

CAPTURING THE GAINS



*economic and social upgrading
in global production networks*

**Capabilities, costs, networks and
innovations: impact of mobile phones in
rural India**

¹Institute for Human Development, New
Delhi, India

Email: bsm_ihd@yahoo.com

Balwant Singh Mehta¹

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Abstract

India did not participate in the landline phone revolution but has seen an unprecedented growth in mobile phones, with over 919 million subscribers by the end of March 2012, making it second only to China in this sphere. The tele-density in rural India, where nearly 69 percent of the total population lives, grew from below 1 percent in 2000 to around 40 percent in 2012. In these areas, people face several developmental constraints, such as low literacy, poor healthcare facilities, low per capita income, a high degree of poverty and problems related to poor infrastructure. Mobile phones can facilitate need-based and user-centric information and services at a cost that is affordable to India's rural population, which was hitherto unreachable.

Given this context, this study explores the socioeconomic impact of mobile phone usage in rural areas on the basis of a field survey conducted in two states of India: Punjab – a relatively developed state – and Bihar – a relatively underdeveloped state. The field survey revealed that mobile phones helped users gather information for both agricultural and non-agricultural purposes, as well as enabling them to keep in touch with their relatives and migrant family members. Mobile users benefit by obtaining timely information on a variety of subjects, including on employment opportunities and higher education for their children, by transferring funds and even by calling family members during emergencies. However, there is a marked difference in the usage of mobile phones among those in Punjab compared with those in Bihar. In developed areas, people were found to be early users of new technologies, reflected also in high usage of mobile value-added services (MVAS) and innovative uses like money transfer and agricultural information in Punjab.

Meanwhile, a major and somewhat neglected dimension of mobile phone usage is that making communication substantially cheaper promotes social interaction. Multi-locational households with at least one migrant worker are increasing in numbers. Cheap mobile phones help such households keep in touch and remit money. Social relations can also cross traditional boundaries. The study also reveals that there are many innovations in the use of mobile phones, often carried out by users of different kinds, pointing to the importance of users in innovation processes.

Keywords: Mobile phones, rural usage, information and knowledge, networking, innovation by users

Author

Balwant Singh Mehta is Associate Fellow, Institute for Human Development, New Delhi, and Research Scholar, CJNS, JMI, New Delhi, India.

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Abbreviations

ANSISS	A.N. Sinha Institute of Social Sciences
APL	Above Poverty Line
ATM	Automatic Teller Machine
BPL	Below the Poverty Line
CPRC	Chronic Poverty Research Centre
CtG	Capturing the Gains
DFID	Department for International Development
ESRC	Economic and Social Research Council
GPN	Global Production Network
ICT	Information Communication and Technology
ICT4D	Information Communication and Technology for Development
IHD	Institute for Human Development
ILO	International Labour Organization
M4D	Mobile for Development
MMS	Multimedia Message Service
MVAS	Mobile Value Added Services
PDS	Public Distribution System
OBCs	Other Backward Caste, usually intermediate castes
SCs	Scheduled Castes, also called <i>dalit</i> , the former untouchable castes
SCI	Sustainable Consumption Institute
SMS	Short Message Service
STs	Scheduled Tribes, internationally called indigenous peoples
TRAI	Telecom Regulatory Authority of India
UK	United Kingdom

Introduction¹

This study of mobile phone usage, along with similar studies of mobile phone usage in Kenya and Uganda, was undertaken as part of the Capturing the Gains (CtG) research project. These studies of mobile phone usage are different from the usual global production network (GPN) analysis. They do not study the production process or chain, as usually understood. In the usual understanding, production starts with raw materials and ends with the finished product, at best carrying it forward to marketing and reaching the consumer. The consumer then uses the product.

A more complete and complex understanding of the economic process of production would not end with the consumer. The consumer not only acquires the product but also uses it. The ways of using a product are not entirely defined by the product that the consumer acquires. The consumer may use it in ways that are not, in fact, defined in the original conception of the product. This would mean that the meaning of the product or service, as in the case of the mobile phone service, would change with its use, implying that the consumer has a role in making the product or service what it is. The role of consumers, not just as passive recipients of products but also as active participants in production, is increasingly being recognized in the literature on innovation, in analysing the role of the lead consumer in making and innovating products (see von Hippel 2005).

It was with such an approach to extending the boundaries of GPN analysis that CtG supported the studies of mobile phone usage in India, Kenya and Uganda. This is a preliminary attempt to see how to extend the conventional boundaries of GPN analysis in order to bring in end uses, which are value-adding. In a more conventional manner, it was decided to study end uses of mobile phones and their impacts. Thus, there are two parts to the paper. One is the analysis of end uses and their development impacts in rural India; the other is a brief account of the innovative uses of mobile phones revealed during the field study.

The bulk of the paper seeks to investigate the ways in which mobile phones are a link in the development process (Hudson 1995) in rural India. After summarizing the context of the recent mobile phone revolution in India, the paper briefly reviews some of the studies on the impact of mobile phone usage. This is followed by an extended discussion on the findings of field studies in the states of Bihar and Punjab. The impacts of mobile phone usage are seen in the areas of developing capabilities, including the acquisition of knowledge and information and the results of such capability development on productivity, market functioning and incomes of small producers and wage workers. In various places, the different ways in which women and men use or relate to mobile phones are brought out. A brief concluding section summarizes the manner in which the use of mobile phones impacts on various aspects of development and teases out a few points about users and consumers in GPN analysis. In a sense, the study of impact on developments is a preliminary step in investigating the various value-adding activities based on the mobile phone.

Mobile phones in India

India did not participate in the landline phone revolution but has seen unprecedented growth in mobile phones, with over 919 million subscribers by the end of March 2012, making it second only to China. The tele-density (number of phones per 100 people) has grown over six-fold during the past six years, going up from about 13 percent in March 2006 to over 75 percent currently. Mobile usage, which was restricted to urban areas a few years ago, has started penetrating the rural

¹The Introduction was written by the coordinator of this study, Dev Nathan. Its purpose is to place the study in the context of global production network analysis.

areas of the country at a good pace. Rural tele-density has grown at an impressive rate, rising from 1.9 percent in 2005 to over 38 percent by March 2012 (TRAI 2012).

According to the Indian Census of 2011, 69 percent of the total Indian population lives in rural areas. People in these areas face several developmental challenges, such as low literacy, poor healthcare facilities, low per capita income, a high degree of poverty and poor infrastructure. In recent years, the mobile phone has emerged as an important development tool (Islam 2011). It is seen as a device that has the potential to break the rural–urban developmental gap by delivering information on a variety of economic and social issues (Aker and Mbiti 2010). Mobile phones can facilitate need-based and user-centric information and services at an affordable cost to India's rural population, which was hitherto unreachable.

Given this context, there is an urgent need to explore the socioeconomic impact of mobile phone usage in rural India. This study will help us understand mobile phone usage patterns, their socioeconomic impact and the challenges faced in rural areas. It will also help policymakers, mobile phone operators, researchers and technology transfer specialists frame developmental strategies in the future.

Objective and research questions

The primary objective of the study is to explore the socioeconomic impact of mobile phone usage in rural areas. Mobile phones, unlike traditional landlines, carry not only voice but also text and data communications. Thus, mobile phones enable not only person-to-person voice communication, but also access to information and knowledge. Mobile phones can have an impact on socioeconomic development through cheapening the cost not only of communication but also of access to information and knowledge.

The impacts can be divided into two broad areas – capabilities and networking. Capabilities may be in direct production or social spheres, such as education and health. The basic manner in which mobile phones impact on capabilities is through increasing or making cheaper access to knowledge and information. Knowledge could be that of improved production methods, for example identification of pests and the corresponding pesticides to be used, and their correct doses. Such knowledge of different production systems, whether in crop production or livestock rearing, can help farmers increase productivity. Access to and use of knowledge in various types of production can be made available through the mobile phone, through contacting various agencies, and can result in increased productivity (Meera et al. 2006; Reddy, 2004).

Besides knowledge of production and related matters, there is also access to information, particularly that on market prices. Small producers, whether fishers or farmers, are unable to secure price information from the various markets in which they could sell their products. This results in income losses, which basically owe to asymmetric access to information – wholesaled traders know prices in various markets and can enter into price arbitrage operations, whereas small producers have to limit themselves to possibly lower price realization in neighbourhood markets. Mobile phones, by enabling small producers to access price information in different markets, can increase the incomes realized by fishers (Abraham 2006; Jensen, 2007). This is not a physical productivity enhancement, but for the small producer it is as good as that, since the income realized per unit would go up. There could be other income-enhancing effects of cheaper access to information through mobile phones (Meera et al. 2006; Mittal et al. 2010; Reddy, 2004).

