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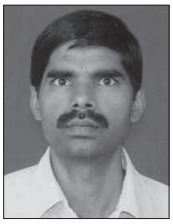

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A case study of factors influencing diffusion of Mobile telephony in rural India

Mobile communication is one of the fastest penetrating technologies which registered an unmatched growth in the history of technology diffusion. Mobile communications has changed the personalized traits of users by increasing exchange of information across the geographical regions. The increased applications of mobile communication on services are changing social economy by contributing to livelihood opportunities too. The multi-users applications of mobile communication resulted a boost in the adoption of mobile telephony despite several economic deterrents irrespective of the geographical regions. Hence, to understand an impact of the related factors and perception of rural users about diffusion of mobile phones is imperative particularly in the rural areas. Therefore, an attempt is made to analyse linkages of socio-economic factors responsible for the diffusion of mobile phones in rural India. The analysis also incorporates the typology of the users and the results may be equally useful for other rural region across the countries. The analysis indicates that access of electricity is an important factor in the diffusion of mobile phone and spending on mobile phone is affected by the availability of electricity in rural areas. The occupancy of wire-line (fixed phones) phones, fridge, radio, microwave oven, washing machines, motor bike/scooters, computers and other domestic household items significantly affect the penetration of mobile communication. The adoption of mobile phone is influence by size of the village too.

1. Introduction

Mobile telephony has registered an exponential growth across the world in the last decade and is argued that the mobile communication will replaced the wire line phones in future. This signifies a widespread sign of diffusion rate of mobile communication. The diffusion of mobile phones was observed ubiquitously irrespective of the economy and regions. Therefore, the mobile phone is an example of a perfect diffusion of technology so far, where in some clusters of population and countries the density of mobile phones has outreached the users. According to a study mobile phones have out-diffused virtually every prior technology, including bicycles, radios, television (TV) sets, wallets, wire line phones, and wristwatches, and have done so in twenty-five years (Kalba, 2008). It was also estimated that there were 6 billion mobile subscriptions by the end of 2011 (ITU, 2011). In the developed economies the mobile subscribers has reached at saturation point with at least one mobile phone subscription per person. At the end of 2011 there were 4.5 billion mobile subscriptions in the developing world (76 percent of global subscriptions). The Portio Research (2012) estimated that mobile subscribers worldwide will reach 6.5 billion by the end of 2012, 6.9 billion by the end of 2013 and 8 billion by the end of 2016. The Portio research further estimates that Asia Pacific's share of the mobile subscribers will rise from 50.7 percent in 2011 to 54.9 percent in 2016. By 2016 Africa and Middle East will overtake Europe as the second largest region for mobile subscribers Africa. In China there were 1,023.7 million subscribers (76 percent of population), in India: 919.2 million subscribers (75 percent of population) and in USA: 331.6 million subscribers (105.8 percent of population by the 2011. The global mobile phone density was 86.7 percent, in developed nations 117.8 percent, developing nations 78.8 percent, Africa 53.0 percent, Arab States 73.9 percent, CIS nations 143.0 percent and Europe 119.5 percent respectively in the year 2011.

The Indian telecommunication sector has also shown a comparable growth and undergone different phases of advancement since its inception between Calcutta and Diamond Harbour in 1850. During the last two decades telecommunication has witnessed a phenomenon growth in India and is predicted one of an emerging market in the world. In the developing countries fast penetration of mobile phones was observed in China and India led by rapid mobile adoption rate due to a large user based market. The pervasive nature of telecommunication technologies spurred the rate of diffusion not only in urban areas but in rural areas also in particular the mobile phones. The empirical statistics shows that India was the second largest network in the world after China with 926.55 million telephone connections in 2011–12. It was also the second largest wireless network in the world and wireless telephones are increasing at a faster rate. The share of wireless telephones is 96.47 % of the total phones. The overall tele-density has reached 76.86 %. Urban tele-density is 167.46 %, whereas rural tele-density is at 37.52 % which is also steadily increasing. The wireless connections contributed substantially to total rural telephone connections. Their share in the rural telephones increased from 73.33 % in March, 2007 to 96.90 % in March, 2011 and further to 97.53 % in December'11. During 2011–12 (upto December), the growth rate of rural telephone was 11.73 % as against the growth of 8.35 % of urban telephones. It was reported that 32.67 % of total wireless subscribers were in rural areas (DoT, GoI, 2011). Evidently, the penetration rate of mobile phones in rural areas was not as fast as in urban areas which led rural-urban divide in telecommunication services. The slow diffusion of telecommunication in rural areas is attributed to low access of the telecommunication services due to prevailing socio-economic and infrastructural inequalities. The existing obstacles gave rise to a gap in rural and urban tele-density. Consequently, the major focus of the Government of India is to make accessible

