

How can ICTs be used and appropriated to address agricultural information needs of Bangladeshi farmers?

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Abstract: It has been argued that the use of ICTs can provide disadvantaged communities with access to information and thereby enable them to enhance their quality of life. This paper attempts to analyze the use of the ICTs from the perspective of the target beneficiaries (i.e. farmers). It reports on the results of an action research intervention in Bangladesh. The first phase of the fieldwork was designed to identify agricultural information needs. An intervention enabled farmers' groups to have access to the services offered by two telecentres in Bangladesh through mobile telephony technology. Evidence from interviews, focus group discussions, diary notes and personal observation suggests that the telecentre projects had limited impacts in terms of meeting some crucial agricultural information needs. Mobile telephony, computers and internet connectivity have the potential to deliver the information. However, the information content and the applications need to be developed through a bottom up approach in order to achieve the objectives of meeting the information needs of farmers.

Keywords: Agricultural information needs in Bangladesh, mobile telephony, telecentres, appropriation of ICT

1.0 INTRODUCTION:

This paper investigates the use and appropriation of ICTs (Information and Communication Technologies) by rural Bangladeshi farmers. It examines farmers' information needs and how and to what extent those needs can be addressed through the use of different ICT tools and applications and their appropriation in the settings of rural Bangladesh. It has been suggested that ICT applications and services can enable farmers to obtain information on input and output prices, the weather and so forth. The information provided needs to be situationally relevant if it is to enable farmers to improve their farm income and/or reduce their production cost. It is also important to investigate whether or not farmers find it easy to access the information, generated by ICTs. The paper attempts to examine these issues from the point of view of the target beneficiaries – the rural farmers using an action research approach.

In the first phase of the fieldwork, the information needs of rural farmers were investigated. The second phase enabled groups of farmers to have access to the services offered by two telecentres using mobile phone technology. The centres in question were D-Net¹'s Community-based Technology Centre (CTC) and Grameenphone and Katalyst²'s GPCIC (Grameenphone Community Information Centre). D-Net, a Bangladeshi NGO, runs the Microsoft Unlimited Potential Project in the form of Pallytathya Kendra (a type of CTC). Both of the projects provide the rural communities with access to different ICT tools including computers and Internet. The fieldwork project examined the current and potential interaction between farmers and these telecentres. The intervention of the action research also enabled small groups of farmers to use mobile 'phones to retrieve information from telecentres and other sources. The fieldwork thus had the scope to assess the roles of telecentres and mobile telephony in resolving farmers' agricultural information needs.

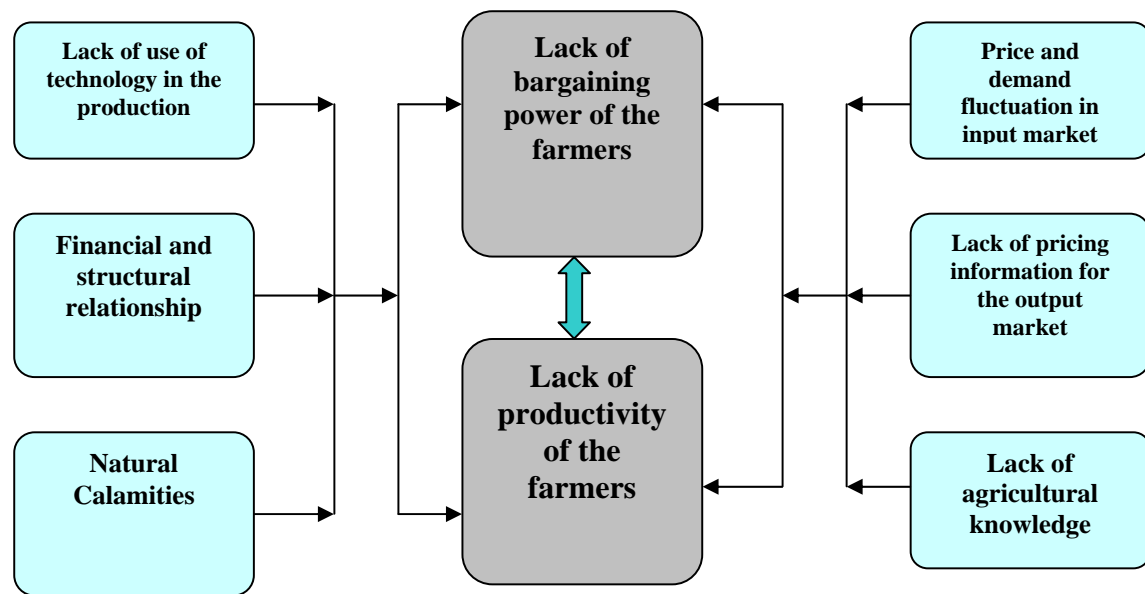
¹ www.dnet-bangladesh.org
² www.katalystbd.com

2.0 FARMERS' INFORMATION NEEDS

In a country like Bangladesh farms are extremely small, cultivation is dependent on the uncertainties of variable rainfall and average output is generally low. Value addition in agriculture requires technological, institutional and price incentive changes designed to raise the productivity of the small farms (Todaro, 2000). In 1991 the top ten percent of landowners owned sixty percent of the land, while the bottom sixty percent of landowners had only one percent of the land (Ullah and Routray, 2007). The structure of the agrarian system in Bangladesh is considered as a major impediment for balanced rural development (Rogaly, Harris-White and Bose, 1999). Small farmers are entangled within a vicious cycle because of sharecropping, tenancy, money lending and other structural and financial relationships with owners and traders (Crow, 1999). The situation of the vulnerable farmers is exacerbated by the land erosion, drought, flood, deforestation and other natural calamities. These together with lack of access to finance reduce farmers' propensity to take risks. The bargaining power of farmers in the input market is not very strong with the result that farmers pay high prices for inputs thereby reducing their net earnings. Lack of bargaining power also impacts adversely on the prices farmers receive for their produce. Low net earnings in turn reduce the capacity and incentive to make productivity improving investments. The overall situation can be summarised by the figure-1.