Greater access to knowledge could also have impacts on education and health outcomes. The ability to access material on the internet, or even directly by contacting health professionals, could improve health outcomes, for example.

Besides making access to knowledge and information cheaper, one more area in which mobile phones have an impact is that of networking. Networking has both economic and social aspects to it. An economic network could reduce the role of intermediaries and directly link buyers and sellers, or professionals and lay persons. The benefits of these networks are often covered under the term 'social capital'. Dense, multidimensional networks increase social capital, allowing for, in the original Putman (1993) analysis, better development prospects.

Social networks are at least those of the ubiquitous multi-locational families, where members of even the nuclear family live and work in different locations. Mobile phones, by reducing the cost of communications, could help increase emotional and social contact. A look at the literature on the impact of mobile phones (Abraham 2006; Jensen, 2007; Meera et al. 2006; Mittal et al. 2010; Reddy, 2004) shows that the social network dimension of mobile phones is quite neglected.

Based on the above approach, this study was conducted on the basis of the following research questions:

1. What kind of agriculture-related information is available to farmers through mobile phones?
2. How can mobile phones increase trading and income opportunities in the area of agricultural and allied activities?
3. What is the impact of mobile phone usage on labour market participation?
4. How can mobile phones help enhance life skills like education, health and credit information for the rural populace?
5. Would mobile phones help enhance social networking and the security of a vulnerable section of people like senior citizens and women?
6. What types of innovative practices were devised by service providers and end users?

Research methodology

Data collection

This study is based on both primary and secondary sources. The primary data were collected through surveys by using a structured household questionnaire and case studies. The secondary data were collected mostly from government departments and websites of the mobile companies, among other sources. In addition, discussions were held with various stakeholders such as mobile phone service providers and local vendors.

Area and sample

A primary survey was conducted in two states of India, namely, Punjab – a relatively developed state – and Bihar – a relatively underdeveloped state. Those in the developed areas are early users of technology as compared with those in the underdeveloped areas (Aker and Mbiti 2010). It was also assumed that the pattern of mobile phone usage might not vary much among different socioeconomic groups in a developed areas compared with an underdeveloped one. Therefore, it was decided that the study of these two areas using a sample survey method in Bihar and a case studies approach in Punjab would help in understanding the difference in mobile usage patterns between early and late users.

In Punjab, Fatehgarh Sahib, a well-developed district with the highest average wheat productivity in India, was chosen for the study. Six villages, namely, Sohavi, Mullanpur, Kheri, Naudhsingh, Pholwal and Hargan, were covered in the state, with four cases from each village representing different socioeconomic groups. The subjects of the selected case studies varied from poor to wealthy persons involved in agriculture (farming and allied activities), traders, women, casual labourers and others. Stakeholders like middlemen (traders or contractors), rural resource persons, government officials and experts were also interviewed.

The Institute for Human Development (IHD), New Delhi, conducted a large-scale survey covering 898 households across seven districts in Bihar, namely, Nalanda, Rohtas, Gopalganj, Gaya, Madhubani, Purnea and Araria by using stratified random sample in 2009-2010². The IHD conducted a repeat survey of the same households in 2011, out of which 418 people with mobile phones were interviewed in this study.

The study was conducted during the period January-February 2011 in Punjab and the period April-July 2011 in Bihar.

Why was a household survey done in Bihar and just some case studies in Punjab? Initially, the idea was to conduct case studies in both locations, and the Punjab study was done first. But later on, as IHD was conducting a large-scale household sample study in Bihar, it was decided that it was more feasible to administer a separate questionnaire on the use of mobile phones.

Data analysis

A structured questionnaire was prepared for the survey in Bihar, which included one section on demography and ownership of and access to mobile phones. The second section pertained to the usage of mobile phones, with major sub-sections on activities, information sources and the benefits or impact of their usage. The third section focused on innovative uses of mobile phones and challenges faced with respect to their usage. A similar approach was employed during focus group discussions and case studies used for conducting detailed investigations in Punjab.

Study framework

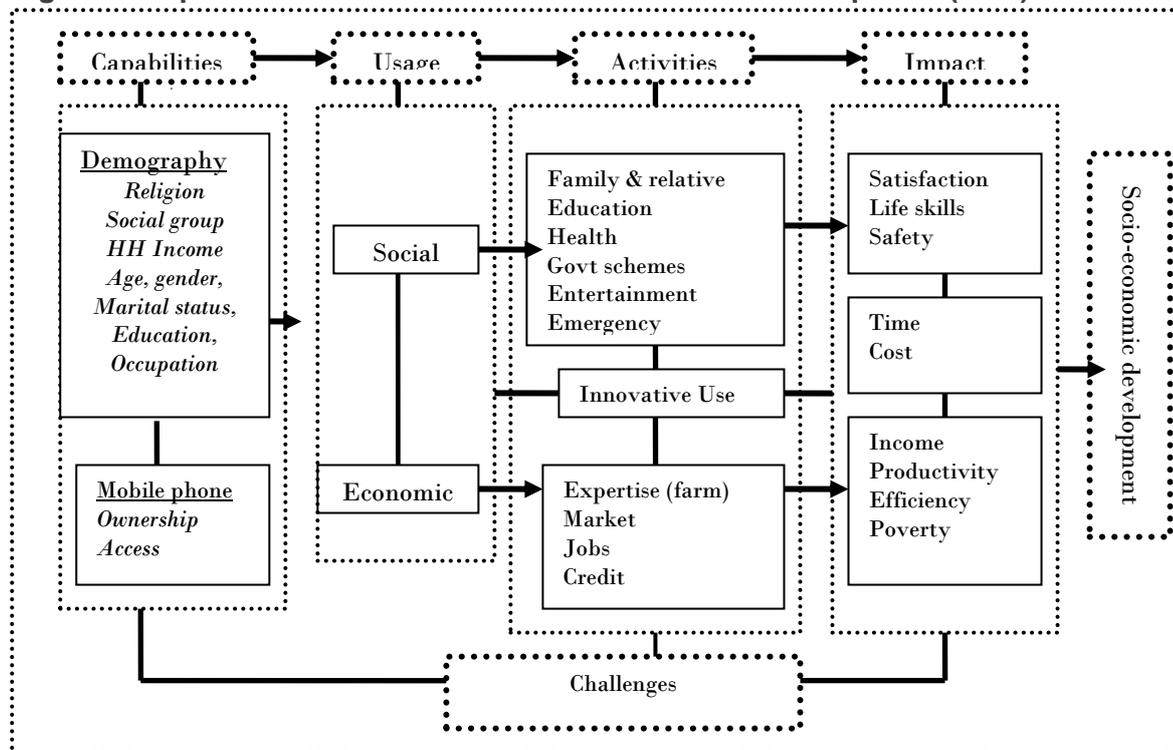
A number of evaluation frameworks have been employed in Information and Communication Technology for Development (ICT4D) studies (Alampay 2006; Heeks 2002, 2010; Islam 2011; Lee and Chib 2008; Qureshi 2005). However, these have lacked a holistic impact evaluation framework, especially when it comes to general and mobile services (m-services). ICT4D was built on the notion that the use of ICT motivates human, social and economic development (Qureshi 2005). Mobile phones are now considered an essential part of people's lives around the world. Used in its simplest form, this technology could greatly help developing countries like India in bringing rural and urban areas together.

This study employs Qureshi's Modified Framework to assess the socioeconomic impact of m-services. Capability plays an important role in ownership and access to any technology (Alampay 2006; Sen 2005). These capabilities can be physical as well as environmental. Environmental capabilities include socioeconomic indicators like household income, religion, social group, occupation, gender, age and literacy level, among others. Physical capabilities include ownership of and access to technology, that is, the mobile phone in this case. Usage of technology (the mobile phone) differs according to one's needs.

² Details of the sample are given in Annex 2.

In rural areas, usage of mobile phones can be divided broadly into two categories: social and economic purposes. Mobile phone usage can help improve the economic status of the rural populace by providing timely information on farming, jobs or the labour market, trading and credit. In addition, usage of mobile phones can help improve life skills and social capital by providing timely information on healthcare, education, government schemes, family and friends. Stakeholders in rural and underdeveloped areas have been known to devise innovative ways of using technology for their development.

Figure 1: Impact evaluation framework for mobile for development (M4D) services



Source: Modified from Qureshi (2005).

Thus, mobile phone usage can aid the process of socioeconomic development in rural areas by bringing about an increase in per capita income and life skills and by facilitating poverty reduction. The adoption of this technology faces several challenges, however, such as the prevalence of illiteracy, power shortages, lack of trust and the high cost of smart phones (Mehta 2010).

In view of the above objective and the evaluation framework, certain variables were selected and a questionnaire was prepared. The following sections analyse the survey results and case studies.