telecommunication services (mobile phones) in rural areas to reduce the gap in terms of teledensity between urban and rural areas. However, the penetration of mobile telephony is slower in rural areas as compared to urban inhabitants. However, the adoption of mobile communication is on the rise in rural India with about 38 percent rural mobile teledensity. Therefore, in this paper linkages between different potential factors responsible for mobile adoptions and perception of rural subscribers towards mobile penetration are discussed.

2. Conceptual framework

There have been considerably faster changes in the communication technologies during the past few decades. The driving forces behind emerging trends arise from different reasons such as pervasiveness, necessity, accessibility and multi-utility of the communication technologies. Theories of diffusion shows that the factors such as pervasiveness, necessity and accessibility plays an important role in the diffusion of technology in addition to income, literacy and other similar factors. The theory of innovation diffusion advocated by Rogers (1995) has been the leading theory in the research of the diffusion of new technologies and products since the 1960s. The theory of innovation diffusion attempts to explain the process through which an innovation gets diffused via certain channels in certain social systems over a period of time. According to Zhu and He (2002a), the diffusion of innovation theory ends at the adoption stage of innovations and neglects a more important stage — post-adoption stage, which refers to the use of innovations. The needs, practical use, resource availability and users' perceptions also prevail in the diffusion of innovation and new technology. Evanjeline Eriksson (2008) identified two categories; personal and society context which affect penetration of mobile diffusion in rural areas. Wei (2008) advocated the theory of motivation by means of innovative applications like Video phones, and Wi-Fi among other supplementary applications for diffusion of mobile phones. In fact, there are several reinventions when adopters use new technologies, which is true in particular, for the emerging technologies such as mobile phone and the Internet. Since, people try to use new technologies in their own ways and apply it as per their convenience, which in turn influence the development of technologies. Thus, mobile communication technology has shown fast diffusion not only in urban communities but in rural communities as well.

It was observed that pattern of uses and individual's choice is ubiquitous in the diffusion of mobile phones. The studies (Chigona et al, 2008) underline that uses and gratifications theory provides people with some insights into the interaction between technologies and their adopters. In their study of Chinese urban residents' adoption and use of the Internet, Zhu and He (2002b) synthesized the diffusion of innovations theory, the uses and gratifications theory and developed a perceived needs theory. They identified three psychological factors independent of adopters' demographics and social economic factors. These three factors are Perceived Characteristics of the Internet (PCI), Perceived Popularity of the Internet (PPI), and Perceived Need for the Internet (PNI). They found that these three factors can effectively explain and predict urban residents' adoption and use of the Internet in China. Since the adoption of mobile phones is comparable as Internet therefore the present study attempts to investigate the diffusion of mobile phone in Indian rural areas. The analysis includes the relationship between the potential attributes which may influence users' mobile phone adoption and use. This is corroborated by Rogers' mass media use, interpersonal communication, and adoption of functionally similar innovation communication technologies which are supposed to influence users' perception of mobile phone, and therefore their adoption and use of mobile phone.

3. Data collection and Methodology

Data for the study was collected through questionnaires to understand different aspects of mobile telephony of the rural users to analyse mobile penetration in the rural areas. The data was collected from the rural mobile users and to maintain un-biasedness and heterogeneity, the respondents were selected from all social strata and different age groups of the mobile users. Total 568 responses were received from 67 different villages. The villages are classified in four main categories such as very small village (population less than 500), small village (population between 500 to 1000), medium village (population between 1000 to 2000) and large village (population greater than 2000).