Imperfect information and high transaction costs can constitute major impediments in the agricultural marketing process (Dao, 2004). The potential impact of lack of knowledge and other relevant information on the bargaining power and productivity of the farmers is reflected in the figure-1. Kizilaslan (2006) argues that proper dissemination of information for agricultural and rural communities is a crucial tool in the fight against poverty and deprivation. Information helps the poor to avail of the opportunities and also reduce their vulnerability. Kiplang'at (1999) postulates that dissemination of relevant information to the farming communities can facilitate the effective adoption of agricultural inputs, decision making on markets and adoption of scientific methods. However, lack of dissemination of information across the agricultural supply chain is a major concern in the developing world.

Figure 1 Reasons behind lack of bargaining power and lack of productivity of Bangladeshi farmers



Source: author's synthesis of factors noted in the literature review

Research conducted by Lio and Liu (2006) found strong correlation between the use of ICT and farmers' productivity. They consider that use of ICTs can also increase farmers' bargaining power. With the access to information, small scale farmers are better able to compete with the larger operators. They can even develop knowledge regarding crop choices, develop products for the niche markets and even can market the products directly to the consumers. Without the access to knowledge and communication capabilities the small farmers remain at the mercy of the global market forces. However, high costs coupled with infrastructure and context related inhibitors can dilute the advantages of having access to information.

Can ICT be a panacea?

As ICT diffusion started to grow in many developing countries, the application of ICT to agricultural and rural development began to receive the attention of researchers and policy makers. A number of studies have suggested that ICT could play an important role in agricultural development. Lio and Liu (2006) found that a microwave-radio telephone system installed in the remote region of Tumaca, Columbia, along with community access points resulted in better trade and market opportunities. James (2004) reported that rural telephone and community radio services initiated in India and Sri Lanka had received a positive response from farmer communities. The International Institute of Communication Development (IICD) and Manobi, an African telecom company have initiated a collaborative program to help the farmers of Burkina Faso, Ghana, Mali, Uganda and Zambia gain access to market price information via text messages, Wireless Application Protocol (WAP), or the mobile internet as well as personal computers and personal digital assistants (PDA)³. Bayes (2001) has argued that the Village Phone Program (VPP) of Grameen Bank of Bangladesh can convert telephones into production goods by lowering transaction costs.

³ (<http://www.uneca.org/aisi/picta/pictabulletin/pb55.htm>)

While some research has suggested a significant positive contribution of ICT to development, others have been more cautious or even skeptical. Cullen (2003) argues that new technologies may co-exist with the old and in doing so enhance the digital divide. It has also been suggested that the opportunity cost of the resources engaged in bridging the digital divide may lead to the neglect the other development priorities. Mutula (2005) argues that resources utilized to bridge the digital divide would have more impact if they were directed to meet the basic needs of the poor. Even so, he has been optimistic about the outcome of the effective use of ICTs. Heeks (1999) argues that ICT can contribute positively to development if it is used appropriately. Other researchers like Nikam, et al (2004), Kirlidog and Aydemir (2005) and Leaning (2005) express concerns regarding the appropriation of western born ICTs in the setting of developing societies. They suggest the bottom up approach that pays greater attention to the local needs and context.

3.0 OBJECTIVES:

The research reported in this paper has two main objectives:

1. Identifying agricultural information needs of the rural Bangladeshi farmers: What are the problems faced by the rural Bangladeshi farmers with regard to production and marketing of agricultural commodities?
2. Farmers' perceptions about the role of the ICT enabled projects and/or applications in resolving those problems: To what extent and how the use of the ICT enabled projects and/or applications can address their information needs? What are the reasons behind such perceptions?