Findings

Socioeconomic profile of mobile users

In Bihar, 418 mobile phone users were interviewed out of 898 households from the IHD survey conducted in 7 districts across the state. Table 1 shows the profile of these users on the basis of their religion, caste and economic background. A majority of the interviewees from Bihar were Hindus (91.38 percent). The distribution of social groups³ shows that 41.72 percent of them belonged to Other Backward Castes (OBCs) followed by the General Caste (33.33 percent)

³Social groups are classified into four groups, Scheduled Castes (SCs)/Scheduled Tribes (STs), Muslims, Other Backward Caste (OBCs) and General Caste. These groups largely show the socioeconomic hierarchy in India: SCs/STs represent the lower and General Caste the upper strata.

category. According to the data obtained from ration cards,⁴ around 28 percent of respondents belonged to Below the Poverty Line (BPL) families and 16 percent were from very poor families.

Table 1: Religion, caste and economic status of mobile phone users in Bihar (N=418)

Criterion	Sub-group	%
Religion	Hindu	91.38
	Muslim	8.62
Social groups	SC/ST	16.32
	OBC	41.72
	Muslim	8.62
	General	33.33
Economic status	Very poor	15.62
	BPL	28.21
	Above Poverty Line (APL)	56.18
Total		100.00

Source: Field survey.

Around 60 percent of respondents belonged to households with migrants⁵ and more than 80 percent to households comprising marginal landholders and the landless. This corroborates the findings of previous studies (Aker and Mbiti 2010), which also showed that people from the upper socioeconomic strata were early users of mobile phones, except respondents from the families of migrants and marginal landholders, who were also included in our study (see Table 2).

Currently, a large number of marginal landholders and landless families are residing in rural Bihar (Rodgers 2012). The members of such families migrate because of poor economic conditions and lack of jobs or income opportunities in their native towns. Therefore, the incidence of out-migration is very high in rural Bihar. The members of these migrant families remain in touch with each other through the mobile phone. According to the IHD survey in 2009-2010, there was a higher percentage of mobile phone users among migrant households (65 percent) as compared with other households (48 percent).

Table 2: Migration and landholding status of mobile phone users in Bihar (N=418)

Criterion	Sub-group	%
Residential Status	Household without any migrant(s)	59.67
	Household with migrant(s)	40.33
Landholding	Landless	34.73
	Marginal	47.32
	Small	10.49
	Medium	4.90
	Big	2.56
Total		100.00

Note: Four major categories of landholding are marginal (below 1 ha), small (1-2 ha), medium (2-10 ha) and large/big (10ha and above).

Source: Field survey.

The individual characteristics of respondents show that a little more than one-fourth were female. These were predominantly middle-aged (between 30 and 59 years of age), married and literate.

⁴ Economic status is defined on the basis of ration cards, provided under the Public Distribution System (PDS). Depending on their economic condition, people can purchase essential items such as kerosene, sugar and food grains at low cost if they carry these cards. Three types of cards are available: Antyodaya Ration Cards, which are issued to the poorest households, BPL Cards for BPL households and APL Cards for APL households. Accordingly, households are classified as very poor, BPL and APL.

⁵ At least one member of the household is a migrant.

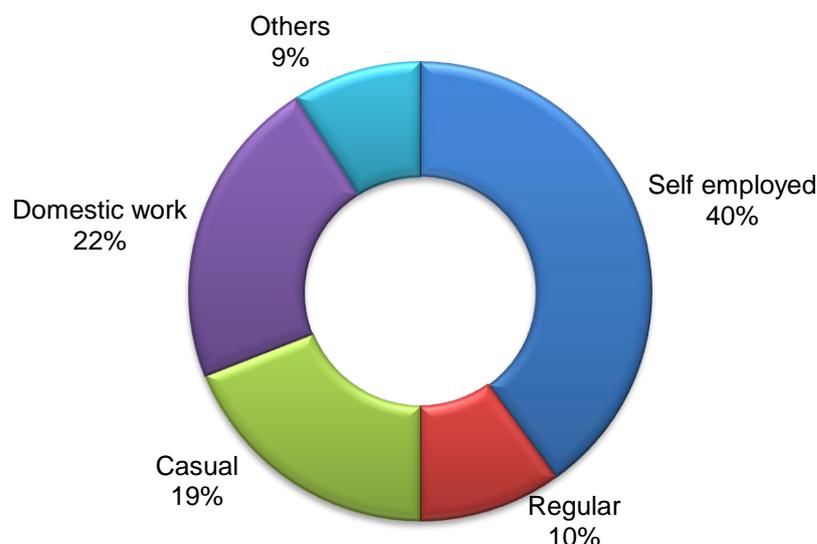
Table 3: Gender, marital status, age group and educational status of mobile phone users in Bihar (N=418)

Criterion	Sub-group	%
Gender	Male	71.79
	Female	28.21
Marital status	Unmarried	4.66
	Married	86.95
	Widow/widower	8.39
Age group	15-29	16.32
	30-59	65.27
	59+	18.41
Educational status	Illiterate	6.06
	Below primary	37.06
	Secondary and higher secondary	38.46
	Graduate	18.41
	Total	100

Source: Field survey.

More than one-third of the respondents were self-employed and engaged in the farming and non-farming sectors, reflecting dependence on agriculture and small trading activities for their livelihood. A substantial proportion of the respondents (22 percent) were involved in household activities, particularly women, who took care of domestic chores like preparing food, washing utensils and taking care of the children and elderly members of the family. Regular and casual workers constituted one-tenth and one-fifth of the respondents, respectively.

Figure 2: Occupational profile of mobile phone users in Bihar



Source: Field survey.

The individual characteristics of the mobile phone users surveyed show that the early mobile users in the underdeveloped areas belonged to the dominant social class. This mainly included respondents who were male, literate, working and married, and young to middle-aged people.

Mobile phone ownership and access

According to the study, most respondents owned mobile phone sets (92 percent), and 6 out of 10 had purchased them. The rest had got them from their family members, primarily their children and parents. This phenomenon was observed to be higher among women, who had got their mobile phone sets from their spouses and parents. Those who did not have mobile phones used devices belonging to their neighbours, relatives/friends and family members.

Table 4: Mobile phone ownership and access pattern of mobile phone users in Bihar (%)

Access to mobile	User category	Male	Female	Total
Purchased	Self	61.75	49.55	58.33
	Parents	4.56	10.81	6.31
	Brother/sister	2.81	0.00	2.02
	Spouse	4.91	14.41	7.58
	Son/daughter	22.81	21.62	22.47
	Relatives	3.16	3.60	3.28
If no, access	Family members	16.67	0.00	11.76
	Relatives/friends	16.67	30.00	20.59
	Co-workers	8.33	0.00	5.88
	Neighbours	58.33	70.00	61.76
Total	%	100.00	100.00	100.00
	N	300	118	418

Source: Field survey.

Differences were also found in the average number of outgoing and incoming calls per week. The average number of outgoing calls was lower when compared with the average number of incoming calls per week. This is because a substantial number of people in rural areas use their mobile phones only to receive calls from their migrant family members. A missed call to their migrant family members was used as a signal to ask them to return the call. The average expenditure per month on mobile phones by males was higher as compared with that by the female population. As mentioned earlier, women kept mobile phones largely to receive calls from their family members.

Table 5: Frequency of use and expenditure by mobile phone users in Bihar

Call patterns	Male	Female	Total
Outgoing per week (N.)	29	25	27
Incoming per week (N.)	35	30	34
Monthly expense (Rs.)	176	152	169

Source: Field survey.

Further, the low tele-density (17.95 percent) in the surveyed areas clearly showed a low level of mobile penetration in rural Bihar.

No significant differences were found between the respondent profiles of Bihar and Punjab except for the mobile phone ownership pattern. In Punjab, mobile phones were mainly owned by male family members, the household head or children, with a few exceptions. They were owned by women only in those households where the male members had out-migrated or in well-off households. It was observed that, in poor households, only male members went out of their villages to nearby places for work. On the other hand, the women of these families were largely involved in domestic chores (cleaning utensils, washing clothes, sweeping etc.) or were a part of the affluent families of the village. Thus, the overall ownership of mobile phones among men was found to be higher than among women. Female respondents restricted themselves to using the phone of their spouse or their children's phone when the need arose.

