Examining Linkages between Smart Villages and Smart Cities: learning from Rural Youth accessing the Internet in India[1]

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Abstract

The literature on Smart Cities has not as yet paid adequate attention to the rural sector, and the potential in villages for creating smart and sustainable solutions for the 21st century. This paper focuses on linking proposed smart city strategies to smart village policies to ensure that rural youth have improved opportunities for employment through ICT initiatives to ensure digital inclusion, using primary surveys undertaken in India. The motivation was to understand how mobile telephony could be a catalyst to create Smart Villages in India, where young people can chart out new pathways to realize their aspirations with regard to tertiary education and new avenues for diversifying into rural non-agricultural employment. We use data obtained from a household survey in villages in the states of Punjab and Tamil Nadu to examine the mobile phone usage preferences of rural educated youth to identify the way forward in improving the accessibility of services on the supply side. We make the case that where youth are using mobile phone access to increase their social information base it is indeed possible that the new social media groups formed by rural youth become a powerful conduit for generating new employment opportunities. The key to accessing this solution is to use a demand driven model for mobile services that would permit a bottom of governance model to generate sustainable growth of enterprises and improved human development of these villages.

1. Introduction

In a post 2015 era, the new global agenda has emphasized the need to achieve the Sustainable Development Goals (SDGs). The SDGs provide a way forward to build upon the successes of the MDGs, but it is important to note a major difference between the two, given the new emphasis on participation and empowerment in the SDGs. A core pillar for such inclusion is to bring households and the communities within which they are located into the development arena. The sustainability agenda has tended to be focus on cities, which are regarded as the future of humankind, particularly after the world has tipped to an urban location in 2007. There is an urgent need to recognize that smart and sustainable solutions are even more important for rural communities, that are often far away from the growth poles of urban based industrial development, and disadvantaged in their access to education and health.

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The context within which this sustainability agenda has developed is one where access to ICT has already come to be regarded as an important measure of development. While measures of access show that rural areas are becoming connected there remains the matter of quality of connection, and here the digital divide remains a major characteristic that differentiates urban from rural areas (Akamai, 2016). There is also evidence that the cost of ICT militates against furthering access to more economically disadvantaged groups in poor countries, and as well as on account of socio-cultural factors, due to the lack of relevant content in local languages (ITU, 2015). The United Nations Committee (Economic and Financial) has indicated its concern about the obstacles faced by poor countries, and the negative consequences for communities in rural areas as they are fall further behind in race to access ICT.

The discussion on sustainability also occurs in a global context where the importance of skills in getting poor youth out of poverty to ensure improved human development has become a major focus of international research and policy making. Recent survey results published by UN agencies and international donors show that poor rural households regard education as the way forward to ensure better lives for their youth, but these very youth face increasing obstacles in accessing employment. These difficulties have arisen because the opportunities in agriculture are shrinking and the alternative strategy of seeking jobs through migration within the country or beyond national boundaries is proving to be more challenging (FAO, 2016).

These realities underline the need for new policies that can provide new growth opportunities through innovative solutions that can increase investment and jobs. There has been a global push for 'smarter' solutions provided by digital technologies, and that focus on improved transport, healthcare and energy provision in cities (European Commission, 2017). In the case of developing countries, it is crucial that these solutions simultaneously focus on smart village policies where rural communities can access ICT, education, health and energy services to empower youth and young adults with the skills necessary to improve agricultural production opportunities and provide pathways to diversify into other forms of rural employment.

This paper focuses on linking proposed smart city strategies to smart village policies to ensure that rural youth have improved opportunities for employment through ICT initiatives to ensure digital inclusion, using primary surveys undertaken in India. This paper builds on the discussion on the spatial challenges that contribute to a digital divide in developing countries (Sujarwoto and Tampubolon, 2016) to explore the possibility of using demand-led bottom up solutions as a way to reduce spatial forms of exclusion.

2. Smart Cities, Smart Villages and the role of Internet Technologies in India

The concept of Smart Cities where the lives of citizens are improved by facilitating greater participation through the use of new technologies that permit greater responsiveness of

service providers has emerged as a solution in many high-income countries. The opportunity provided by better connectivity to bring together hard infrastructure and social networks has a strong potential for inclusive development (Department for Business Innovation and Skills, 2013).

The notion of Smart Villages is built around the notion of advancing economic and social development and regarding the provision of sustainable energy, healthcare, education, water and sanitation infrastructures as the key catalysts for ensuring improved livelihoods, increased incomes, human security, gender equality and democratic engagement (Holmes, 2017). The contribution of new technologies, such as digital and photovoltaic, takes place through the installation of new infrastructures, while in the Smart Cities formulation the focus is directly on the new technologies. One reason for the differential emphasis in the Smart Cities and Smart Villages formulations is the much greater deficit in infrastructure provision in rural contexts.

In the specific case of Smart Cities as India, the need for cities and an increased urbanization rate in the 21st century, is to move away from a predominantly rural based economy. It is important to note that 69% of India's population, lived in rural areas, while 31% million people reside in urban areas (Census 2011). However, a growing urban population poses challenges for a country that was the least urbanized among the top 10 countries in the world (Chandrasekhar and Gupta, 2014). Census data shows that India's youth are largely located in rural areas, with 70 per cent residing in villages while the remaining 30 per cent reside in urban areas (Motkuri, 2013). This spatial divide exists against a backdrop of a falling share of agriculture in the national GDP over the previous decade, falling from 66 per cent in 1993-94 to 56 per cent in 2003-04. Furthermore, the employment generating capacity of non-agricultural activities was higher than that for agricultural activities for all workers over the course of that decade (Dev and Venkatanaryana, 2011). There is concern that there has been a shift away from agriculture to non-agriculture, particularly in relation to rural youth employment (Van der Geest, 2010)[2]. The share of the non-agricultural sector in the rural employment has risen from 27 percent in 2005 to 42 percent in 2015, adding to the woes of the agricultural sector, as it has a poorer performance with regard to employment than any other sector in the economy (Basole, 2017).