Access of electricity, spending on mobile phone, size of village and other techno-economic factors like access of TV, radio, and other household items are supposed to influence penetration of mobile phone in any social system. So, the data was collected on aforesaid determinants and was analysed using Pearson Correlation which is a suitable technique for analyzing statistical relationships involving dependence among the two or more variables. The Pearson correlation analysis represents a linear relationship between two quantitative variables. For analysis of variance ANOVA techniques was used for testing whether or not the means of the groups are equal and therefore generalizes *t-test* to more than two groups.

3.1. Classification of the sample

The sample population was heterogeneous comprising male, female, students, farmers, labour and white collar workers etc. The classification of the sample was arrived at through a filter and the classification of the respondents was made in terms of age, annual income of the house hold, gender, education etc. Broad classification of the respondents is described in Table 1 and could be understood by the descriptive analysis of the following key variables.

Table 1

Broad demographic profile of the respondents

Variables	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Age	568	16	70	36.45	0.513
No of People in Household	567	0	13	4.95	0.074
Adults in the Household	567	0	11	3.84	0.061
No of people living in other city/ town/village	432	0	10	.46	0.054
How many people in the house have mobiles	565	.00	10.00	2.2389	0.05100
How many years since first mobile phone at home	564	.00	16.00	4.8587	0.10707
How many years are you using phone	553	.00	15.00	3.9799	0.10112
Spend on mobile phone	564	0	4000	242.43	11.212
spend on fixed phone	101	30	1000	252.23	25.522
spend on roaming	415	0	1000	19.96	3.772
Annual Income	519	1500	2500000	182159.34	9267.715

Further, total six telecom service providers were identified on the basis of data received from the mobile users (respondents). The sample reflects that the users preferred Idea and then Bharat Sanchar Nigam Ltd. (BSNL) while Virgin was the least preferred service providers. The preferences and observed percentage of service providers are given in Table 2 and actual market share of the different telecom service providers are given in Table 3.

Table 2

Percentage share of different service providers in villages

Responses categories	Operator's typology	Frequency	Percentage	Calculated percentage
Valid responses	BSNL*	104	18.3	18.4
	Idea	194	34.2	34.3
	Vodafone	86	15.1	15.2
	Airtel	102	18.0	18.1
	Tata	43	7.6	7.6
	Reliance	13	2.3	2.3
	Virgin	1	0.2	0.2
	Uninor	22	3.9	3.9
	Total	565	99.5	100.0
Missing responses	System	3	00.5	
Total		568	100.0	

*BSN represents Bharat Sanchar Nigam Limited

Table 3

Actual percentage share of different service providers

Service providers/operators	Percentage
BSNL	10.72
Idea	12.26
Vodafone	16.30
Bharti	19.72
Tata	8.89
Reliance	16.65
Uninor	4.62

Source: Telecom Regulatory Authority of India Website

However, Table 2 & Table 3 indicates a similarity in percentage share for service providers like Vodaphone, Uninor and Tatas, there is a variation for Bharati, Reliance & idea for the market share. The variation could be due to uneven unavailability of the telecom service providers and are geographical specific.

4. Analysis of the data

Earlier studies indicate that factors such as per capita income, urbanization and internet/broadband penetration, as well as regulation affect the penetration of mobile phones (Bohlin et al, 2010; Kalba, 2007). Wei and Zhang (2008) argued that behavioral and psychological factors also influence the adoption and use of mobile phone in rural areas. Hence, this study undertakes to investigate linkages between selected factors affecting diffusion of mobile phones such as correlation between village type (size) and monthly spending on mobile phone, electricity access and monthly spending on mobile phones, numbers of years of mobile phones in the village and economic growth and perception of influence and type (size) of village. The 'influence' is a summated scale used to measure the people's perception of effect of mobile phone in their life. Accordingly, hypotheses for causal relationship for the relevant factors were formulated and tested with statistically. The description of analysis for different factors is given below.