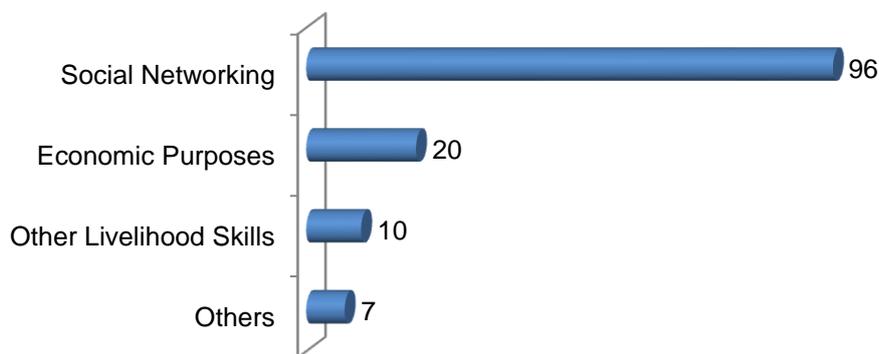
Usage of mobile phone

Type of uses

The survey results in Bihar show that almost every single respondent used the mobile phone for keeping in touch with friends and family members (social networking). Around one-fifth of respondents were found to be using mobile phones for economic purposes like securing information on agriculture, employment, trading and credit. One-tenth of respondents mentioned

that they used mobile phones for improving their livelihood skills through education and securing information on healthcare. Around 7 percent of respondents revealed that they used mobile phones for entertainment and for contacting others during emergencies.

Figure 3: Type of mobile phone usage in Bihar (%)



Note: Multiple answers.

Source: Field survey.

On the other hand, use of mobile phones for economic activity and enhancement of livelihood skills was substantially higher in Punjab than in Bihar. The application of mobile value added services (MVAS)⁶ in Punjab was also high. However, the use of mobile phones for social networking and entertainment purposes was quite similar in both states. The following sections draw on the survey findings from Bihar and Punjab to indicate the usage of mobile phones for different purposes in the two states.

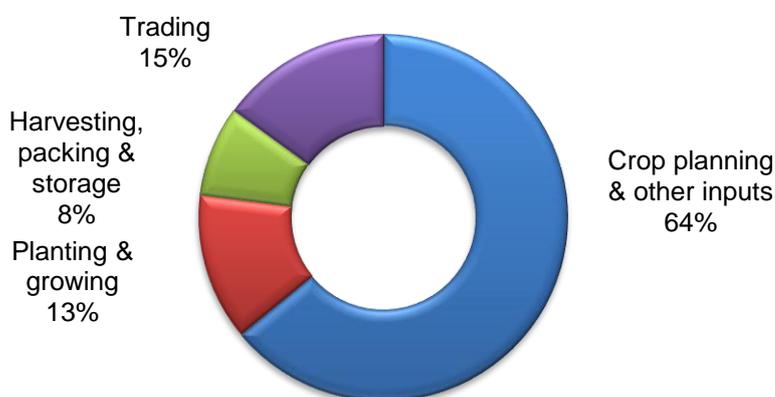
Use of mobile phones in agriculture and allied industries

Respondents involved in farming activities collected information at various stages of the agricultural cycle, and for vegetable and dairy farming purposes, through their mobile phones.

Agriculture

In Bihar, as mentioned earlier, only one-tenth of respondents collected information on agriculture through their mobile phones, mainly on seeds and fertilizers, that is, information pertaining to the initial stages of cultivation. Further, about one-tenth of the respondents said they collected information pertaining to the growing, harvesting and trading stages.

Figure 4: Usage of mobile phones in the agriculture cycle (%)

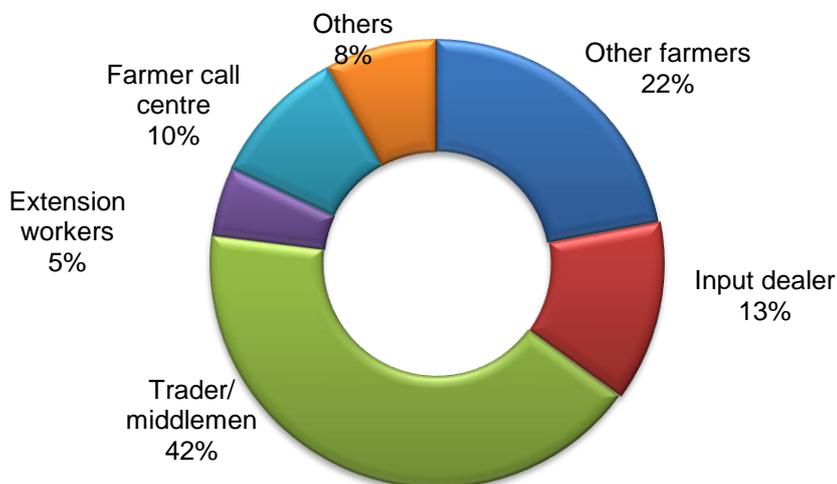


⁶MVAS include SMS, internet use, downloading of music and ring tones, among other things.

Source: Field survey.

The major sources of information in Bihar were traders/middlemen, other farmers and input dealers. Some of them also contacted the State Farmer Call Centre directly to receive important information.

Figure 5: Information sources (%)



Source: Field survey.

In Punjab, a higher percentage of respondents used their mobile phones to receive information on agriculture. Mobile phones assumed greater importance during the initial phase of farming when farmers contacted dealers and colleagues to make enquiries about high-yielding varieties of seeds and fertilisers, among other things. During the initial and middle phases of the agricultural cycle, the big landholding farmers not only contacted other farmers but also called up agricultural universities, government officials and dealers to get information, as can be observed from the following statements:

‘I call other knowledgeable farmers and dealers for soliciting information on the high-yielding varieties of seeds, fertilizers and pesticides’ (farmer in Punjab).

‘I directly contact the Agriculture University in Hisar, Haryana, for information on new varieties of seeds pesticides and sprays’ (big landholder in Punjab).

‘I talk to the officials at the Agricultural University when I need any information related to my crops’ (big landholder in Punjab).

During the growing or the middle phases of the agricultural cycle, farmers were found to collect information on pesticides and crop diseases, and on removing weeds growing alongside the crops.

‘During the crop-growing season, I enquire about diseases in crops and available pesticide remedies in the market from other farmers and traders’ (farmer in Punjab).

It was found that, while harvesting agricultural crops, farmers in Punjab contacted casual labourers directly and also called contractors, who provide casual labourers. Farmers also coordinated with traders through their mobile phones for the sale of their agriculture produce at *mandis*(wholesale markets)at appropriate prices.

'I use my mobile phone for all business purposes and I also sell my produce directly to the cooperative' (farmer in Punjab).

'I usually sell my produce to traders, whom I contact over the phone. My income has grown, thanks to better connectivity with traders, farmers and dealers, which has resulted in higher productivity ultimately' (big landholder in Punjab).

A large number of farmers in Bihar are marginal and small landholders (Rodgers 2012). They mostly sell their produce to middlemen, who buy the produce from the villages. Very few of them directly go to the *mandi*.

A majority of the small and medium landholding farmers in Punjab sell their produce through local traders, as they take cash advances for farming. This cash advance can be procured easily from the local traders, leading to a symbiotic relationship between the two. The farmers can obtain credit from the traders when required, whereas the latter receive commissions from cooperative societies for selling the farmers' produce while also securing the money back with interest. The traders also call up the farmers regularly regarding payments for their produce and loan repayment. The post-harvest period is a busy time for farmers in terms of selling their produce and loan repayment. Hence, the use of mobile phones during this season was reported to be very high.

However, big farmers reportedly sold their produce directly to the cooperative societies or *mandis* without the involvement of any middlemen. During the course of selling produce and obtaining other information, they benefited a great deal from the information obtained through their phones.

'I enquire about the rates in the market and then sell the produce directly. I also get money when people call me to rent harvesters. My income has increased, thanks to the knowledge of prices, renting out harvesters, with operators, and vegetable sales owing to better information flow' (big farmer in Punjab).

Those found to use mobile phones for farming purposes in Bihar, though small in number, reported that they had saved time, improved farming techniques, reduced production costs and struck better bargains with middlemen and traders, all of which resulted in their garnering higher profits.

Table 6: Benefits in the agriculture cycle by use of mobile phone in Bihar

Benefits	No.	%
Reduction in tractor cost	4	12.5
Higher productivity	2	6.3
Saving of time	20	62.5
Improved farming practice	4	12.5
Timely decision	2	6.3
Total	32	100.0

Source: Field study.

In Punjab, farmers noted an increase in their incomes, with more business opportunities and savings in transport costs and search costs owing to mobile phone usage.

'The mobile phone has reduced my transport costs because I can now communicate with other people over the phone and get information regarding prices at the market. Otherwise, I

would have to spend Rs. 50 for one trip, which I now use for other purposes. Prior to mobile phone coverage, we used to travel to the *mandi* (farmer in Punjab).

Mobile phones and vegetable farming

Mobile phones have also helped a great deal in increasing both productivity and income in the field of vegetable farming in rural Bihar. Vegetable-growing farmers in Bihar sell their vegetables at the local market situated within a radius of 10-15 km from the villages. They enquire about the prices of vegetables from other markets situated in a radius of around 100-200 km through their mobile phones and accordingly decide the appropriate sale price of their vegetables at the local market. This has helped them secure better prices, reduce wastage, provide timely service and ensure easier access to buyers.