These employment prospects occur at a time when India's education levels for youth (5-29 years) have been rising, with the latest figures showing that urban youth literacy rates of 86 per cent and 71 per cent youth literacy in rural areas (NSSO, 2014), and the Census data indicating a fall in the gender gap in literacy in both urban and rural India, and the figures for urban India at 89 per cent for men and 79 per cent for women, while the corresponding figures are 78 per cent and 68 per cent for rural India (Census, 2011). The opposing

[2] Van der Geest (2010) undertakes a global review of rural youth and employment and highlights the challenge of providing national estimates of this shift, as population data is not disaggregated by age group. The absence of large scale data has spurred scholars to undertake sample studies on the subject over the past few years.

tendencies in the trends of increasing educational achievements of rural youth, and the falling contribution of agriculture in creating jobs for rural youth, makes the opportunities that could be provided by mobile phone telephony in rural India a potentially important source of employment for youth[3].

The projections for the period 2014 to 2050 indicate that the India's population will increase from 1.3 billion to 1.7 billion (UN Population Prospects, 2015) and urban populations are expected to grow by 404 million people in India, while the number of rural residents is expected to decline by 52 million (UN Population Prospects, 2014). The government's 'Make in India' programme estimates that the increase to 843 million urban Indians, corresponds to 25–30 people will migrate every minute to major Indian cities from rural areas in search of better livelihood and better lifestyles (http://www.makeinindia.com/article/-/v/internet-of-things) and that the focus should be on the creation of smart cities.

The launch of the '100 Smart Cities Mission' in 2016, was followed by the announcement of the S*hyama Prasad Mukherji Rurban Mission (SPMRM)* aimed at making villages smart and the future growth centres of the nation, and a proposal for 2,500 Smart Villages to be established by 2019. To ensure a standard of development, 14 components have been included in a list of parameters: skill development training linked to economic activities, agro-processing, storage and warehousing, digital literacy, sanitation, provision of piped water supply, solid and liquid waste management, village streets and drains, streetlights, fully equipped mobile health units, upgrading school infrastructure, village road connectivity, electronic delivery of citizen centric services, public transport and LPG gas connections.

The intention of building Smart Cities and Smart Villages in India lacks any mention of potential for a explicit linkages between the urban and rural spheres. This shortcoming can be addressed by working with the E4SV concept of Smart Villages[4] that recognizes the central value of introducing rural community demands as a crucial component for ensuring the sustainability of technology based interventions in rural development. This addition is particularly relevant at a time when India, as a signatory to Sustainable Development Goals (SDGs) and the Paris Declaration, and this commitment requires not only specific, monitorable indicators but also an enabling policy framework and implementation capacity at the state level.

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[3] India currently has a relatively young population, with a median age of 28 years. This demographic profile is a consequence of a larger number of young adults entering the labour force than those exiting the labour force, creating a demographic bulge in the middle of the demographic pyramid. The phenomenon occurs when there is a change in population trends, and a reduction in fertility rates results in a smaller number of very young children and an increase in the number of young adults (Bloom, Canning and Sevilla, 2003). The opportunity for an economy with such a profile arises from the ability to have an upward spike in production and income, or a 'demographic dividend'.

[4] The Smart Villages Initiative http://e4sv.org/ focuses on innovative interventions to create demand led solutions for ensuring skills, health, education and empowerment through the creation of productive enterprises that build on upgrading human and technical skills

The idea of a Smart Village must consequently, not only focus on the means and design for providing access to basic infrastructure such as roads, water, power, education and healthcare facilities, but also focusing critically on the local institutions and networks that can ensure sustainable growth and development of these villages. Communication and information technologies will play a major role in design, delivery and monitoring of the services. Above all, the key to success in creating 'Smart Villages' lies in integrated planning which is well supported by robust monitoring and execution of the activities using appropriate governance models. Devising an appropriate Smart Village requires the use of an institutional lens to understand how development can be catalyzed in villages must focus on both supply and demand features of the provision of infrastructure, such as ICT service provision. Focusing on the organisations providing the ICT infrastructure as well as on the preference of the clients accessing these services takes place allows for a more nuanced matching of supply and demand (Fennell, Clark and van Gevelt, 2013), and in this paper we focus on the matching of the preferences of rural educated youth in accessing information as a way forward to improve the accessibility of services on the supply side.

3. The Contribution of Mobile Telephony for Increasing Internet Access to Rural India

India provides an important case study that shows how increased access to ICT can have very powerful impacts on improving economic opportunities, and also of the very inimical consequences for rural areas that are increasingly marginalised through exclusion from the Internet. While India has been a prominent player in the export of software exports, the diffusion of ICT remains in single figures (ITU, 2015).

India has embraced the Internet revolution quite recently. The Internet was first introduced in India by the government-owned agency, Videsh Sanchar Nigam Limited (VSNL), in August 1995. Internet services were initially provided as a monopoly service provided by VSNL, and was restricted to the four cities of New Delhi, Mumbai, Chennai and Kolkata. The entrance of private players and widespread adoption by users following the introduction of a new ISP policy in 1998, accelerated the ace of provision, and by the year 2000, the number of Internet users had grown to 10 million. By the end of 2009, there were more than 60 million Internet users in India, predominantly accessed through PCs. Although data services on mobiles were introduced in 2000, the huge growth in the user base did not occur until the introduction of 3G services that provided a huge boost to mobile Internet access. By the end of 2010, almost 40 percent of the 100 million users were accessing the Internet through a tablet or a mobile device. The introduction of 4G services is likely to provide further impetus to mobile-based Internet (Gnanasambandam, Madgavkar, & Kaka, 2012).

There is clear indication that mobile telephony is preferred over wired telephones among Indians.[5] The latest figures show that there are 1033.16 million wireless/mobile phone users as compared to the meager 24.87 million wired phone users. There are 584.25 million mobile phone users in urban India, and it would appear that the mobile phone subscription rate seems to be saturated, as there is a slight fall in growth rate of new customers (-0.37%). (TRAI, 2016), but the sole focus on urban consumers tell only part of the telecommunications story.

