottle-necks problem for sustainable increase of farmer's income. Finally, they established agricultural products outlets on web. Through the internet, the agricultural products information is disseminated at home and abroad. In such, it helps them to contact with the traders and sell goods in a more convenient manner. At present, the internet connects to each village of Pingluo which forming an integrated sales network system. Internet marketing as made the local agricultural products to be sold in European, American and South eastern Asian countries and regions.

Case 3 Development of special industry

In Haojiaqiao town of Lingwu city, due to the introduction of VIC, the smallholder production structure was changed. At present, 617 households, 89.4% of the total in Xiqu village, engaged in the production of grass woven products. Meanwhile, on the basis of the distribution of product information via the Internet, the comunication was smoothly carried out by phone and network vedio leading to sign more orders and contracts. Due to the large quantity of orders, the farmers were united organised to market the products. The sale markets extend to

Gansu, Shanxi, Inner Mongolia as well as Yanchi County and Huaiyuan County of Ningxia. Online orders made 40% of the products to be sold out with the accumulated trade amount of CNY 1.2 million in 2008. Among which, Mr. Liu Shaowei, a young farmer in the village, has gained more CNY 30 thousand.

F. Livelihood outcomes

Reducing livelihood vulnerabilities

Through the improvement of the livelihood assets, their vulnerabilities can be reduced. As the analysis on financial capital, farmers can benefit from an enlarged market and up-to-date information on market prices through this project. Except for increased market access, this information project can also increase production efficiency, especially for small-scale farmers. Farming is an uncertain business, with farmers facing many threats to their harvest from poor soils, drought, erosion and pests. Because the information project was used to provide information and advice to farmers, the threats have been drastically reduced. Climate change is adding another level of instability to the lives of farmers, the project greatly facilitates the flow of weather information to farmers and also opens up new opportunities for farmers to document and share experiences with each other. The survey results showed that more than 60% of respondents recognized the role of ICTs in reducing climate vulnerability.

Enhancing farmer's knowledge and capacities for more incomes

The callcenter of Ningxia provided comprehensive information and training courses in video, voice and literature format. Depending on VICs, farmers can be organized to learn new knowledge and get agricultural advice. These programs help to enhance local farmer's knowledge and capacities. VICs has also become a forum for farmers' communications each other. Local knowledge on good practices and lessons learned about innovations can be timely captured. For example, messengers chat each other via QQ group, talk with experts wherever they are, negotiate with traders and buyers, also the sellers can get together to talk each other. During the delivery of information, new networks are forming. The project has created opportunities for collecting and sharing local knowledge and for interaction between farmer groups and experts. It contributes towards strengthening existing knowledge networks in rural communities. The promotion of social capital and human capital help to create more income. At the same time, local

massive technical change has altered people's ideas of what is possible. Video and broadband offer even more opportunities for increasing well-being.

Conclusions

The rural information project in Ningxia made the local farmers getting rid out of information poverty. They reasonably adjusted the structure of cropping and breeding with the guide of market information to avoid the disorder in production. Through the analysis based on the sustainable livelihoods framework, the human capital, financial capital and social capital of rural communities has been greatly changed to help the income increase of farmers and the improvement of life, especially the use of computer, projector, and printer and access to the Internet in rural areas changed the spiritual and cultural life of farmers.

Due to the implementation of ICT project, the construction of ICT infrastructure had been strengthening and the project had far-reaching impacts on livelihoods in rural Ningxia. 95% of respondents were generally satisfied with the information services delivered by this project, and now more aware of the use of ICT. This provides a basis for a more substantial improvement on livelihood assets. Most farmers find themselves in a disadvantageous position when they face disease and pest, and the middleman who buys produce. When accessing information by this project, more than 50% of respondents indicated that they benefited from enhanced empowerment, enabling them to acquire better input and sales prices, also increased income through save time and transport cost, higher sales prices and increased sales by access to new markets and higher productivity through improved production methods. Except for the direct impacts on financial capital, the impacts on human capital are hard to be valued. It will take time before human capacity is developed to yield economic benefits. The survey data suggested that 72.9% of respondents were empowered by employment opportunity increase depending on ICT-based training, and 69.3% experienced direct positive effects on their income.

At present, the project seems to make more contributions to building of human capital than to financial capital and social capital. Because the education, location and the type of income-generating activity are important differentiating factors in Ningxia, the impacts on assets vary in various regions.

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