Table 7: Benefit in vegetable selling by mobile phone use in Bihar

Benefits	No.	%
Reduction in wastage	5	12.5
Availability of additional time to provide services	5	12.5
Reduction in procurement cost	10	25.0
Higher returns	15	37.5
Access to buyers	5	12.5
Total	40	100.0

Source: Field study.

Mobile phone usage was also found to be high in the relatively larger sector of vegetable farming in Punjab. It was found that small vegetable-growing farmers go to the *mandi* directly on two-wheelers to sell their produce there or sell it on their own. Medium and big landholding farmers, on the other hand, enquire about market rates at different places through their mobile phones before collecting and loading their produce onto tractor trolleys or jeeps on a daily basis. This helps them get better prices and ensure the vegetables remain fresh and unspoilt.

‘I sell vegetables in the market myself. As I proceed to the *mandi* for selling my vegetables, I call the *mandi* and enquire about the rates. Only then do I decide to collect the produce and sell it. The latest information on the market rates is just a call away, which has also led to a growth of income. This way, my produce doesn’t get spoilt as I collect it only when I am sure of selling it’ (vegetable-growing farmer in Punjab).

‘Because of mobile connectivity, I now receive specific orders for vegetables from people living in my village, which has contributed to a growth in my income’ (vegetable seller in Punjab).

There are small vegetable sellers who buy vegetables from the *mandi* and sell them at a place near their village or within the village itself at a marginally higher price than in the *mandi*. There are also a few vegetable vendors who sell vegetables on demand to many villages on their horse carts. Earlier, carts filled with vegetables were taken all around these areas. Now, people call these vendors on their mobiles and demand specific vegetables. This reduces spoilage, as the vendors procure and transport only what the customers want.

Vegetable-growing farmers in Punjab reported an increase in their customer base, savings on transportation and reduction in spoilage, resulting in higher profit through usage of mobile phones.

Use of mobile phones for dairy farming

Mobile phone use in dairy farming was not common in Bihar, as respondents revealed that they sold milk only locally to their regular customers within the villages or to consumers in nearby places. On the other hand, most dairy farmers in Punjab sell milk to cooperatives and regular customers in the village. Some of the farmers in both the states, however, reported using the mobile phone to contact veterinary doctors rather than making personal visits. Mobile phones were also used to receive information on the market rate for the sale and purchase of cattle.

'I call the veterinary doctor from my mobile. Earlier, I used to go to the town to personally visit him. Sometimes I sell and purchase cattle after calling the market to know the current rates. I am able to negotiate better prices in livestock trading owing to mobile connectivity. Apart from regular customers, if someone in the village needs milk in an emergency, he just gives me a call. Thus my sales have also gone up' (dairy farmer in Punjab).

Use of mobile phones in education and skills development

The enhancement of education and development skills is often considered a priority in rural areas, as they help improve livelihood skills. Respondents revealed that they gathered information relating to opportunities for higher education through relatives or friends and employees of educational institutions and through websites. In rural Bihar, the use of mobile phones for educational purposes is very limited. However, there have been instances where the use of mobile phones has helped in obtaining information about educational institutes, admission procedures and examination results. Most respondents, however, claimed they preferred visiting educational institutes directly to obtain detailed information. Information was also sourced from relatives/friends and family members and by contacting the institutions directly.

'I enquired about the admission procedure for engineering colleges in Delhi and nearby Delhi from one of my relatives residing in Delhi. I got a few contact numbers and spoke to the college administration staff directly. This helped my son secure a seat in an engineering college in nearby Delhi' (respondent in Bihar).

In Bihar, very few people reported accessing the internet over their mobile phones. However, the use of education-related websites was common among students and highly educated people. Some respondents also mentioned that they used the SMS facility to learn more about exam results and other related information.

The state of Punjab, on the other hand, saw higher usage of mobile phones when it came to education-related information. Mobile phones were used to gather information on examination results and admission procedures and also to access the internet. The SMS facility was also found to be rather popular for gathering the above-mentioned information.

The pursuit of higher education abroad is considered rather popular in Punjab and mobile phones come in handy for this purpose, as they facilitate direct access to the universities or institutions concerned for obtaining details regarding admission procedures and other related information.

'The overseas educational consultants regularly call me over the mobile phone and also SMS regularly about university delegations visiting India and other educational events' (student in Punjab).

Respondents revealed that mobile phones had transformed the education landscape by providing timely information, as well as helping them cut down travel expenses.

Use of mobile phones for obtaining Information on health services

Rural areas in India face a number of challenges when it comes to obtaining information on health services or developing healthcare infrastructure. Respondents mentioned that they sourced information on health services either from their relatives/friends or by contacting doctors directly. While traditional healers in the village could be called within minutes in case of emergencies, ambulance services were also made available on call.

‘People call for ambulances or private vehicles during an emergency. Mobile phones have ensured they are made available within minutes bringing in the necessary medical attention’ (respondent in Bihar).

To illustrate, World Health Partners, a Bill & Melinda Gates Foundation project being implemented along with the Idea Foundation, has established a regional medical centre at Patna in Bihar. A team of doctors at the centre ask their patients or medical personnel to describe the symptoms of their illness over the mobile phone and accordingly dispense remedies. This has helped the rural population cut down on travel and medical expenses and also obtain professional advice rather than being solely dependent on touts/healers and paramedics. Sub-centres established at the block level in every district have trained rural health workers, who provide basic and primary healthcare services to rural patients with the help of doctors based in Patna. These centres have been established primarily for rural patients who do not have access to doctors or medical facilities, and are situated in remote locations. Doctors or counsellors at the regional centre also provide medical information and conduct referrals for their patients in the rural areas. Thus, with mobile phones now easily available in most places, rural India has easier and better access to medical care.

In Punjab, mobile health vans are also available on call within a few minutes thanks to mobile phones. In some places, pregnant women and women nursing their infants are informed about impending health check-ups and vaccinations through text messages. Rural healthcare workers use mobile phones for consulting doctors in urban hospitals for serious cases. A list of the mobile phone numbers of doctors has been made available by the government to all rural healthcare workers for consultation purposes and emergencies, and in the case of complicated medical cases. In the case of the latter, mobile phones also facilitate direct referral to other hospitals.

Easier and cheaper access to medical services in the rural areas through the use of mobile phones has thus led to a change in the healthcare sector there and has also probably helped save lives.

Mobile phones and the labour market

Mobile phones also play an important role in accessing labour market information. In Bihar, respondents said there were two major sources of labour market information: migrant members (who could be family members, relatives and friends) and employers. Both these sources provide information through mobile phones. Employers and casual labourers contact each other for construction and agricultural work, both within and outside the state. Mobile phone usage has reportedly reduced the control of middlemen or contractors in casual labour outsourcing processes and also led to better working conditions for labourers. Earlier, contractors or middlemen used to exploit workers, which would result in low wages and poor working conditions.

‘My friends are working in private companies in Delhi and they call me whenever a vacancy arises in their companies’ (educated unemployed respondent in Bihar).

'I used to go to Punjab during the harvest season. Earlier, we had to either contact local contractors or visit Punjab and stay unemployed for a few days before getting work. Now, we are able to save time and money, apart from bargaining for higher wages and better working conditions' (respondent working as a casual labourer in Bihar).

In Punjab, the mobile phone usage pattern for accessing labour market information was found to differ substantially from that in Bihar. Non-farm work available in villages and nearby places in Punjab primarily includes construction work and the loading and unloading of goods. Poor people from rural areas in Punjab were able to get regular work through local contractors and employers, as their mobile phone numbers were available with local contractors, truckers and other traders. This enabled the latter group to call on the former on their mobile phones when required. In this process, the rural poor in Punjab not only saved time but also enhanced their wages.

'Drivers/transporters call me if they require my services. Owing to mobile connectivity, I am in indirect contact with employers (drivers and transporters). This enhances my employment opportunities and income' (casual labourer in Punjab).

Since mobile phones enable internet access, they have also helped educated but unemployed youth to contact prospective employers (who regularly release advertisements in the local newspapers seeking employees).

'I called up a private cell phone company regarding the sales job that had appeared in the local newspaper, and got the job of sales executive after a short interview' (sales worker at Airtel, Punjab).

With the mobile phone numbers of applicants now available to employers, companies now find it easier to contact prospective employees directly.

'I applied for a job at a leading fertiliser company, which interviewed me over the mobile phone and selected me as a trainee manager' (student in Punjab).

'I contact contractors in Bihar during the harvest season for casual labourers and negotiate with them over the phone' (big farmer in Punjab).