On the other hand, rural India is enthusiastically joining the mobile telephony platform with 448.90 million wireless/mobile phone users. Every month, an average of 0.24% increase in new customers is seen in rural India. Quite interestingly the presence of wired telephony subscribers is concentrated (20.73 million out of 24.87 million users) in the urban area, where infrastructure is better to make the necessary setup available. The meagre presence of wired telephony subscribers (4.15 million) with a negative growth rate (-1.95%), is a clear indication that wireless/mobile telephony has bridged an important gap in the digital divide; rural India is willingly and quickly adapting to the mobile telephony technology. Urban teledensity is 147.12, whereas rural teledensity is 51.27 for mobile telephones in 2016, and in relation to subscriber percentage, urban India has 56.55% of overall subscribers and rural India is fast catching up with a strong 43.45% of total mobile subscriptions.

There is a positive trend in the use of broadband the number of broadband subscribers increased from 151.09 Million at the end of April 2016 to 159.76 million at the end of May 2016 with a monthly growth rate of 5.74%. The number of users who access the Internet via mobile phones/dongles is the maximum with 142.06 million out of 159.76 million users as on end May 2016 (TRAI, 2016). The strong base of customers of mobile telephony is a platform that opens up an array of opportunities for youth who have access to ICT based information and services in India.

The ability of digital technologies to advance human and economic development lies in their ability to generate innovative interventions that can create opportunities for improving production possibilities. The key features that can be identified are (i) a significant reduction the time taken to access information, (ii) the ability to improve coordination of activities at home and at work, and (iii) the opportunity to scale up activities and increase entrepreneurship (World Bank, 2016).

Our focus is on the possibility that ICT services can be a powerful lever of change for the youth population by generating employment opportunities that can help youth achieve their

[5] The uptake of mobile phones in rural areas has a great deal to do with the lack of availability of landlines in many interior parts of the country, often at considerable distances of over 20 kilometres from a paved road. This could be a case of leapfrogging, while in urban areas the adoption of a mobile phone could be complementary to the use of a landline in the initial stages (Sauter and Watson, 2008). An early study by Narayana (20010) indicates that there is definite evidence of substitutability of landline and mobile phones in the city of Bangalore in the early 2000s.

unmet aspirations in the labour market. This is particularly important in the case of rural households to access education, where the parental generation has not completed secondary schooling it is difficult for them to successfully identify educational strategies that will ensure social mobility (Fennell, Malik, Agbley and Akbazaa, 2013). The achievement of educational and employment aspirations is key to the translation of the education outcomes into improving human lives and can be enhanced by appropriate information that is provided by ICT channels. Such a demand led formulation of skills for rural youth provides an approach that is distinctive and almost diametrically opposed to the dominant approach to smart cities based on smart grids and devices and focuses almost exclusively on supply side features. The Smart Villages notion proposes as a bottom up mechanism based on an data generated understanding of rural aspirations to generate economic growth, create wealth and sizeable demand for rural and agricultural products, thereby enabling the shift from subsistence to a more diversified and sustainable agriculture.

The reason for our proposing a focus on rural areas, and on the aspirations of rural youth is that the promise of higher agricultural productivity that is necessary to bring about a diversification of non-agricultural, income generating activities (e.g. food processing, construction, businesses and services) requires an in-depth understanding of rural communities. For a sustainable transition of the entire economy there needs to be a linkage of networks, both human and technical, between rural and urban areas to sustain growth and to promote the convergence of living standards for all citizens. Our argument is that youth populations in countries such as India, with a large demographic bulge in the young adult population, provide a valuable opportunity to leverage new technologies to create a more inclusive development model.

There is also a need to understand how the provision of mobile phones and ICT in rural areas can be a catalyst for rural populations, particularly among the youth, to improve their lives and livelihoods. The current educational provision in India has been unable to provide equal access for those who are spatially or socially marginalized, which means that poor rural youth have far fewer opportunities to access information on educational and employment opportunities (Fennell, 2013). The ability of mobile phone and ICT to overcome the barriers in accessing information will provide young people new pathways through which to realize their aspirations with regard to tertiary education and new avenues for diversifying into rural non-agricultural employment.

4. Youth Aspirations and the Opportunity of ICT

The adoption of Green Revolution technologies, characterised by High Yielding Varieties (HYVs) of wheat and rice in the 1960s, was regarded as a transformative strategy for rural India that would be achieved by increasing productivity through the cultivation of HYVs that results in a substantial increase in rural incomes. The state of Punjab has been a significant

contributor to India's agricultural production of wheat and rice, provides 13-14 percent of the total food production, and there was been a significant reduction in poverty by the 1990s (Shergill and Singh, 1995). The State of Tamil Nadu saw a major shift to rice production in the 1960s as a result of the High Yielding Varieties (HYVs) and by the 1990s this resulted in both an increase in income and a diversification into new high-income rural activities for middle and large farmers, though small and marginal farmers did not benefit to the same extent (Harriss-White and Janakarajan, 1997).

The benefits of the Green Revolution technologies plateaued in the 1980s, with a subsequent stagnation in agricultural productivity (Janaiah, Otsuka and Hossain, 2005). The continued adherence to an intensive agriculture strategy to ensure the cultivation of wheat-paddy annual crop cycles has led to pressure on water resources and a depletion of ground water and the nutrient balance (Frankel, 2015). In the last decade, there has been a marked shift in the sectoral contribution to GDP as the share of agriculture has fallen, and there has been a significant increase in the share of the tertiary sector (TERI, 2015). Life on the farm is no longer regarded as a preferred form of employment and youth are looking to other sources of employment. NSSO estimates (68th Round), the overall unemployment rate in Punjab is 3%, while it is 7.7% among the rural youth (15-29 years) and 6.3% among urban youth (15-29 years). It is noteworthy that almost 72% of the job seekers in Punjab are educated, and unemployed rural educated youth constitute approximately 54% of the aggregate rural unemployed in the state (Chadha, 2015).