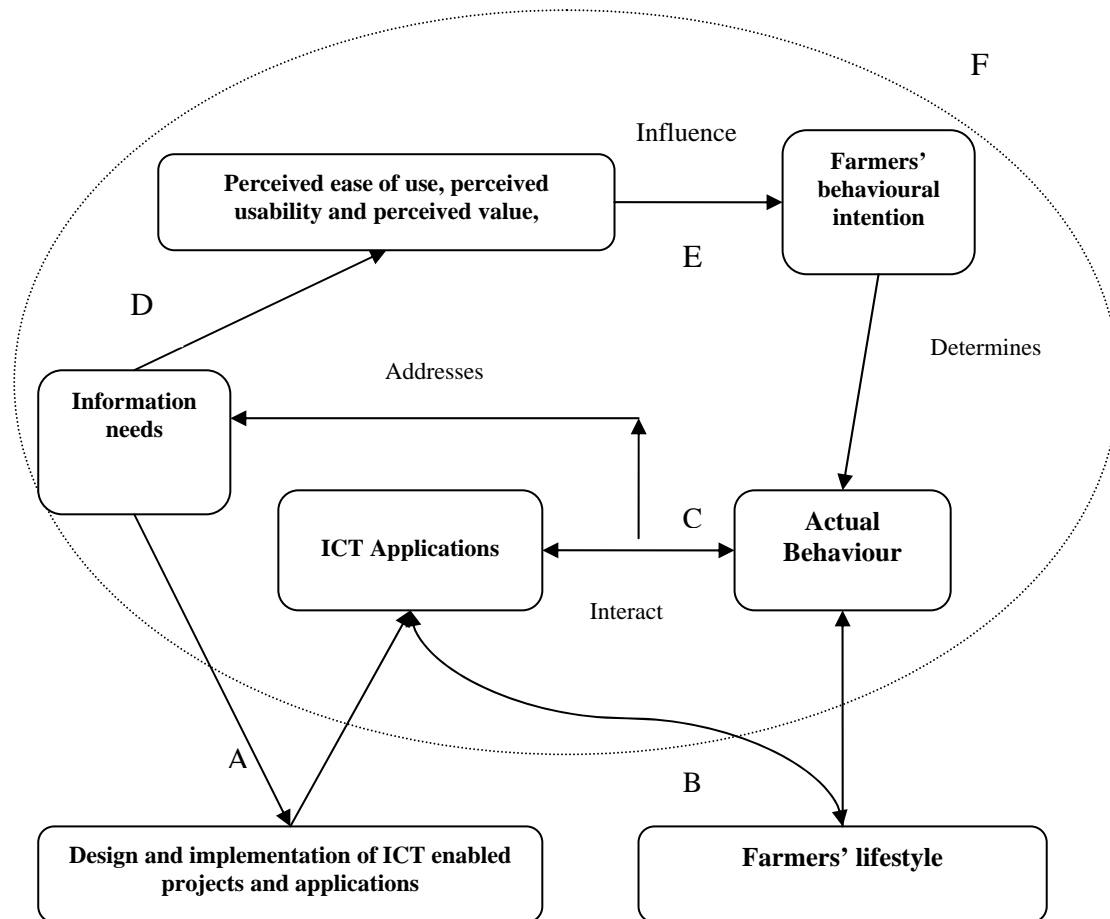
4.0 CONCEPTUAL FRAMEWORK

The conceptual framework (figure-2) of this research has got four basic facets:

1. ICT applications are designed and introduced to meet certain information needs of the target users (i.e. farmers).
2. Farmers' use of ICTs is intertwined with social practices and their lifestyle.
3. Farmers interact with the ICT applications and they develop perceptions through such engagement. The whole process is part of the circle F.
4. Farmers' use of ICTs is a dynamic process. Through a longer duration of use, farmers can get more comfortable with the use of the ICTs, they can explore new applications and develop innovative ways to gain benefits. Farmers integrate ICTs in their lives through a process of appropriation of the technologies.

These four facets along with the corresponding relationships among different agents are examined in detail below:

Figure 2: Conceptual Framework



Source: Understanding gained through literature review

1+2. The design and use of ICT applications to address social needs (farmers' information needs) (A, B & C)

A is the social shaping of technology (Edge, 1995). Like all other technologies, ICTs are designed to cater the needs of particular groups. They are shaped by social forces such as the needs of those who pay for their development, and the assumptions of the technologists who develop them. Most mobile telephony devices and services have been designed to meet the needs of businessmen or teenagers in western cities. This has resulted in designs that are inappropriate for village use. E.g., most mobile 'phones in Bangladesh do not support Bengali, so users are forced to navigate English menus and send text messages in Latin characters. And the one 'phone that uses Bengali comes from West Bengal, a province in India. The word it uses to select an option has a different meaning in Bangladesh. There it means to vote in an election. The problem here is to understand better farmers' needs, before starting to design ICT applications.

While society and technology shape each other, individuals also make use of a technology according to their lifestyle. It is also important to understand the appropriation of technology – how individuals are likely to use technologies and with what (intended or unintended) consequences in different conditions (Wiredu, 2007). To investigate this issue structuration theory and its use in analysing the interaction between human agents and technology can be used. Anthony Giddens' (1984) structuration theory sees the social structure as the result of recursive interaction among the human agents, institutionalized rules and material resources. This theory

has been used in this research to develop an understanding about how human agency (rural farmers) through interaction with material resource (ICT applications) and institutionalized rules (the rural lifestyle in Bangladesh) can confront or overcome the problems pertaining to the existing agricultural system. The use and appropriation of different ICT tools are the results of farmers' ability and intention. Again, the use of those services may facilitate or restrict farmers' action.