Most respondents revealed that the availability of timely information on jobs and direct contact through the mobile phone helped them receive higher wages and access more employment opportunities.

Mobile phones in finance and credit

The use of mobile phones for credit or cash transfer by family members is also gaining popularity in rural areas. Mobile phones enable families to learn about their migrant members' bank account numbers, the amount of money transferred and other bank transactions. In Bihar, apart from the formal banking system, the informal money transfer system is also gaining popularity through the usage of mobile phones.

In the formal banking system, processes of money transfers through internet banking or cash deposits in the accounts of family members are gaining in popularity. Money is transferred in two ways: when family members from rural areas deposit money in the accounts of their children and

other family members, and exchange details about these transactions over the mobile phone; and when migrant family members deposit money regularly into the accounts of their family members in their native villages and communicate details of these transfers over the phone. Some also mentioned that they used the bank accounts of other people to receive or deposit money for their relatives back home.

'I have an account in the local State Bank of India branch where my husband deposits money every month in my account from Delhi. Details of the deposit are then conveyed over phone. I withdraw the money from the ATM machine in the local market' (female respondent in Bihar).

'My son deposits money into my neighbour's account and gives the details over phone. My neighbour withdraws the money and hands it over to me on the same day. Earlier, I used to get money only once in every six or twelve months from my son, depending on when he visited us' (senior citizen in Bihar).

The use of mobile phones for obtaining or soliciting formal bank loans is, however, not popular in Bihar. Given the low literacy rate, people often prefer seeking loans from relatives, friends and local traders or moneylenders.

'I prefer to take loans from the local trader or moneylender as it requires no paperwork and is easily available' (respondent in Bihar).

In rural Bihar, only a few people hold formal bank accounts, which is why they largely depend on the informal credit system. Under this system, people transfer and deposit money by using their mobile phones. One such cash transfer system is through the *Jai Janta* store in Delhi, which is specifically designed for India's rural populace. The agency, which has franchisees all across north India, is specifically designed to ensure its agents hand-deliver their clients' money to their families. Once the money has been delivered to the customer, his/her family member calls the migrant member to confirm the transaction. The store charges a commission of 2-5 percent per transaction.

'I regularly send money via mobile phone to my mother in Purnea in Bihar. It's very easy and stress-free as the money reaches my mother quickly' (respondent in Bihar).

Another example is that of the World Bank-funded Eko Financial Services, which provides mobile banking services by using small shops as *de facto* banking outlets. When a customer wants to send money to a relative, s/he deposits cash with an Eko shopkeeper, who dials a code to get the transaction cleared. The Eko shopkeeper alerts the bank to transfer the money to their outlet (shop) in the customer's relative's village, where he or she can pick up the cash. One Eko shop-owner said he dealt with more than 120 cash transfer customers per day, who send money to their villages that are scattered across east India. At present, Eko has more than 1,000 outlets in several states across eastern India.

However, in Punjab, people use mobile phones more for formal banking transactions. There is a higher incidence of out-migration from Punjab to foreign countries like Canada, the UK, Australia and European states. These migrants regularly send money to their family members through wire transfers. A large number of transactions also take place via Western Union counters, whose codes are exchanged through text messages or mobile phone conversations.

'My son working in Canada regularly sends money through the Western Union counter there and I withdraw it from the locally available counter. He sends the details across via SMS and also lets me know about the transaction over a phone call' (female respondent in Punjab).

In rural Punjab, small and marginal farmers still prefer to procure loans for agricultural purposes from traders. They regularly contact local traders via mobile phones, who in turn provide them the necessary funding. Banks also reported that farmers have been taking a large number of auto loans for buying new vehicles, tractors and trucks, among others. SMS and phone banking facilities also enjoy a huge popularity among the educated classes and youth.

Respondents revealed that money transfer via mobile phones has helped hugely in cutting down travel time, thereby reducing costs, besides making access to information easier.

Use of mobile phones in ensuring social security, connectivity and safety

Mobile phones have proved to be a boon in rural areas, as they have brought about a sense of social security, connectivity and safety among the people there. Thanks to mobile phones, people in remote areas are now able to keep in touch with their family members in distant places. Mobile connectivity has also made it possible for many villagers to get emotional or financial support during emergencies. In Bihar, users have benefited by broadening their social network. Mobile phones have enabled easy communication with family members and friends, particularly for women whose spouses are working in far-off places. Women added that mobiles had actually helped in maintaining and strengthening their familial and social bonds.

Table 8: Use of mobile phone in connectivity and social security in Bihar (%)

Connectto	Male	Female	Total
Spouse	34.74	55.37	40.56
Parents	20.45	25.62	21.91
Other family members	38.64	40.50	39.16
Relatives/friends	95.45	95.87	95.57
Total	100.	100	100

Note: Multiple responses.

Source: Field study.

'The reason I bought a mobile phone is to connect with my friends and family, especially my children studying in Delhi' (retired senior citizen in Bihar).

Similar results were found in Punjab, where incidence of migration to other countries is rather high. Mobile phones have helped people connect with their children and relatives easily and frequently, thereby bringing in the desired moral and financial support.

'I now call my daughter and other relatives regularly. Earlier, I had to travel twice a year to meet her. Mobile phones have helped enhance social connectivity and networking' (housewife in Punjab).

Another 40-year old housewife also mentioned how she would keep in touch with her husband through the mobile that he had bought her.

‘The mobile phone has immensely improved my communication with family members and has helped reduce my fears and anxieties. Earlier, I had to write letters and wait for at least a month to get a reply’ (teacher in Punjab).

Female respondents revealed that they mostly used mobile phones for keeping in touch with their children studying in urban areas, married daughters and other relatives. It was found that women in poor households in rural areas did not own mobile phones. However, most of them used the phones of their husbands to talk to their parents, children and other relatives.

‘The cold-storage owner calls me whenever there’s any work available. I now get work regularly and earn Rs. 200 a day. My kids go to school and, once they return, I call my mother-in-law and ask her about the children. This way I am able to maintain my work–life balance’ (female casual worker in Punjab).

Some women belonging to poor families revealed that they did not know how to use a mobile phone and only used it when a family member was around to help them operate it. Other salaried women and those working as casual labourers revealed that they used mobile phones for work-related activities and for social connectivity.

‘I do not use the mobile phone, but the well-off people in my village call my husband when they need casual labourers like me. Our income and economic status has improved thanks to the increasing number of opportunities that I am now able to avail myself of over the phone’ (female casual labourer in Punjab).

Overall, the social impact of mobile phones was observed in the form of enhanced social capital for mobile phone users, which in turn resulted in improved personal well-being and satisfaction, and in saving time.

Use of value added services

In Bihar, MVAS are slowly gaining popularity among rural people. About one-tenth of total respondents mentioned using SMS during festivals and important occasions like birthdays and New Year celebrations for sending congratulatory messages. A higher percentage of female respondents (9.9 percent) were found to be listening to music as compared with their male counterparts (8.8percent). Only a few of them (6.8 percent) mentioned accessing the internet through mobile phones in rural areas. Approximately one-tenth of total male users added that they also used mobile phones to download ring tones, music and games. This facility was availed of by people who were relatively wealthier and more educated.

Table 9: Use of MVAS by mobile users in Bihar (%)

Service		Male	Female	Total
Use of	SMS	8.44	4.13	7.23
	Internet	7.47	4.96	6.76
	Music	8.77	9.92	9.09
Downloading of	Ring tone	13.31	13.22	13.29
	Music	14.29	10.74	13.29
	Games	10.71	10.74	10.72

Source: Field study.

In general, mobile handsets were used as much for ‘entertainment’ as they were for communication. Many of the respondents mentioned that people, especially youngsters, had started using mobile phones for listening to music only in rural areas.

The use of MVAS in Punjab was found to be rather high as compared with in Bihar. Youth and students there use SMS and internet services for varied purposes. Students and the unemployed use these services to gather information on travel, employment, entertainment and examination results, among other things. Farmers and others use it for collecting information on the prices of crops, cattle and agricultural instruments. In rural areas, SMS and the internet are mainly used by educated people.

Summing up socioeconomic development impacts

This paper began by looking at two areas of impacts of mobile phones – capabilities and networks. The studies of Bihar and Punjab corroborate numerous impacts of mobile phones on capabilities in production.

There has been improved access to knowledge of production systems in agriculture, including non-grain products, such as vegetables and milk production. Farmers in Punjab reported obtaining access to useful production knowledge through the mobile phone from a variety of sources, knowledge they were able to use in increasing production.

In Bihar, on the other hand, there was not much use of the mobile phone to secure agricultural production knowledge. This could owe to the fact that agriculture in Bihar is largely of the subsistence rather than commercial variety.