In the case of Tamil Nadu, the annual population growth rate in rural Tamil Nadu is lower than the overall population growth rate of the state on account of a rapid urbanization process. In sharp contrast, villages with the most diversified employment cover a much larger population, are much larger in size, and significantly more literate (Vaidyanathan and Srinivasan, 2015). Furthermore, the data from the 2011 census shows that the share of the total members of workers in total labour force has declined from 69.70 percent to 68.84 percent over the period 2001-2011, indicating a falling ability to absorb the youth population who appear to have chosen higher education rather than entering the labour force after completing the secondary school cycle (Government of Tamil Nadu, 2014).

It is now half a century since the onset of the Green Revolution, when rural households that adopted the HYVs in the 1970s. The increase in the farm incomes that accrued to these households from the Green Revolution technology has provided improved investment opportunities for the next generation (Joshi, 2004). This additional resource has improved the educational status of rural youth, with the wherewithal to pay for the education of children of subsequent generations (Frankel, 2015). This provides a valuable opportunity to assess how educated youth access information to further improve educational and employment prospects in the successful Green Revolution regions in India. The ability to understand the preferences of rural youth with regard to education and employment provides much needed information about how they see their futures, particularly on whether they are looking to stay in the villages and

work as farmers or to travel to the city in search of urban employment. This is crucial information for policy design, as provisioning for a Smart City requires an accurate database on the number of new entrants, their skill sets and aspirations. The linkage to Smart Villages provides an important mechanism by which the preferences of rural residents, particularly of youth, become the catalyst for improving service provision and skills in the village and ensure a better matching when these youth look for employment opportunities both in the village and the city.

4. 1 The Indian Research on Rural Networks (IRuralNet) project

This project was funded by a UK-India Education and Research Initiative (UGC-UKIERI) grant, and was a collaborative partnership between two UK partners (University of Cambridge and Anglia Ruskin University) and two Indian partners (Indian Institute of Technology, Madras and University of Punjab, Chandigarh). The focus of this project was to develop a set of tools with which to examine and evaluate the opportunities for social entrepreneurship in rural areas, within the larger geographical context of India's rapid urbanisation. The aim of the IRuralNet project was to identify the bottlenecks that prevent Internet access from being used by rural youth to improve their opportunities for employment and entrepreneurship either in agricultural production or from diversifying into non-agricultural rural employment.

The first phase of the project was designing a research method for examining the educational and employment choices of rural youth, undertaken in collaboration with the pioneering incubation programme, Rural Technology Business Incubator (RTBI) set up by the Telecommunications and Internet (TeNeT group) at IIT Madras. The project partners devised a protocol that would permit us to examine the accessibility of the current programme of IP connectivity expansion in selected sites in the states of Punjab and Tamil Nadu. Our field research was designed to permit us to undertake data collection in these selected sites through the collection of upstream and downstream data. The upstream data was collected using the network sensing architecture application Portolan (http://portolan.iet.unipi.it/) developed by the University of Pisa, to map geo-located quality and availability of mobile internet connectivity. This allowed our team to construct appropriate maps of geo-located metrics for the quality of the connectivity supplied by every competing mobile provider. We were also able to explore and represent, in terms of network analysis, the set of upstream network interconnections, starting from the local mobile provider and ending at a chosen set of destination sites. The downstream data was collected using a survey instrument that was designed to examine how young adults in rural India used mobile phones to access the Internet and gauge their understanding of the facilities that are accessible through mobile phones and internet connectivity.[6] The survey explored the type of devices used to access the Internet, the knowledge of the functionality of mobile phones, as well as the usage pattern, the network

[6] The field research was conducted with the assistance of post-graduate researchers at the IIT, Madras and at the Department of Economics, University of Punjab, Chandigarh, between 2014-2016.

provider, and applications accessed using their mobile phones.[7] The questionnaire, which had closed as well as open-ended questions. In this paper we will be presenting the results of the downstream data on the nature of mobile phone usage by rural youth.

4. 2 Sampling

The purpose of the survey was to examine how the aspirations of rural youth are reflected in their usage of mobile phones, and to understand whether this usage data can assist in improving our understanding of what programmes might assist in improving the social mobility of rural youth in these Green Revolution regions of India. As the focus was on the youth population, those who had completed secondary schooling and were in the labour market or in tertiary education, we selected the age group, 18-35 years, which was further subdivided into 18-25 years and 26-35 years of age. This sub-division allowed us to further differentiate between new entrants into the group who were likely to be in tertiary education and unmarried, and the older cohort who were likely to be married and in a form of employment.

Our Survey of Internet Access in Rural India also built in the additional sampling criteria of distinguishing between areas of medium and poor connectivity to permit differentiation by Internet geographies. The selection criteria was within a distance of 10 kilometres for a mobile phone mast and beyond 10 kilometres from mobile phone mast, to understand how much poor connectivity affected the mobile phone usage.

The survey was conducted in the states of Tamil Nadu and Punjab between 2015-2016 and the villages selected were chosen in relation to the distance from a mobile phone mast. The graduate students who worked as part of the survey team were selected to ensure that they had previous experience of living and working in rural communities. This ensured that they had been sensitized to everyday rural practices so that they would be able to easily engage with the residents of the selected villages.[8] The survey team was trained in the survey instrument, and the survey instrument was implemented in each of the selected villages through a random sampling of the youth population present in the village on the day. The procedure for the sampling was devised after the survey team had undertaken a transect walk of the entire village and maps out all the location of all households in the village. Subsequent to this exercise the team walked through each street, and knocked on each door to enquire if there were youth members in that household. If the household member answered in the affirmative, then the survey team sought permission to interview the youth and young adults in the household. In cases, where the household member indicates that the youth were away but were likely to return