3+4. Individual's behavioural intention and use of technology (C, D & E)

Inside ellipse F, we see the cycle through which the farmers appropriate ICTs into their lives. We have taken from the Technology Acceptance Model (TAM) (Davis 1989), the Theory of Reasoned Action (Fishbein and Ajzen, 1975) and the Theory of Planned Behaviour (Ajzen, 1991) their emphasis on perceived usefulness and perceived usability as determinants of the users' behavioural intention to use a technology. Most TAM studies use quantitative tools to find and validate factors determining behavioural intentions. However these take a snapshot of perceptions, and do not allow for changes over time, as people learn to use a technology (increasing perceived usability) and discover new benefits or costs (changing perceived usefulness). Snowden et al (2006) have used action research approach to assess the technology acceptance for m-commerce. They argue that it is equally important to find how practitioners can intervene to positively affect the acceptance and therefore the adoption of new technologies. This is particularly necessary when the potential users are not much aware of the technological applications. That is one of the reasons we have modelled the technology appropriation process as a cycle. As farmers interact with the mobile 'phones and telecentres, they gradually learn how to use these technologies to help their farming, improving subsequent interactions, until they can integrate these new technologies into their lives.

5.0 RESEARCH DESIGN

5.1 Context

The two telecentres:

D-Net partnered with Gandhi Ashram, a local NGO to set up the Pallytathya Kendra (rural information centre) at Joyag, Noakhali, as a part of the Microsoft Unlimited Potential Project. The project is situated at the South East corner of Bangladesh, around 120 miles from the capital city of Dhaka. While the salary of the employee is paid by D-Net, Gandhi Ashram provides the infrastructure and logistic support. According to the Gandhi Ashram authority 90% of the project cost is covered by them, and D-Net pays for the rest.

Grameenphone Community Information Centre (GPCIC) is a joint project initiated by Grameenphone, Katalyst (funded by a donor consortium comprising of SDC, DFID and SIDA) and Grameen Telecom. GPCICs are set up in different corners of the country with an aim to providing internet connectivity and other ICT facilities to rural areas. Unlike, the Pallytathya Kendra, GPCIC is an entrepreneurial project. It is expected that the young entrepreneurs of rural Bangladesh can develop profitable ventures by selling ICT services (i.e. electronic top up of mobile 'phones' credits, photocopy and internet access). Grameenphone provides the GSM/GPRS/EDGE infrastructure and other partnering organizations provide training and content support

for the entrepreneurs. A typical GPCIC hosts a number of ICT tools including computers with internet connectivity through EDGE technology, telephone, photocopier and printer. There are more than 400 GPCICs across the country. We chose the one based in Shaturia Upazila (sub-district) of Manikganj district 40 miles from the capital city of Dhaka. The following table presents features of GPCIC at Shaturia and Pallytathya Kendra at Joyag:

Table-1 The features of GPCIC and Pallytathya Kendra

	GPCIC at Shaturia	Pallytathya Kendra at Joyag
Nature of the location	A semi-urban area	Remote rural area
Sources of finance	Entrepreneur's own investment	Gandhi Ashram Trust and Microsoft
Technical expertise and support	Grameenphone	The trained staff of Pallytathya Kendra takes care of trouble shooting.
Service Offerings	E-mail, web based fax, online chatting, photocopying, electronic top up facilities for mobile phones and computer training.	Computer training and Pallytathya Help Line services (phone based solutions for public health related issues and non farming businesses for rural women).
Duration of operations (till January 2008)	One year	Less than one year (seven months)

5.2 Action Research Stages

An action research with ethnographic approach was used to design the fieldwork. The first author of the paper travelled to Bangladesh to conduct the fieldwork. He worked with both of the projects (GPCIC and Pallytathya Kendra) to implement a planned intervention. The following points were taken into consideration while designing the fieldwork project:

1. We had to implement an intervention to facilitate the farmers' access to the CTC (Pallytathya Kendra) and GPCIC. This was done by providing the small groups of farmers with mobile 'phones so that they could develop an understanding about using the mobile 'phones and also contact the telecentres.
2. The access was community based with a view to enabling farmers to develop networks amongst themselves to meet their information needs.
3. All the farmers in the intervention groups were provided with equal opportunity to get access to the CTC and GPCIC.

In this research the reactions to a planned intervention were monitored and evaluated with the aim of discerning the consequences of the action. From the intervention and subsequent evaluation we have tried to develop an understanding that can resolve some of the present concerns and confusions regarding the usability and effectiveness of the telecentres in the agricultural development.

Planning stage

The bottom-up approach for introducing ICT enabled projects and the appropriation of different ICT tools in accordance with the needs and cultures of rural populace are the major prerequisites for the projects to become effective. Our project carefully took this issue into consideration by devoting considerable efforts to elicit farmers' views and opinions. The initial planning and preparation started from 1st week of January, 2008. The first month was spent mingling with the farmers and learning about their problems. In-depth interviews and focus group discussions (FGD) were conducted to learn about their lifestyles, how they collect agricultural information (i.e. prices and sources about fertilizers), what sort of problems they face while getting such information, how they overcome those problems. Farmers' opinions regarding the use and availability of fertilizers, use of technology in farming and non farming activities were gathered. Their perceptions about the telecentres and mobile telephony were also investigated during this period.

Intervention stage

After the FGDs were completed five groups were formed each comprising five farmers. The groups were formed on the basis of geographic, religious and family connectivity so that the farmers in a particular group could comfortably get along with one another. Each of the groups was given a mobile telephone with connection. The intervention continued for 10 weeks until the end of April. The first author met the groups once in every two weeks. These groups had the opportunity to contact the telecentres as well. Through the use of the mobile telephony the intervention provided the farmers with an opportunity to communicate with the centres without visiting them. The first author visited the farmers and stayed with them for two to three days in every two weeks. The farmers were supported by the representatives of Gandhi Ashram, and GPCIC when the first author was not around.