Besides knowledge, information about market prices secured through mobile phones enabled farmers to choose wholesale markets in which to sell their products or even the harvesting of vegetables. It is instructive to note that the only case in Bihar of use of mobile phones for securing market information was in a village that specialized in vegetable production. Where farming is a commercial activity, as in this case of vegetable production, then farmers in Bihar are not different from Punjab farmers in seeking market information.

The study did not have data on prices realized by producers before and after mobile phone use. But farmers in Punjab and the vegetable-growing area of Bihar both reported improved marketing because of better price information. Increasing access to price information would seem to improve the functioning of markets, reducing the spread between prices in different locations.

Cost savings were realized by both farmers and petty traders. Farmers could reduce spoilage by harvesting when prices in the market were better. Small traders could fine-tune their supplies according to customers' needs, conveyed over mobile phones.

One area in which mobile phones have had a clear impact is in reducing the role of intermediaries in market relations. Small farmers, who earlier sold to intermediary traders in the village, could not find out prices in wholesale markets and take their produce to these markets.

Punjab and Bihar have developed strong links as labour-absorbing and labour-supplying regions. Intermediaries had an important role in bringing employers and workers together, obviously taking a cut for their intermediation services. With the mobile phone, employers and workers can be in direct contact with each other. Wage rates are easily known and contracts and timing of work negotiated over the phone.

But it is not as though the role of intermediaries is eliminated. Rather, the costs of being an intermediary are reduced and new intermediaries can arise. Locally landowners contact *sirdars* (leaders of worker gangs) who then gather together the required groups of workers. Search costs are reduced on both employer and worker sides. Economic networks become denser, with multiple interactions between employers and workers. Market functioning then becomes more efficient, with a reduction in search-related transaction costs.

Related to migration are remittances, initially, at least, the reason for migrating. Mobile phone-based remittances, whether through formal channels or through informal networks, have become cheap and safe. Remittances are made regularly and do not have to be made just during a visit home. In fact, before the advent of mobile phone-based remittances, workers from Bihar returning home used to be preyed on trains and buses along the way. Returning migrants were known to be carrying money and thus were easy targets for robbery. Mobile phone-cum-ATM-based remittances have eliminated this risk and thus increased the real returns from migration.

The most important impact this study found is that in networking, a topic that has been neglected in the study of the impact of mobile phones in India. Networks are both economic and social, the latter usually based on familial and kinship relations. Economic networks are connected to improved market functioning. There are now greater connections between buyers and sellers, whether in product or factor (labour) markets. The mobile phone, by enabling both direct connections and larger numbers of intermediaries, could reduce the margin that intermediaries get.

The mobile phone is particularly important in sustaining familial relations in multi-locational households with at least one migrant. These households differ between Punjab and Bihar, being international in the former case and inter-state in the latter. But in both cases the mobile phone has made it possible for migrants and their families to remain in regular touch.

Many young boys from Bihar are sent by their parents to work in urban centres. Are these boys trafficked or not? As a study of child labour in Delhi (Bhaskaran et al. 2010) shows, these boys are in regular touch with their families through the mobile phone. This type of contract is not a feature of trafficked or bonded labour. However, young women who work in the Sumangali system in spinning mills live in company dormitories and are not allowed to have mobile phones. As studies have shown, this is a form of bonded labour. The deprivation of the mobile phone, which would enable them to remain in contact with their families, is a sign of attempted control by the employers.

Being allowed to keep or use a mobile phone has become a matter of struggle for young women in Bihar and other parts of rural India. Many village councils have banned unmarried women from having or using phones. Traditional social norms prohibit pre-marital contact between young women and men, and certainly those between members of different castes. In conjunction with educational institutions, which bring together young people of various castes, the spread of mobile phones has also made it easier for young women and men to develop relations that go against traditional and caste-based norms. The mobile phone enables a privacy of communication otherwise quite absent in rural India (Jeffrey and Doron 2013). It has helped disrupt traditional social relations. While many village councils oppose young women's use of mobile phones, the phone companies campaign on the socioeconomic benefits of mobile phones to young women.

Mobile phones were also found to have certain negative outcomes in traditional, rural societies. Local vendors were found to be earning substantial revenue by selling obscene movie clips (local and other), film songs and MMS, which had gained popularity among rural teens and youth.

Innovative uses of mobile phones

Stakeholders and mobile phone users in the surveyed areas were observed to have come up with innovative methods of using the technology. These are as follows:

- In general, the use of the 'missed call' was very common among migrant family members/friends, serving as an indication for them to return the call. Women and senior citizens in particular benefited from this practice.
- The courier facility: This basically meant using the mobile phone for money transfers and credit facilities in rural Bihar.
- Members of poor families used a single mobile phone set with multiple SIM cards. A member could then insert his/her SIM card in the phone to make a call. Understanding this pattern of saving on fixed costs, mobile phone manufacturers came out with instruments that could hold multiple SIM cards.
- In Chandkura village of Bihar, a local shop had installed solar panels and was charging Rs. 4 to recharge a mobile phone.
- In Punjab, private mobile operators like Idea and Spice provide information related to agriculture and the prices of agricultural instruments regularly. They also provide marketing information on agricultural products during the harvest season.
- Agricultural experts like Professor Sucha Singh Gill⁷ revealed that some big farmers and village officials called them regularly to obtain information on new varieties of seeds and farming practices. The central government has also established call centres for farmers, which entail dialling a toll-free number to receive any information on farming practices.
- Mobile phone operators were also found to have launched innovative schemes specifically designed for the rural populace. For example, Idea/Spice recently launched the Sabka Spice/Idea offer in Punjab, which provides a unique Spice handset that has been designed keeping in mind the needs of the rural people. This scheme was not only found to be economical, but also had been designed to increase mobile penetration in rural markets. Even the technology provided was rural-centric. The mobile handset was equipped with a unique voice response technology, making it even easier for semi-literate people to understand messages. Thus, both the price factor and the technology made the phone highly useful for the rural population. It had also led to a substantial increase in the penetration of mobile services in rural areas.
- Nokia Life Tools was found to provide market-related and educational information through mobile phones. The new handset, equipped with a torch, FM radio and camera, has gained immense popularity because of the multiple features and functions that are particularly useful in rural areas. The use of the mobile phone camera was found to be a hit, as it enabled people to record malpractices like bribes and misbehaviour in the government system. Video clips were passed on to news channels or government officials for further action.
- In Punjab, the theft of automobiles, especially motorbikes, is reported to be a very common problem. Worried by these problems, Mr. Gurvinder Singh, a villager, developed an innovative mobile phone-operated vehicle controller that can switch the vehicle on or off by

⁷ Director General and Agricultural Expert, Centre for Research in Rural and Industrial Development, Chandigarh, Punjab.

just dialling a configured number. The system could prove beneficial to police control rooms if expanded. The innovator is keen on providing such systems for all automobiles, making it easier for police control rooms to track them.

- Imagine a village where the farmer has the luxury of being able to stay at home and switch his or her irrigation pump on or off in the faraway field, as required, during the day or at night. This has been made possible via Prem Singh's innovative device in Punjab, which uses the power of mobile telephony to trigger electrical control switches. The farmer can now know the status of the pump from a remote location through their mobile phone and turn the motor on or off by calling the particular configured number. It activates the switch control through a specific number of rings and hence also incurs no call charges.

As can be seen from the above list, a number of these innovations have been carried out not by phone companies but by users. Some of the users have devised information systems, a form of MVAS. Others have devised ways to use the phone to carry out operations, such as controlling irrigation. These examples reaffirm the role of lead users in carrying out innovations. It is usual to term such innovations as 'innovations in use', but are they not a form of 'innovation in production' being what are called value added services? The irrigation controlling function is clearly a value added service, the difference from a commercial service being that it is not marketed. It is possible that some of these innovations by users could be developed into commercial products.

Conclusion

Mobile phones have reduced the cost of accessing information, as between potential employers and employees, and of small producers gaining access to market prices in different locations. They have also enabled rural people to access knowledge about crop and livestock rearing. In the fields of education and health too, mobile phones have increased rural access. Cheapening and thus increasing access to information and knowledge increases capabilities and enables both cost reduction and production increase.

Transaction costs have been reduced, as the search is carried out over the phone. The phone also enables small producers to reduce their transportation and wastage costs by making deliveries more in line with the demands of consumers. The use of mobile phones also helps in connecting markets, as, for instance, in Bihar and Punjab, which can help reduce the spread of wage differences and promote the development of a unified national market for wage labour. Reduced transportation and transaction costs, and denser interactions between buyers and sellers, be they in the product or the labour markets, accrue in addition to the benefits resulting from access to better information and knowledge.