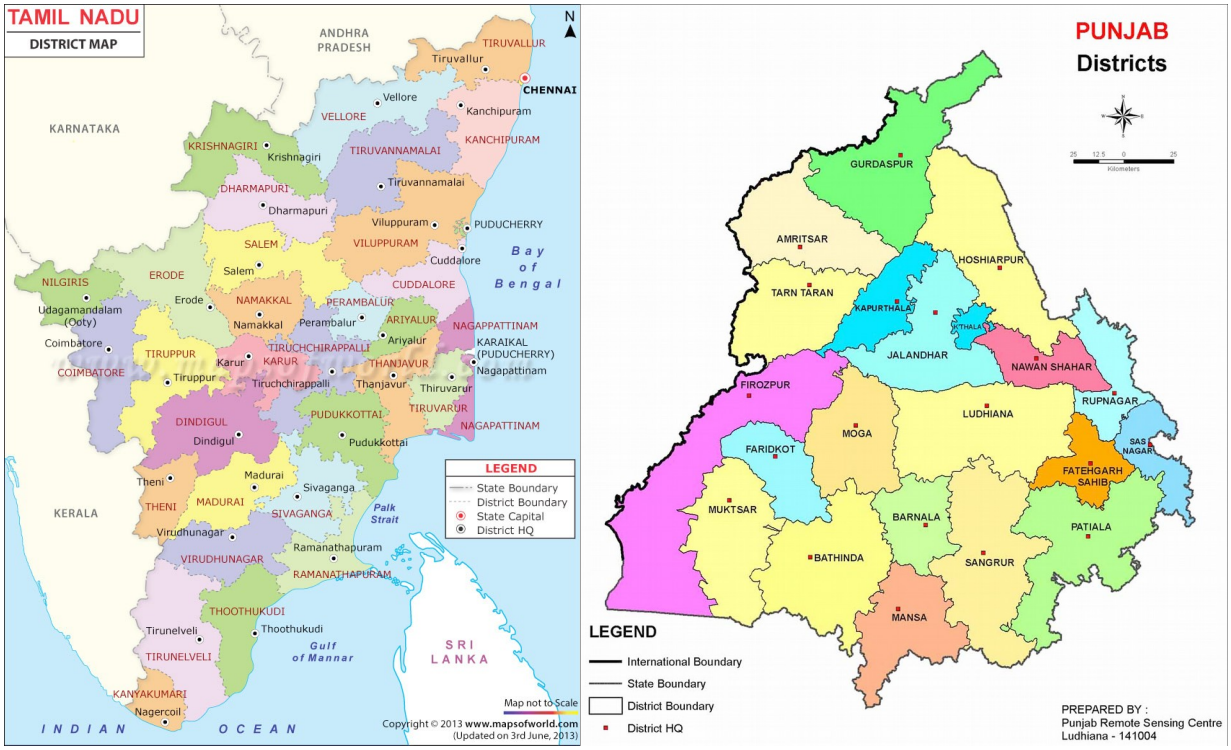
[7] Android 4.0 phones were introduced into the Indian market in the summer of 2014 and this made it possible for the survey team to download the Portalan App, and also allowed us to test the functionality of the range of new Android phones, Sony, Micromax, Lava and Karbon. It become clear in the pilot that neither the Lava or Karbon models had the necessary functionality to allow the Portolan App to operate.

[8] A pilot exercise undertaken by graduates who came from urban backgrounds provided very limited and poor quality responses, as the graduate team was unfamiliar with the cultural milieu of the village. They did not undertake a transect walk to map out the village instead they treated the survey as a market data collection tool.

later in the day or the followind day, the survey team returned to the household to carry out the survey. Care was taken to ensure a representation of both genders and of both age groups of youth. Verbal consent was sought from the participants prior to the administering of the questionnaire. The average time taken to complete each questionnaire was 15 minutes.

In Tamil Nadu, the study was conducted in three districts and there were 100 participants, while in Punjab the study was conducted in one district and there were 112 participants.

Fig 2: Areas of study



In Tamil Nadu, the selected districts were Vellore, Madurai, Pudukkottai, while in Punjab, the selected district was Fatehgarh Sahib. There were 71 men and 29 women in the Tamil Nadu sample, 31 in the age group 25-35 years and 69 in the age group 18-25. There were 78 men in the sample and 34 women in the Punjab sample, while 69 respondents were in the age group 18-25, while 43 were in the age group 25-35.

In both states, the selection of villages was undertaken to ensure that we had an equal number of villages located in areas of moderate Internet connectivity as and poor network connectivity. In the villages with moderate Internet connectivity (based on signal strength), both 2G services and 3G services were available, though often with varying strength.[9] Furthermore, in these

[9] In Punjab, it most villages are at a distance of less than10 kilometres from a telephone mast, indicating that the infrastructure for connectivity is already available. The team had to spend an entire day identifying specific

areas, almost all local networks were accessible. In the areas that faced network challenges and fell under the Network challenged area category, 2G services were accessible, but 3G services were usually unavailable. Furthermore, in these areas only a few locally available networks could be accessed. The team noted that residents in these areas had to step outside their home to access the network, and that the network coverage was far better in the street.

4. 3 Data Analysis[10]

The survey data showed distinctive patterns in the two states with regard to the employment characteristics of rural youth.

Table 1: Number of respondents by occupation

Occupation	**Punjab**	**Tamil Nadu**
Student	28	22
Self-employed	4	17
Farmer	24	0
Professional (office worker)[11]	25	18
Daily Wage Earner	5	13
Housewife	20	8
Unemployed	6	10
Total	112	100

The employment status of the respondents indicated that the no youth in the Tamil Nadu sample identify themselves as farmers, while a fifth of the respondents in Punjab self-identify as farmers. The responses to open-ended questions indicated that rural youth in Tamil Nadu did not regard farming as a preferred form of employment, while the respondents in Punjab indicated that they took up this occupation in the absence of any other source of employment. This disillusionment with farming is corroborated by recent studies that show the farming is no longer regarded as an attractive employment option (Agarwal and Agarwal, 2016; MSSRF 2014). The variation in the proportion of youth self-declaring themselves as farmers in the two states reflects the finding that the state of Tamil Nadu has the lowest percent of agricultural contribution to the state domestic product (IAMR, 2013).

villages that were in the poor connectivity category. This scenario is also present in the other districts of the state.