Reflection stage

Weekly meetings within each group were regularly monitored to find out different aspects of the use of mobile 'phones and the interaction with the telecentres by the farmers. FGDs with farmers' groups and interviews with the individual farmers were conducted. The following issues were examined through the meetings:

- How did they manage to contact the centres?
- How helpful were the centres and the mobile 'phones?
- What did they perceive about the operations of the telecentres?
- How comfortable were they while sharing knowledge and information?
- How comfortable were they when they had interacted within the group and across the groups?
- What were the benefits they have been receiving?
- Whether or not the mobile telephony technology and the CTCs had been helping them to overcome the obstacles to getting information (mentioned during the initial FGD)? If so, how? If no, why?

The first author conducted FGD and in-depth interviews with the group members. The outcome from the discussion with one group was checked with that of the other groups. He author also interviewed the other members of farmers' families, who on

some occasions made more use of the mobile 'phones. This was done to find what makes them want to make use of the mobile 'phones. He took diary notes describing daily lifestyle, practices and culture. Other fieldwork included visiting crop fields to photograph pests, the videoing of the rural environment and the observation of different aspects of farmers' daily activities including how farmers work with the irrigation, how they top up the mobile phones, how they mingle amongst themselves. The video records provide evidence of such things as of lack of space in farmers' houses to keep cattle, shops at the remote villages who top up mobile phones, the rural muddy roads and so forth.

The research processes and methods of operation were fine tuned based on the feedback generated from the meetings and interviews. For example, the farmers remain busy during the day time. After the first week the meeting time was set during the evening.

Analysis stage

The intervention was over by the end of April. The next stage involved transcription of data, from audio and video tapes and field notes, using Transana⁴, computer aided qualitative data analysis software that has been designed to work with video recordings. The diary notes collected from the field were used to assist the interpretation of the data collected from the FGDs and interviews.

We have used the conceptual model (explained above) to pick out examples of findings that illustrate the farmers' perspectives on their information needs and the telecentres.

6.0 EXAMPLE FINDINGS

This section gives examples of some of the findings from this research approach. It is not intended to be a comprehensive evaluation of the two telecentres.

6.1 Needs assessment:

Our research set out to investigate the information needs of the farmer community of Joyag and Shaturia. The following needs have been identified:

1. Information about prices and sources of fertilizers
2. Information about the solution for crop diseases and cultivation methods
3. Output price information

Prices and sources of fertilizers:

In Bangladesh fertilizers are subsidized and the government fixes the price range with a view to preventing price manipulation by dealers. Although the local government and administrators are responsible for monitoring the distribution of fertilizers, we found that the price and availability of fertilizers are still major concerns for farmers. One farmer explained that chemical fertilizer had become increasingly as an input:

"I need to put up to twelve kg fertilizers in my land. We used to use the organic fertilizers in the past days and 5 kg chemical fertilizers were enough."⁵

Another farmer reported problems with the availability of fertilizer and with price inflation:

⁴ <http://www.transana.org/>

⁵ All quotations have been recorded and translated from Bengali by the first author

“No, we do not get it (fertilizer). Even if we get, the price is too high. There is a particular variant of fertilizer, known as red fertilizer, happened to cost us TK⁶12 last year. Now the price of the same fertilizer is TK28-TK30. Now you can imagine how difficult it is for us.”

Farmers believe the local government members and dealers created artificial crises, and that nepotism and corruption worsened them.

Information about the pests, crop diseases and cultivation methods:

In recent times the farmers of Joyag and Shaturia have been facing increasing problems with the pests and plant diseases. They are not very familiar with many of the pests and the plant diseases they come across these days. They attribute the presence of unfamiliar pests to changing weather conditions, the use of hybrid crops and the use of chemical fertilizers.

As far as weather conditions are concerned, during the last few years, nature has behaved in an uncharacteristic manner in Bangladesh. The agricultural system is very much dependent on the weather and the seasons and changes in the climate or seasonal weather can create plant diseases and pest attacks. This year, when the fieldwork was conducted, the winter started in mid-January, a month later than is usually the case. Throughout the month of February, which is normally the beginning of the Bengali spring, it was overcast and quite cold. The farmers believe that this unseasonal weather caused strange plant diseases which they are not familiar with. There were also some strange pests in the field.

“This year we are unable to understand the nature's characters. We are not having any spring this year.”

“We come across new pests. The pests have destroyed the potato field. Even in the corn field there are some strange pests”

In addition to the impact of unseasonal weather, the elderly farmers believe that pest attacks and plant diseases have increased since they started cultivating hybrid crops and using chemical fertilizers.

Most of the farmers are semi-literate or illiterate which limits their access to printed sources of information about farming and cultivation. The Ministry of Agriculture of the Government of Bangladesh employs advisers, known as block supervisors, to help farmers resolve problems that they encounter. There are two block supervisors in each Union Parishad (a unit of local government). Joyag is a Union, while Shaturia is an Upazila – sub-district (consists of nine unions). A typical union consists of fifteen villages with almost 100,000 inhabitants. Almost eighty percent of the families live on agricultural activities in typical Bangladeshi villages. Two block supervisors are inadequate to support farmers of such a vast area. Hence, contacting these block supervisors is a major concern for the farmers.