4.1. Correlation between village type (size) and monthly spending on mobile phone

This hypothesis examines that monthly spending on mobile phones depends on different types of villages; very small, small, medium village and large village. The null and alternate hypotheses are as follows:

Ho: there is no relationship between the type of village and the monthly mobile spending (i.e. people from each type of village spend equally on monthly mobile bills)

$$\mu_1 = \mu_2 = \mu_3 = \mu_4$$

H1: there is relationship between the type of village and the monthly mobile spending (i.e. people from different type of village spend differently on monthly mobile bills)

$$\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \text{ (where } \mu_1, \mu_2, \mu_3 \text{ and } \mu_4 \text{ are means for respective villages)}$$

Before conducting ANOVA, we need to check homogeneity of variance among groups, which is a necessary assumption for ANOVA. Hence Levene's of homogeneity was performed to know if the variances in the groups are equal. The null and alternate hypotheses for testing of homogeneity are below and the statistics is given in Table 4.

Ho: the variances are homogenous across groups

H1: the variances are not homogenous across groups

Table 4

Test for Homogeneity of Variances for Spending on Mobile Phone

Levene Statistic	df1	df2	Significance
2.130	3	560	0.058

Since the Significant value in the above Table is 0.058> 0.05 (significance level) which indicates that the null hypothesis is not rejected and alternate hypothesis is rejected indicating equality of variance assumption of ANOVA is satisfied.

Table 5

ANOVA test matrix for Spending on Mobile Phone

	Sum of Squares	Df	Mean Square	F-value	Significance value
Between Groups	$3.087x10^5$	3	102904.408	1.476	0.220
Within Groups	$3.904x10^7$	560	69712.286		
Total	$3.935 x10^7$	563			

The above Table 5 indicates that the significance value is 0.220 which is >0.05 (level of significance), hence the null hypothesis for ANOVA cannot be rejected and Alternate hypothesis is rejected. This indicates that there is no significant difference between means spending of different types of villages. The results indicate that spending on mobile is independent of type of villages suggesting people from small or large villages spend equally (not significantly different). This is an interesting finding for mobile service providers indicating the uniformity of revenues irrespective of the size of the village.

4.2. Correlation between electricity access and monthly spending on mobile phone

This hypothesis analyses the effect of the access of the electricity on the monthly spending of mobile phones. The null and alternate hypotheses are as follows and the related statistics are provided in Table 6.

Ho: there is no relationship between access to electricity and spending on mobile phone (i.e. people spend equally on mobiles at all levels of electricity access)

$$\mu_1 = \mu_2 = \mu_3 = \mu_4.$$

H1: there is relationship between access to electricity and the mobile spending (i.e. people spend differently on mobiles at different levels of electricity access)

$$\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4.$$

Table 6

ANOVA test matrix for Spending on Mobile phone and electricity access

	Sum of Squares	df	Mean Square	F-value	Significance value
Between Groups	$9.094x10^5$	2	454699.323	6.630	0.001
Within Groups	$3.840x10^7$	560	68579.333		
Total	$3.931x10^7$	562			

It is obvious from Table–6 that the significance value is 0.001 which is <0.05 (level of significance) hence the null hypothesis for ANOVA is rejected and Alternate hypothesis is accepted. This shows that there is a significant difference between means spending of different levels of electricity access. That means people having more access to electricity may cause more spending on mobile phones. Analysis indicates that means of spending on mobile communication is directly proportional to the access of electricity in the rural areas (Figure 1).