[10] As far as we are aware this is the first study of youth aspirations for employment recorded using community surveys in India. A recent paper that undertakes such research on youth employment and mobile phone usage in African contexts (Porter et.al. 2018) reports that mobile phones provide youth with information on opportunities beyond their current communities. By providing youth new social networks it allows them to move into new lines of employment and to overcome social exclusion and improve their mental well-being.

[11] The term 'professional' is a catch all to distinguish between those who were undertook manual work and those who were working in offices. The term professional signifies white collar work in this study.

There are also distinct differences in the proportion of self-employed youth in the two states, with self-employed youth in Tamil Nadu being four times the number in the Punjab sample, and this corroborates the recent finding that non-agricultural rural employment is rising in Tamil Nadu, so youth are migrating to nearby towns for such forms of employment (IAMR, 2013).

The gendered difference is also marked, with the number of housewives in the Punjab sample being twice then number indicated in the Tamil Nadu sample. Furthermore, the open-ended answers in the questionnaire indicated that the sample villages in Tamil Nadu, had a greater number of female youth who had left the village to work in towns in the district as access to the mobile phone had provided them considerable autonomy.

There was an almost universal access to mobile phones in both states, with the figures for Punjab at 97 percent and for Tamil Nadu at 94 percent. The three respondents who reported as not owning a mobile phone in Punjab did still have some access to a family member's phone. In the case of the Tamil Nadu sample, the respondents who did not have phones also indicated that they could rely on use of phones from family or friends in the case of an emergency or urgent errand. Furthermore, contrary to the common supposition that women in rural India are far less likely to own a mobile phone, our sample did not show any such relationship between gender and mobile ownership.

Table 2: Network Coverage

	Punjab	**Tamil Nadu**
In the Area around the House	6	12
Only in the House	0	0
Both Around and in the Home	102	88
Nowhere	4	0
Total	112	100

The network coverage in both the moderate and poor connectivity villages was almost universally present, thought there was a clear division in the quality of the service, with only 2G being accessible in the network challenged areas (Table 2). In the case of Punjab, over 90 per cent of the sample reported access to coverage in both home and area of residence, while it was just under 90 per cent in the case of Tamil Nadu. While there was a small number of households that did not have access in either the home or area in Punjab (5%) there were 12% of households in the sample households in Tamil Nadu that had to step outside their homes to access mobile phone services.

The respondents in both samples were experienced users of mobile phones, with over 75 per cent of the youth samples in both Punjab and Tamil Nadu having owned some make of mobile phones for a period of over four years (Table 3). The familiarity with mobile phones evident among educated rural youth is in line with other primary findings that this demographic group is rapidly adopting this form of communication (Mehta, 2013), but the long-standing use of phone has not yet been identified in previous studies. The implications of this finding is that such rural youth are likely to be well informed about the facilities provided by mobile phones and have a clear set of preferences.

Table 3: Years of ownership of a mobile phone

Duration	**Punjab**	**Tamil Nadu**
Less than one year	1	5
1-2 years	16	10
2-4 years	10	8
Above 4 years	85	77

These preferences are evident in the choices that the respondents made with regard to service providers in their area (Table 4). The preference structure in each sample closely matches the share of the mobile market held by each of these service providers, at the national level the four major providers are Airtel, Vodafone, Idea and Aircel, but Idea has a much greater share in the north and Aircel has a much larger presence in the south of the country (TRAI, 2016). It is noteworthy that the preferences indicated by the youth samples also reflect these differing market shares very clearly.

Table 4: Service Providers in Punjab and Tamil Nadu

Service Provider	**Punjab**	**Tamil Nadu**
Idea	51	3
Airtel	31	35
Vodafone	11	44
BSNL	10	2
Docomo	4	2
Reliance	2	6
Cellone	2	0
Videocon	1	0
Aircel	0	21

There is an even more pronounced evidence of preferences with regard to phone models, with a majority of youth users preferring to use a windows based, or Android phone over the basic models in both states (Figure 4). There is clear evidence that the youth in Punjab had a greater preference for top end models, with twice as many youth owning an Android phone. Even more

noticeable is the not-insignificant presence of iPhones evident in the youth population. In the open-ended responses the youth respondents spoke about the status of having an iPhone, and one respondent explained that she had both a basic phone and an iPhone. She went onto to explain that the latter was reserved for personal calls to her husband, who also had an iPhone and both phones had matching phone covers- a very powerful enunciation of the sophistication of mobile brand preference!

Figure 4: Ownership of Types of Phones

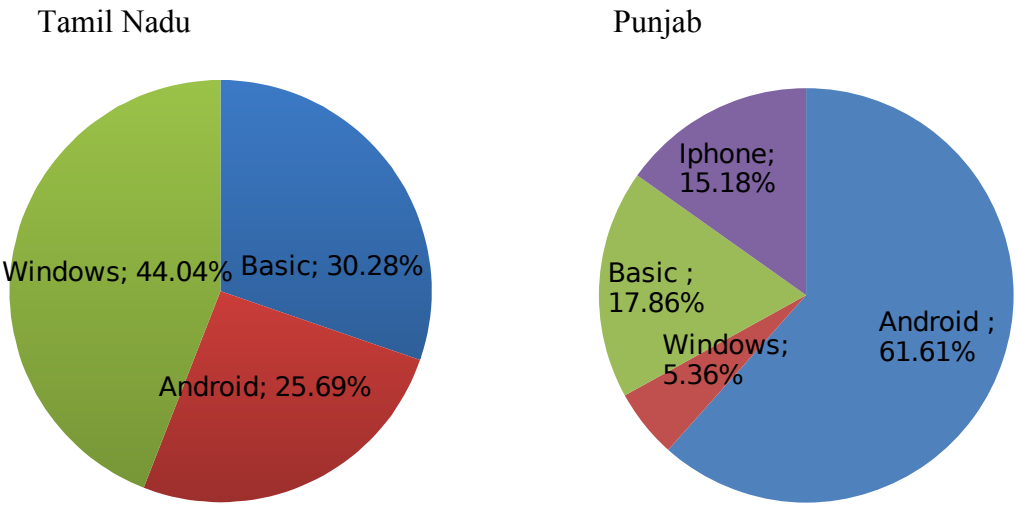


Table 5: Preferred Language Mode to receive information

Mode	Punjab	Tamil Nadu
SMS – Punjabi/Tamil	9	5
SMS – English	39	91
SMS – Both, English and Punjabi/Tamil	59	3
None	4	2