Output price information:

The structural and financial relationships in agricultural production system (between farmers and landlords, between farmers and brokers and farmers and money lenders) are major impediments for farmers' empowerment and welfare. Farmers often take loans from the solvent people in their area. These people are often their landlords and brokers (who work for the bigger wholesalers) for the yields. These people are also their customers, as they often sell part of their produce to their landlords. Farmers

⁶ TK stands for Taka, Bangladeshi currency. 1US\$= TK 68.80 (on 22nd Sept 2008)

need to borrow money from these individuals for different reasons. At different stages of the cultivation they require hard cash to buy fertilizers, pesticides, to pay off diesel and electricity bills. Particularly by the end of the season they need financial support to pay off all the debts, incurred during different phases of the cultivation. They also need to pay the day labourers that help them during the harvest season.

“They (the brokers) pay us less; often they cheat on us while measuring the crops. Basically at the end of the cultivation season we need hard cash. We need to pay debts; we need to pay labourers. This is why we do not wait for anything. Say even if the normal price of one maund ⁷ of rice is TK500, we often end up getting TK400 per maund due to such pressure”.

If the farmers had not taken any loan from any of their customers, they could have been in a position to sell their produce at the market price. It is often argued that through the use of the ICTs farmers can learn about the wholesale price and thereby can achieve superior position in terms of bargaining power. There is some evidence that this is true for the fishermen and for the vegetable producers. However, it does not appear to be the case for the Bangladeshi rice producers, particularly the sharecroppers for the following reasons:

(i) The traditional trading system Traditionally the brokers of the big wholesalers or millers (who convert the paddy to rice) visit the village farmers. They move around from door to door to buy the produce. As a result often farmers have little chance to verify the price at the local market. However, they normally discuss prices with others in their neighbourhood with a view to making sure they get the going local rate for their produce.

(ii) Risk of keeping the paddy/rice for longer time Farmers are often concerned about keeping the paddy/rice in their possession for longer period because rain water, rats and insects may damage their hard earned harvest. Hence they prefer to sell off the produce as soon as they can.

(iii) Risk of taking the produce to the bazaar Farmers often find it costly to take the produce to the nearest bazaar because of high transportation costs. The financial risk is quite high as well. This is why they prefer to sell it from their door steps.

6.2 Farmers' perceptions about the use of ICT applications in addressing their information needs

Both of the centres were within the first year of their operations when the project was initiated. This was not long enough to make a substantial impact on the lives of many local residents. Farmers, the target users, were yet to embody the use of telecentre services in their daily lives and farming practices. However, it is important that farmers find these centres helpful in resolving their problems. Based on the theories pertaining to the study of technology acceptance we can analyze the two major determinants of behavioural intention in this regard.

Perceived usefulness and perceived ease of use

Farmers need to have the belief (an organized pattern of knowledge) that the centres can satisfy their information needs. In other words, farmers need to believe that the centre is going to be useful for them. It has been observed that the training programmes of the centre are valued by local young population. They consider these training courses will be helpful in enabling them to secure overseas employment. As a

⁷ a local unit of rice, equals to 37 kg approximately

result local teenagers and young adults (many of whose fathers are involved in farming activities) assemble at the centre. One of the trainees told the researchers:

“I came to the centre to learn computer. I believe this learning will be helpful for me in future. I pay TK1200 for the entire course, which is reasonably expensive. But this is worth it.”

The farmers, on the other hand, are not convinced that the centres can be of any use for them. This is why they do not visit the centres. As one of them said:

“What can I do with the computer?”

There seems to be a gap between the information needs of the farmers (as explained above), and what the telecentres provide.

The services farmers receive from the centres need to be easily used. Making something available is not the same as making it usable. The “Jion” package or ruralinfobd.com provides answers many basic agriculture-related questions. However, many farmers do not know how to operate a laptop or how to access the Internet. As Talbot and Newman (1998) explained in the context of community groups learning to use the Internet in Northern Ireland, there are hurdles people have to overcome before they can make effective use of such tools, what they called the “how-to” gap (or effective use). To learn how to use these tools and ruralinfobd.com, they need not only to learn a set of computer literacy skills, but they also need to learn the potential benefits. Otherwise they will not be motivated to visit the centre often enough. Farmers even do not know what computers can do for them. As they registered during the interviews:

“No I have not used the computer at the Gandhi Ashram, because when we are free the office is closed. And we do not have time to go to the Gandhi Ashram and explore the computer.”

“No I do not have any clue about what they (computers at Gandhi Ashram) are for”.

However, some farmers were interested in trying to use electronic communications to help identify pests infecting their crops, as an alternative to trying to get hold of a block supervisor. In Shaturia photographs were taken, and sent over MMS and the Internet to people who might help identify the pests. The local telecentre staff did not have the expertise to identify the pests, nor were the block supervisors able to receive and respond to electronic images. It took two weeks to get a reply from the concerned persons of Katalyst, based in Dhaka. They had to find a specialist to identify the pests. By that time the entire potato field was destroyed. The delay in getting response made the farmers skeptical about the effectiveness and efficiency of the process. Talbot and Newman (1998) explained how it is important to experiment with ways of integrating Internet technologies into people's lives. But not everyone is willing to spend much time experimenting, if they perceive the technology as either difficult to use or useless.