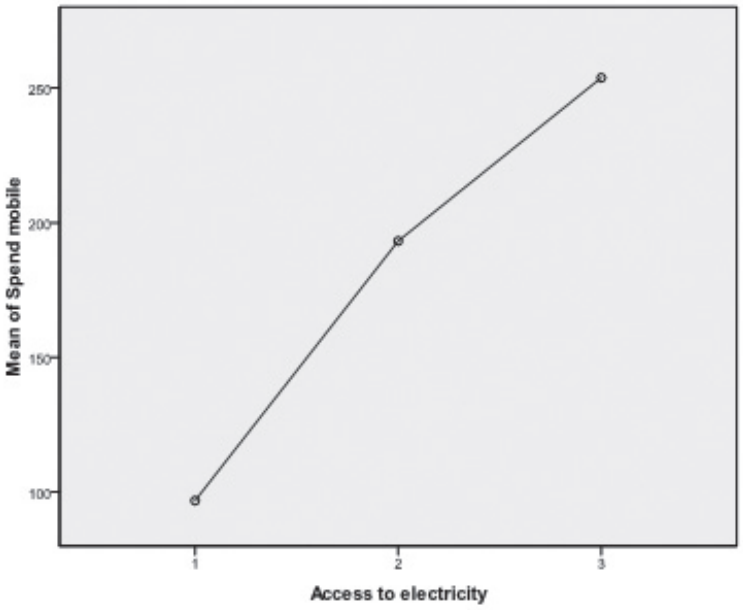

Figure 1. Relationship between means of spending on mobile and electricity access

This is reasonable as availability of electricity is most important factor for mobile diffusion and is one of the key factors affecting the teledensity in rural India.

The service providers are doubly hit in the areas having irregular electricity:

• They have to spend extra cost on getting the network going by either generating electricity or by using power backups like UPS;

• Their revenues gets affected as people spend less due to lack of electricity.

This is a grave concern for rural connectivity.

4.3. Correlation between numbers of years of mobile phones in a village and other economic indicators

In this section statistical association is investigated between number of years of mobile phones in a village and other indicators. The Pearson Correlation test was applied to analyse the relationship between various socio-economic indicators such as Electricity, Fixed phone, Television, Fridge, Radio, Microwave, Washing Machine, Computer Bicycle, Motorbike / scooter, Tractor , Truck and Car etc. The analysis and correlation coefficient for the respective socio-economic indicators with that of numbers of years having mobile phones are given in Table 7.

Table 7 indicates that there is a significant correlation between number of year of mobile phone services started in the village and different indicators. The analysis indicates that with the increasing period of the availability of mobile phones in the village the prosperity of the village grew in proportion. For demonstrating the above relationships (Table 8), a descriptive analysis was conducted on related variables to sort out by number of years of the arrival of the creature comforts in relation to the basic need of electricity and the advent of mobile phones in villages.

Table 7

Matrix for occupancy of mobile phone with other indicators

Socio-economic indicators	No. of years mobile services started in village		
	Pearson Correlation	Significance (2-tailed)	N
Electricity how many years	0.091*	0.034	545
Fixed phone (line how many years	0.208**	0.000	436
Television how many years	0.107*	0.014	525
Fridge How many years	0.249**	0.000	446
Radio how many years	0.132**	0.007	419
Microwave how many years	0.144**	0.005	386
Washing Machine how many years	0.173**	0.001	397
Computer how many years	0.139**	0.006	397
Bicycle how many years	0.066	0.140	496
Motorbike / scooter how many years	0.278**	0.000	495
Tractor how many years	0.046*	0.366	396
Truck how many years	0.110*	0.030	389
Car how many years	0.114*	0.023	397

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

Table 8

Matrix for arrival of different indicators and influence on prosperity

	N	Mean	Std. Deviation
Electricity how many years	547	13.9887	9.96990
Fixed phone line how many years	436	2.11	4.425
Television how many years	527	5.893	6.6267
Fridge How many years	446	1.369	3.7808
Radio how many years	419	3.25	7.050
Microwave how many years	386	0.03	0.214
Washing Machine how many years	397	0.169	1.3518
Computer how many years	397	0.154	0.8806
Bicycle how many years	497	10.40	9.616
Motorbike / scooter how many years	496	4.461	6.0721
Tractor how many years	396	1.21	4.632
Truck how many years	389	0.024	0.3251
Car how many years	397	0.34	1.897
years mobile services started in village	566	6.44	4.593
Valid N (listwise)	377		

The Table 8 shows a relationship between the availability of electricity in villages and the diffusion of mobile phones, electricity is the predecessor. There is a subsequent introduction of the other comforts of life after the dawn of mobile telephones in the villages clearly heralding the ability to communicate as the prerequisite for accelerated economic growth. The only necessity that preceded the mobile phone after the electricity was the bicycle.