The youth in both states also show very different preferences for the language in which they receive text messages and information (Table 5). There is much more marked preference for an English language text in Tamil Nadu, and as the youth sample there showed that 90 percent prefer English, while in Punjab only 30 percent showed such a preference. In contrast, there is a far greater preference for SMS that use a combination of Punjabi/English (60%) while only 3% of the Tamil Nadu youth sample, chose a combination text in Tamil/English. In the open-ended discussions undertaken with youth in Tamil Nadu, they indicated that they preferred English texts as these provide an opportunity to read English sentences and that they regarded the

quality of language construction in these texts to be superior to their own, as it was likely to have been written by individuals who had fluency in the English language.[12] This finding could be linked to the recent finding that in the state of Tamil Nadu there is a large percentage of secondary students take engineering examinations and this requires a adequate understanding of English (E &Y, 2015).

The survey was also able to throw light on the preferred method for accessing the Internet, indicating that the two-thirds of Tamil Nadu youth sample using their mobile phones, while over 90 percent of the youth sample in Punjab use their mobile phone to access the Internet (Figures 5 and 6).

Figure 5: Method of accessing the Internet in Tamil Nadu

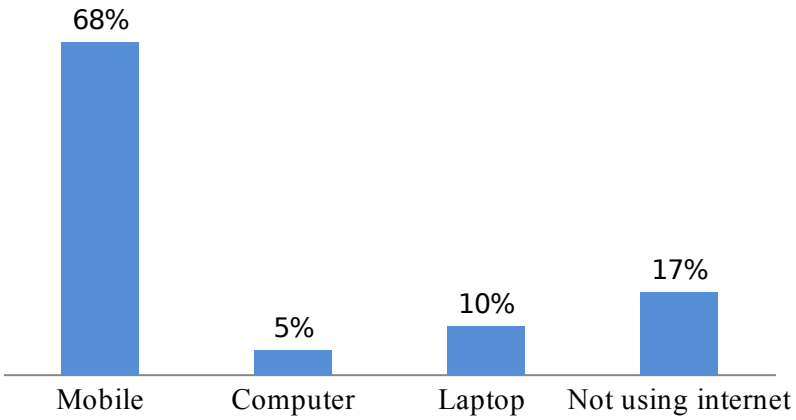
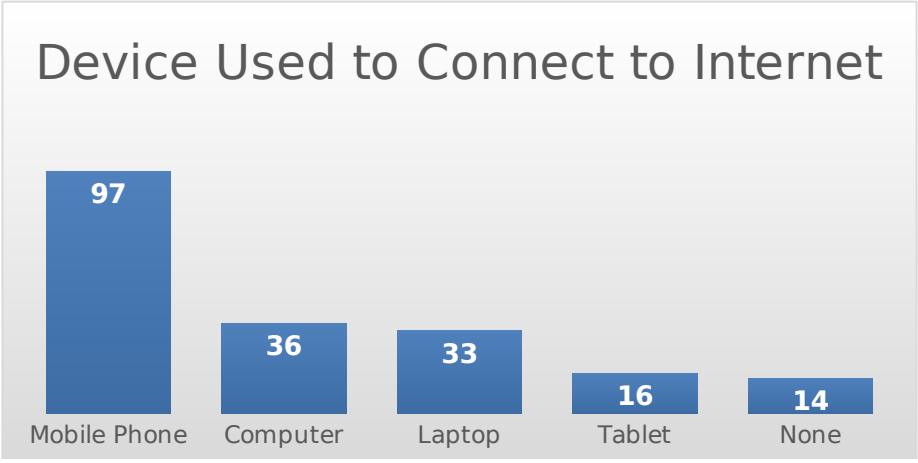


Figure 6: Method of Accessing the Internet in Punjab



[12] This perception was also corroborated in the comments provided by rural youth on the online platform Rural Aspirations Support Appliance for Youth (RASTAY), that was an innovative peer to peer pilot conducted by RTBI, to understand the aspirations of rural youth in tertiary educational institutions in the state of Tamil Nadu.

In the case of both samples, all the respondents who accessed the Internet used the mobile phone as their first preference to access the net, and only chose the computer, laptop or tablet in situations where the mobile phone was not able to access the Internet (Figures 7 and 8). The decided preference for the mobile phone is further indication of the decided preferences of this demography.

More than 75 percent of all the respondents, both in Tamil Nadu and Punjab, also indicated that the duration of use of the Internet was for more an hour, while there was a significant difference in the frequency of use with over half the youth population in Tamil Nadu accessing the internet every day, whereas the three-fourth of the Punjab sample were daily users.[13]

Figure 7: The Frequency of Internet Usage in Tamil Nadu

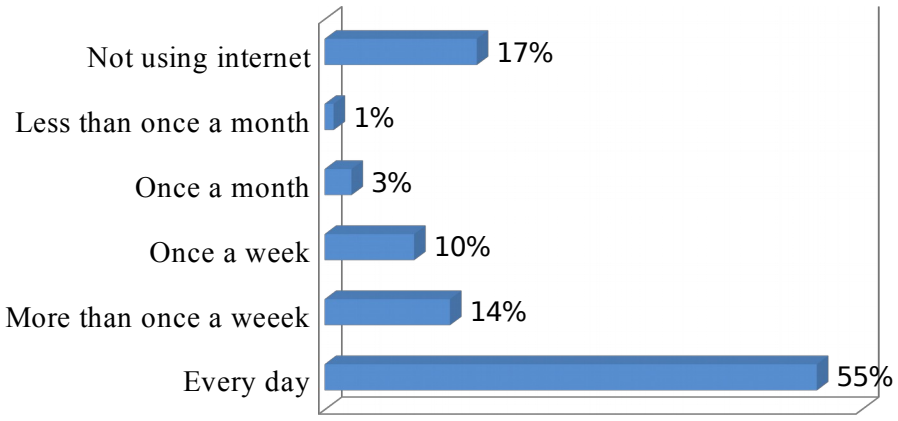


Figure 8: Hours Spent on the Internet in Tamil Nadu

[13] The frequency of use appears to be related to the availability or non-availability of 3G or 4G services. Where the service was minimal and only 2G was available the respondent did not show a willingness to spend time on the net. Furthermore, respondents who spent a considerable period on the internet appeared to have an upgraded contract and service bundle and/or access to laptops and other methods of accessing ICT services.