A major and somewhat neglected dimension of mobile phone usage is that making communication substantially cheaper promotes social interaction. Multi-locational households with at least one migrant worker are increasing in numbers. Cheap mobile phones help such households keep in touch and remit money in safe and secure ways. Mobile phones enable the development of social relations in non-traditional ways, although conservative sections of rural society often oppose their use by young women. The issues of changes in networks and social relations enabled by mobile phones come out in this study as quite prominent effects of mobile phones.

An area where there is much scope is that of developing internet access through the mobile phone. Our study showed that mobile internet access is spreading among educated youth. The spread of low-cost smartphones and of education will play a big role in making the smartphone the main way in which rural India will access the internet. The benefits seen in this paper have been those of the

mobile phone system. When internet access is added to this, there will surely be a very substantial transformation in rural India (Gnanasambandam et al. 2012).

A final point that this study has shown is that there are many innovations being carried out by various consumers. This again is a trend that could become stronger as mobile internet access increases in rural India. With the spread of mobile use, it is very likely that it could be an arena of innovative activity, reducing costs and thus increasing incomes at the 'bottom of the pyramid'.

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Annex 1: Study areas

Bihar's economy is dominated by the rural sector, which is characterised by high poverty (45 percent) and low per capita state gross income (Rs. 20,069). Around 90 percent of the population in the state lives in the rural areas, which accounted for 55.3 percent of the total poor people in the state in 2009-2010. The state has 37 districts, which consist of sub-divisions, *tehsils* and blocks. Agriculture has been the mainstay of the people's livelihood, but its contribution has been declining over the years and is now only at one-fifth. The structure of the economy has also undergone a change over time, with a shift from agriculture to the services sector. The latter made a contribution of 62 percent to the state economy in 2011. The telecommunication infrastructure in Bihar has also been playing a major role in the growth of the services sector in the state. The number of telephone subscribers registered in the state has seen a ten-fold increase during the past six years (rising to 41.5 million in 2010-2011 from only 4.2 million in 2005-2006). This substantial jump in the number of connections owes to a phenomenal increase in the number of mobile phones, which registered a growth of more than 17 times during the same period. However, the tele-density in Bihar is still far behind that in other states and shows a vast gap between rural and urban areas (16 percent and 139 percent in 2011, respectively). The low number of wireless connections in urban Bihar is one of the major causes of this disparity. The study was carried out across seven districts and twelve villages in the rural areas of the state.

In Punjab, around 66 percent of the people reside in rural areas. It is one of the most prosperous states in the country with a per capita state gross income of Rs. 67,473⁸ (Ministry of Finance, 2012) and only 14.6 percent of its population falling in the category of poor people in 2009-2010.⁹ Agriculture is the main source of income of the people in rural Punjab. About one-third of the gross domestic product of the state in 2009-2010 came from the agriculture and livestock¹⁰ sectors. The state has 20 districts, which consist of sub-divisions, *tehsils* and blocks. Punjab has one of the best infrastructural facilities, including roads, electricity and communication facilities, in India.¹¹ The electricity used for agricultural purposes is subsidised and paved roads connect every village in rural areas. The overall tele-density of Punjab was 104 percent in 2011, which was significantly higher than the national average of 71 percent. Although the level of mobile penetration in Punjab is high, mobile adoption is mostly concentrated in urban areas, with their tele-density being 171 percent as compared with 57 percent in rural Punjab.¹² The study was carried out in Fatehgarh Sahib, a well-developed district with the highest wheat productivity in the country. The study covered six villages, situated within a radius of 70 km from the nearest urban centre, that is, Chandigarh.

⁹ According to the Planning Commission, 2009-2010.

¹⁰ As per the Economic Survey, Punjab, 2009-2010.

¹¹ According to the National Council for Applied Economic Research, 2007.

¹² According to TRAI, 2011.

Annex 2: Sampling methodology, Bihar

The present study is based on a larger study undertaken by the IHD in 12 villages of Bihar in 1999-2000 and 2009-2010. These villages were also covered in the earlier International Labour Organization–A. N. Sinha Institute of Social Studies (ILO–ANSISS) study,¹³ which was carried out during the early 1980s.

In the study, a representative sample of 36 villages was drawn from six clusters (of districts) in 1981, which formed the plains of Bihar, and which coincide with the geographical composition of present-day Bihar. Of these, three districts are situated south of the Ganges (Gaya, Nalanda and Rohtas) and four are in the northern part (Araria, Gopalganj, Madhubani and Purnea).¹⁴ In 1981, both the community level census and in-depth surveys were conducted in 12 of these villages, which represented the various zones (stratified by district and village size).

The household database of the survey is based on a survey of households conducted in 12 villages of North and South Bihar. A census survey was conducted in 12 villages to obtain the base for the sample survey. A total number of 3,906 households were covered under the census survey in the first round (Annex Table 1). The number of households varied from 62 in a small village like Paharpur Dayal in Gopalganj to as high as 896 in Jitwarpur in Purnea.

Annex Table 1: Total number of households in different villages

Districts	Village	Number of households
Gaya	Alalpur–Bishnupur	148
	Salempur–Rupaspur	331
Gopalganj	PaharpurDayal	62
	Dewanparsa	192
Madhubani	Mahisan	714
	Khangaon	470
Nalanda	Chandkura	296
	Mohiuddinpur	96
Purnea	Belabadan	283
	Jitwarpur	896
Rohtas	Samhutibuzurg	262
	Amarhi	153
All	Total	3,906

The questionnaire for the household survey in all the villages was specifically designed to permit a class stratification of each village; subsequent sampling was then undertaken within class strata. The class structure is similar to that of the earlier ANSISS–ILO survey. The seven principal groups that comprise this structure, along with their respective characteristics, are detailed below.

- A. *Agricultural wage labourers*: All households engaged in hiring out agricultural wage labour, regardless of other activities;
- B. *Poor-middle peasants*: Cultivating, no hiring or leasing of agricultural wage labour;
- C. *Middle peasants*: Cultivating, no hiring out of wage labour but hiring in, no leasing out, both male and female members working;

¹³ For details of the study, see Prasad et al. (1988).

¹⁴ At the time of the 1981 survey, six districts were chosen, but in 1990 Araria district was separated from Purnea district. For presentation purposes, we therefore club Araria and Purnea together in the regional breakdown.

- D. *Big peasants*: Cultivating, no hiring out of wage labour but hiring in, no leasing out, only male household members working;
- E. *Male farmers*: Cultivating, but supervisory work done only by household members, labour hired in but not hired out, no leasing out;
- F. *Landlords*: All those leasing out land; and
- G. *Others*: Include non-agricultural workers.

Further, a survey was conducted in the same villages but with a smaller number of selected households (varying between 20 and 25 percent of the total number of households) in the villages. The selection of the sample households was done on a stratified random basis with the *class* of the households as the basis of stratification. The next task was to determine the number of households to be surveyed in each of the 12 villages. This was carried out as follows. First, the number of households was tabulated village- and group-wise, which involved an arbitrary 20 percent sampling for each group. This gave a very dissimilar standard error for each group across villages. In order to say something statistically acceptable about each group in accordance with the objectives, the sample sizes were changed in each group (by adjusting 20 percent of the sampling upwards or downwards) to give a similar standard error for each group. Subsequently, the sample sizes were increased for the more heterogeneous groups. The result was a total sample size of little over 22 percent of the total households, which comes to around 900, with the sampling percentage ranging from 30-35 percent in the smaller villages to 18-23 percent in the larger villages. The number of households in different sub-groups was allotted in accordance with the share of each household in every specific group of a particular village. The sample villages covered and the details of the size of the sample households covered under the sample survey are given in Annex Table 2.

Annex Table 2: Distribution of total number of households covered under the census and the number of households covered under the sample survey

Village	Class (% distribution)				No.of households	Sample size	% of sample
	A	B/C/D	E/F	G			
Alalpur–Bishnupur	31	45	14	9	148	47	29.73
Salempur–Rupaspur	43	30	15	12	331	76	22.36
PaharpurDayal	19	68	11	2	62	22	35.48
Dewanparsa	54	33	13	1	192	58	29.69
Mahisan	67	17	7	8	714	136	18.91
Khangaon	55	21	14	10	470	99	21.28
Chandkura	56	34	6	3	296	74	25.00
Mohiuddinpur	79	6	9	5	96	32	33.33
Jitwarpur	59	30	4	6	896	161	17.97
Belabadan	75	12	5	8	283	74	26.86
Samhutibuzurg	66	20	9	5	262	71	25.95
Amarhi	58	29	12	1	153	48	31.37
Total	59	26	9	7	3906	898	22.81

Note: In the mobile phone study, only members (of sample households) having access to a mobile phone were chosen.

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*Capturing the Gains
The University of Manchester
Arthur Lewis Building
Oxford Road
Manchester
M13 9PL
United Kingdom*

capturingthegains@manchester.ac.uk

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