4.4. Correlation between the perception of influence and type (size) of village

This hypothesis tries to investigate the perception of 'influence' with the Type (size) of village. The 'influence' is a summated scale used to measure the people's perception on effect of mobile phone in their life. The null and alternate hypothesis is as follows and the statistics is given in Table 9:

Ho: the perception of influence of mobile phone is independent of the type of village (there is no difference in the perception of influence and the type of village);

H1: the perception of influence of mobile phone is dependent on the type of village (the perception of influence is different for different type of village).

Table 9

ANOVA test matrix for perception between influence and size of village

	Sum of Squares	Df	Mean Square	F-value	Significance-value
Between Groups	22547.987	3	7515.996	67.736	0.000
Within Groups	54481.145	491	110.960		
Total	77029.131	494			

The above ANOVA Table–9 has significance level of 0.000 <0.05 (level of significance) i.e. the null hypothesis that the influence is independent of type of village is rejected and the alternative hypothesis is accepted. This shows that the degree of influence is different for different size of villages.

Since ANOVA is rejected, it is felt necessary to further investigate using Post Hoc Test (Table 10) which provides specific information on which means are significantly different from each other. The analysis shows that the scale of influence is increased as the village size gets larger as shown in Figure 2.

Table 10

Post Hoc Tests test matrix for multiple comparisons for perception between influence and size of village

(I) type of village	(J) type of village	Mean Difference (I-J)	Std. Error	Significance	95 % Confidence Interval	
					Lower Bound	Upper Bound
1	2	3.54663	3.08501	.251	–2.5148	9.6081
	3	–1.80795	3.04798	.553	–7.7966	4.1807
	4	–12.51213*	3.00586	.000	–18.4181	–6.6062
2	1	–3.54663	3.08501	.251	–9.6081	2.5148
	3	–5.35458*	1.31787	.000	–7.9439	–2.7652
	4	–16.05876*	1.21728	.000	–18.4505	–13.6670
3	1	1.80795	3.04798	.553	–4.1807	7.7966
	2	5.35458*	1.31787	.000	2.7652	7.9439
	4	–10.70417*	1.12011	.000	–12.9050	–8.5034
4	1	12.51213*	3.00586	.000	6.6062	18.4181
	2	16.05876*	1.21728	.000	13.6670	18.4505
	3	10.70417*	1.12011	.000	8.5034	12.9050
* The mean difference is significant at the 0.05 level						