6.3 Social structure and social change

Farmers have their own way to accomplish their tasks. They have been following certain traditions and practices for years. Farmers have their own way to collect information about fertilizers, pesticides and appropriate prices for their produces. Farmers move from one bazaar to another to learn about the prices and sources of fertilizers. We observed that farmers easily accepted the use of the mobile telephony to find fertilizer prices. This was possible, because the traditional process could easily accommodate the use of the technology. Farmers were still contacting the same

people (other farmers or the dealers) about the same issue (prices and sources of fertilizers). Without changing the human agents (farmers and the people they contacted for information) and the nature of communication, a cheaper and easier mechanism could be developed with the help of the technology. As one of the farmers said:

“Yes now I understand. If I go to three different shops it costs me the whole day and can cost me TK 50 for the rickshaw fair. Now I can save this time and TK50 by making three phone calls costing me maximum TK 9.”

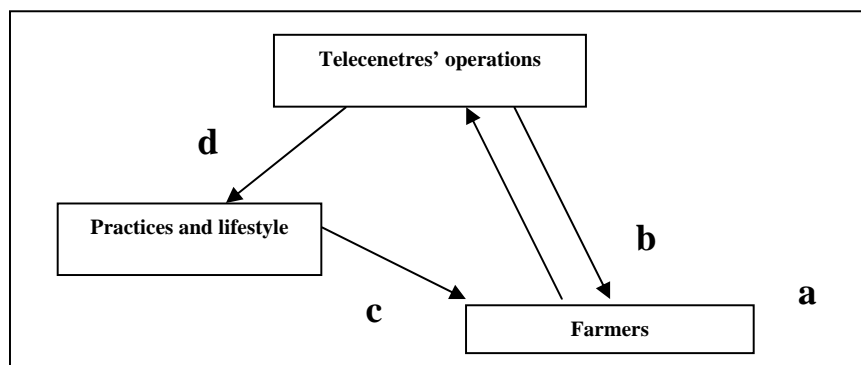
Here we can see that social structure and the use of technology are facilitating each other. The use of the technology gets embodied within the social practice and generates an important and new dimension of its use. This can be attributed as a typical example of the appropriation of the mobile telephony within the social structure of the rural Bangladeshi life.

However, not all the traditions and practices support simple technological substitution. We noticed that normally at first farmers try to solve a problem of their crop (pest attack or disease) with the help of their own experience and knowledge. If they fail to get a solution they then get in touch with their neighbours and other farmers. Getting help from the block supervisors or government officials is not very easy. As some of the farmers argued:

“It is not easy to get hold of them (the block supervisors) first point. We actually try to find the solution by consulting the fellow farmers first before we resort to block supervisor or any other expert persons. We share our experience and thereby try to get the solution.”

As a result even today farmers try different measures to overcome crop diseases or pest attacks until they get the success. In most cases these measures are either learnt from their experiences or suggested by their fellow friends/neighbours. The use of the software package like “Jion” or getting a photograph of the plant/pest and sending it to the nearest telecentre may require a total change of the traditional process. The intervention was not successful in making a drastic change of the lifestyle. A technology needs to be embodied in a set of social institutions to make it work. So, e.g., the use of chipboard requires training courses for carpenters and demonstration factories, otherwise carpenters will use nails or screws, and split the panels. A technology adaptation enables users to get new information through new communication patterns. If the new communication pattern is not preferred by the end users they will not be interested to adapt to the technology.

Figure 3 Telecentres' operations: from social structuration theory



Source: research findings

- a – Farmers’ intention to adopt to telecentre services.
- b – Technology facilitating farmers
- c – Lifestyle and practices influencing farmers to get benefits from the technology
- d – Telecentre changing the practices and lifestyle

The traditional practices and lifestyle influence the interaction between farmers and telecentres’(c) and its impact. Because farmers are tied in the vicious cycle of money lending and sharecropping, there is less chance that the operations of the telecentres can help them to have much of bargaining power to set the farmgate price for their produces. Farmers who live adjacent to the village bazaars are always in touch with the market prices. Hence, their lifestyle and practices do not get much of a value addition through the use of telecentres, as far as getting market price information (for output) is concerned. During the intervention farmers started to collect fertilizer price information or to seek solutions for pest attacks by using the mobile phone and/or by asking the telecentre contact persons. Thereby the operations of the telecentres made a change in the overall practices and lifestyle (d). The factors determining farmers’ behavioural intention, discussed earlier, explain a and b.

7.0 CONCLUSIONS

Based on the conceptual framework (figure-2) and research findings figure-4 can be developed.

1. ICT applications have to meet certain information needs of the target users (i.e. farmers)

Although mobile 'phones are marketing in Bangladesh as supporting the needs of urban people, in our research we discovered three information needs of farmers that potentially could be met using mobile 'phones and telecentres.