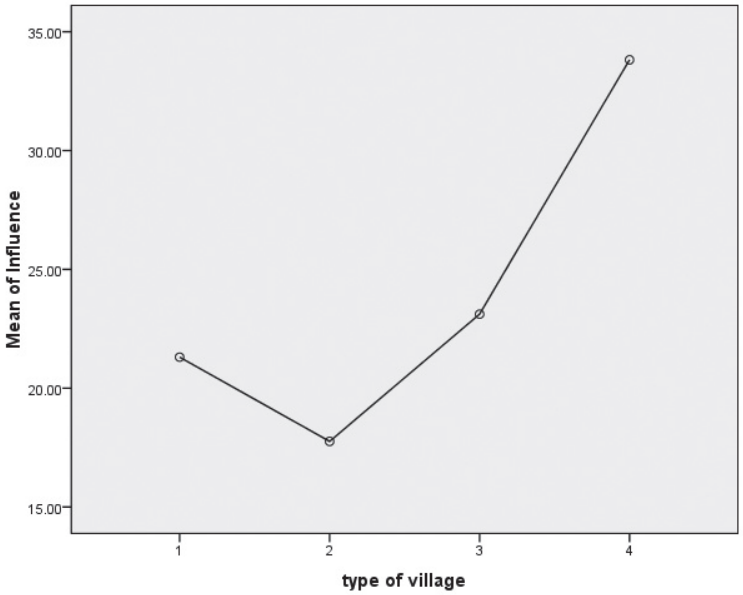

Figure 2. Relationship between size of village and influence on mobile phone

5. Results and discussions

Mobile communication technology is one of the fastest pervasive technologies and has affected all spheres of economy across the world. Despite, its pervasiveness the diffusion of mobile phones in rural India is not faster as in urban areas. It may be attributed to late entry of telecom service providers in the rural areas in addition to the factors like uses, feasibility, applicability and associated socio-economic factors affecting the diffusion of mobile communication in any society. However, the analytical results indicate that spending on mobile phone is irrespective of the village size. It was found that the spending on mobile phone is directly proportional to the access of electricity in the rural areas. The reason is that mobile communication needs availability of electricity for network availability and for functionality of the mobile phone towers. Moreover, the analysis shows that the influence of adoption of mobile phone is influence by type (size) of village. It means that more interaction among the users has positive influence on the diffusion of mobile communication in rural areas which is due to the external influence.

Analysis also indicates that there is a significant correlation between availability of mobile communication services in a village i.e. longer the availability of mobile services in a village the higher penetration of mobile phones. It implies that external influence plays a significant role in product or innovation diffusion. It was also found that the economic factor has also significantly positive effect on the mobile diffusion. Therefore, it may be argued that after mobile phone has reached to a village the economic factors of the village are improved. The inferences may be drawn that the occupancy of wire-line (fixed phones) phones, fridge, radio, microwave oven, washing machines, motor bike/scooters and computers in a household also significant attributes in the penetration of mobile communication. Similarly, occupancy of electricity, television, bicycle, truck and car also associated

positively with the mobile communication. Analysis further shows that the scale of influence of mobile phones diffusion is increased as the village size gets larger. It happens due to interaction among the heterogeneous and peer groups. The financial resources and accessibility of electricity are major constraints in the diffusion of mobile phones in rural areas in India. There is a need to provide some alternative arrangements such as UPS and portable batteries to overcome the problem of electricity. To bridge the gap of revenue the government should provide subsidy to the mobile operators in rural areas.

References

Bohlin, A., Gruber, H., and Koutroumpis P. 2010. Diffusion of new technology generations in mobile communications. Information Economics and Policy, 22(1), 51–60.

Department of Telecommunication. URL: http://www.dot.gov.in/; Accessed on 20.06.2012.

Eriksson, E. April 2008. A case study about cell phone use by people in rural Kenya, Växjö University, Report 08034.

Kas Kalba, 2007. The Adoption of Mobile Phones in Emerging Markets: Global Diffusion and the Rural Challenge, 6th Annual Global Mobility Roundtable, University of Southern California Los Angeles. URL: http://classic.marshall.usc.edu/assets/006/5577.pdf; Accessed on 30.01.2013.

Kas Kalba. The Global Adoption and Diffusion of Mobile Phones, Center for Information Policy Research, Harvard University, December 2008, ISBN 0-9798243-0-3 P-08-2.

Mobile Factbook 2012, Global mobile statistics 2012 Part A: Mobile subscribers; handset market share; mobile operators. URL: http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats, Accessed on 20.07.2012.

Rogers, E. M. 1995. Diffusion of Innovations, fourth (ed), New York, Free Press.

The International Telecommunication Union 2011;

URL: http://www.itu.int/ITU-D/ict/Facts/2011/material/ICTFactsFigures2011.pdf; Accessed on 20.09.2012.

Chigona, W., Kamkwenda, G. and Manjoo, S. 2008. Uses and gratifications of mobile Internet among South African students. South African Journal of Information Management, 10(3), 1–10.

Wei, L. and Zhang, M. 2008. The adoption and use of mobile phone in rural China: A case study of Hubei, China. Telematics and Informatics, 25, 169–186.

Wei, R. 2008. Motivations for using the mobile phone for mass communications and entertainment. Telematics and Informatics, 25, 36–42.

Zhu, J. J. H. and He, Z. 2002a. Perceived characteristics, perceived needs, and perceived popularity: adoption and use of the Internet in China. Communication Research, 29 (4), 466–495.

Zhu, J .J. H., He, Z. 2002b. Perceived characteristics, perceived needs, and perceived popularity: adoption and use of the Internet in China. Communication Research, 29 (4), 466–495.