1. Sources and prices of inputs including fertilizers are important information needs of Bangladeshi farmers. The fieldwork found that the telecentres did not address this issue, but that simply substituting mobile telephone calls to suppliers into their existing processes worked
2. New crop pests had become a problem due to climate change and new agricultural technology. As a result farmers require solution for the strange pests and plant diseases. Again we found that the telecentres had not yet found quicker and easier way to provide solution for pests and plant diseases. Nor was this just-in-time information need addressed by the existing agricultural extension system (with only 2 extension workers for 10000 people).
3. Although information on crop selling prices in different markets has, in principle, the potential to improve farm income and even cut out middlemen; it was not used by the farmers in this study.

Despite the fact that NGOs concerned had initially correctly identified farmers’ information needs and had pledged to address them, little progress appeared to have been made in delivering them, as neither input or output prices or pest identification services were available at the telecentres.

2. Farmers' use of ICTs is intertwined with social practices and their lifestyle

The use of mobile telephony could only be effective where the technology was consistent with the social processes and farmers' lifestyles. We found that simple changes in the social communication process (i.e. getting information about fertilizer price) have been initiated by the use of mobile 'phones. This was possible without making a revolutionary change in the process or lifestyle. As we noticed farmers were still contacting the same people (fellow farmers and fertilizer traders) to get the same information (about the sources and prices for fertilizer). The use of mobile telephony only changed their mode of communication and saved time and money for them. The technology needs to be embodied within the social process, otherwise will not be effective.

Farmers found the use of mobile telephony less applicable for getting output price information. The use of mobile telephony cannot change the nature of the marketing of agricultural produce (i.e. paddy) at the farmgate level. It is also not possible to eliminate the middlemen. Their role in the process often facilitates the farmers. Through this example, it can be argued that the existing social system and process can inhibit the effective use of a technology.

3. Farmers interact with the ICT applications and they develop perceptions through such engagement:

We found that telecentres and mobile telephony can deliver situationally relevant information. When successful, this improves the farmers' perceptions of usefulness and their intention to use. Some of the farmers were able to get cheaper fertilizers by making phone calls with their mobile 'phones. The experts of Katalyst delivered a solution for the strange pests, found in the potato field of Shaturia, but they failed to deliver it in time to save the crops. The fertilizer example caused farmers to have a positive perception about the use of mobile telephony and the pest issue made the farmers skeptical about the services offered by the GPCIC.

Where the services or information delivered are not seen as relevant to farmers' needs, the reverse happens: they decide not to use the technology or service. For example, many farmers do not intend to visit D-Net's *Pallytathya Kendra*, as they perceive the centre's services are not useful for them: in contrast to the young people who go there to acquire computer skills in the hope of leaving farming for jobs in Dacca or the Middle East.

4. Technology appropriation is a dynamic process

The farmers studied did not immediately start using the mobile 'phones and telecentres to acquire agricultural information. At the beginning they were aware only of simple communication uses, such as calling their family members in cities, or the seasonal workers who come from NW Bangladesh to work on their farms at harvest time. During the research period, particular farmers discovered new uses and told the other 4 farmers in the village about their experiences. Farmers' use and appropriation of ICTs require a long process which will gradually enable them to explore new dimensions of use.

By achieving a command over the use of the technology farmers can integrate the same in their life. We are just starting to analyze our data on how farmers learned to handle the mobile 'phone handsets. This was also a dynamic process, with perceived

usability increasing over the 10 weeks (e.g., as farmers using a Bengali language 'phone learned that the word used in Bangladesh for voting in an election means 'select an option' in Calcutta).

Farmers have also widely used the older versions of ICTs including radio and television to get agricultural information (i.e weather and cultivation methods). Once they integrate the technology with their life they get more confident with the use and can optimize the benefits. Thereby farmers' positive perception about its use gets reinforced.

Synthesis

If an ICT or its application is to be effective, the target users need to find it useful and easy to access and explore. Computers and Internet do not make sense to the farmers unless they generate substantial benefits for them. Even if an application is extremely innovative from a designer's perspective, it will not be adopted if the target users find it hard to use and the benefits generated are outweighed by the difficulties of access. ICT applications need to be embedded within the social settings and lifestyles. Once target users can integrate the technology as a part of their day to day life, the perceived benefits are likely to be greater and the perceived costs are likely to be less.

It is worth returning to the distinction Jacques Ellul (1965) made between embodied and disembodied technologies. A machine or tool, on its own, is a disembodied technology. For a society or individual to benefit from the technology, it needs to be embodied within a set of social institutions. In Bangladesh, as in much of the developing world, there exist social institutions to support mobile telephone technology, from handset suppliers and network operators to the village 'phone women and teashops that will charge your 'phone.

But there are few social institutions in Bangladesh to support the use of ICT in agricultural information. Traditional approaches to agricultural extension rely on imparting information on common issues, through meetings, training courses, or the CDROMs covering common diseases found in the telecentres. They cannot handle the just-in-time information requests a farmer can make with a 'phone call or text message. Now that it is possible to photograph an insect on a phone, and MMS it to someone, where are the institutions to quickly solve the farmer's problems? Perhaps developing countries should set up agricultural information call centres, rather than just answering calls for Europe and the USA.

On pricing information, there are text message services in countries like Kenya that can inform farmers of the best input and output prices. But on output prices, selling rice is embedded in traditional social institutions that encourage selling to the same buyer at his set price: from personal relationships embedded in social status, to the economic straitjackets of sharecropping or loan agreements. It is not the technology alone that is going to change the relationships between farmers and middlemen.

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