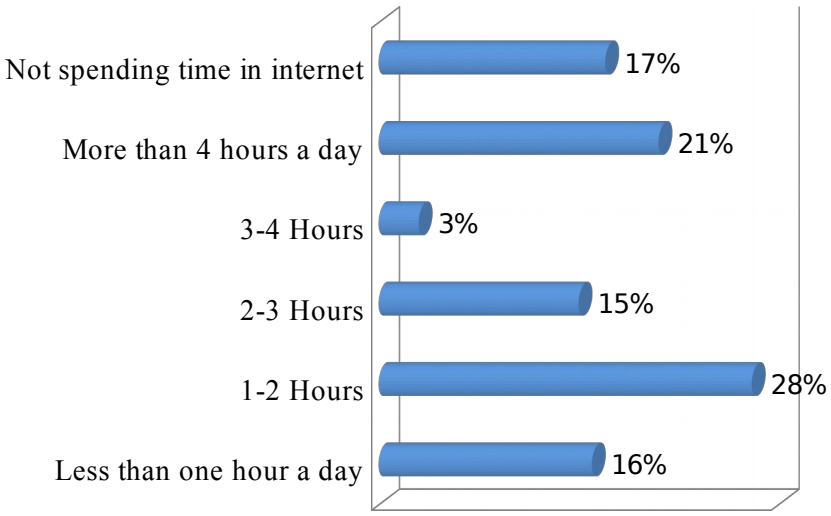
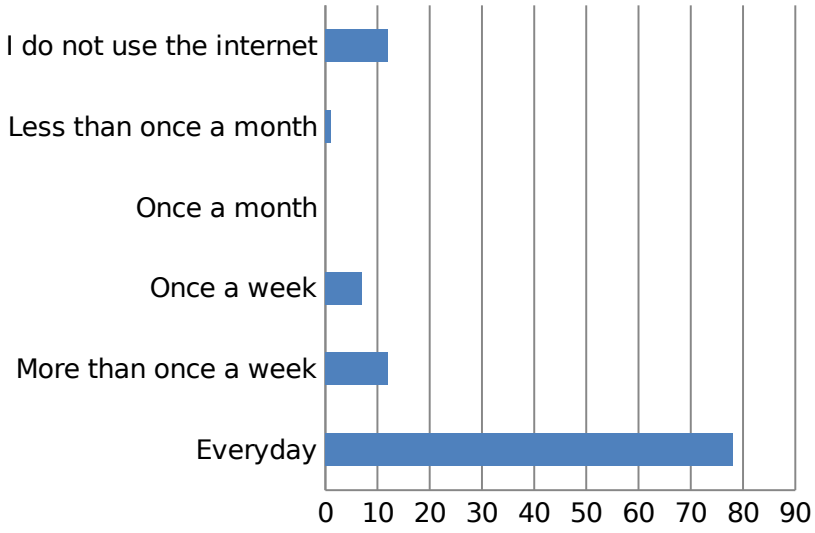
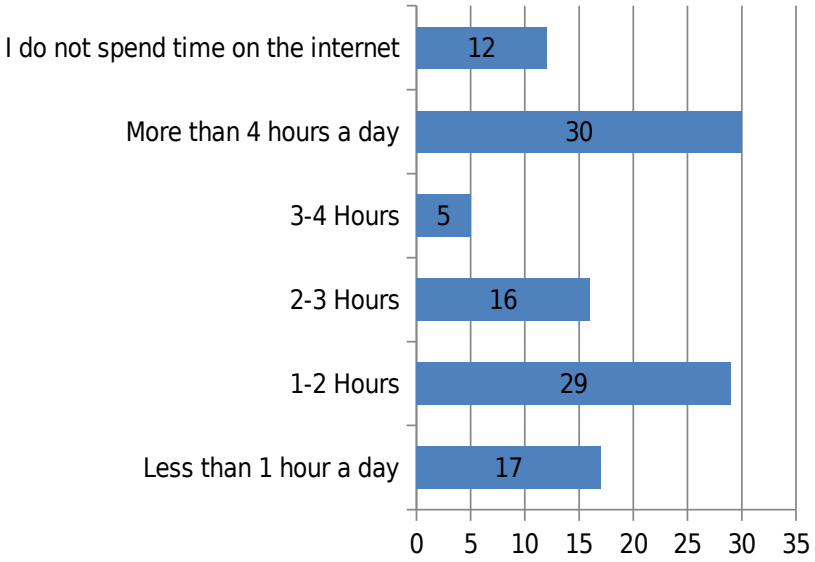


Figure 9: Frequency of Internet Usage in Punjab



There was also a difference in the daily usage within the youth demography in Tamil Nadu, with three fourth of the younger age group accessing the Internet on a daily basis while only half the respondents in the age group 25-35 access the Internet on a daily basis. Internet usage is higher amongst individuals aged 18-25, with 78% of the age cohort reporting daily usage. 59.5% of the 26-35 years age cohort use internet daily. There was also no significant difference in the frequency of usage between men and women, as both were at around 70 percent.

Figure 10: Hours of Internet Usage in Punjab



In the case of the Punjab sample (Figures 9 and 10), there was a similar difference between the younger and older age group, with three-fourth of the younger age group accessing the Internet every day and for over an hour, while the older age group that accessed the Internet was close to 50 percent. There was also a gendered pattern to the frequency of usage, with just under half the women in the youth sample accessing the Internet of a daily basis.

The survey also asked the respondents to list all their pattern of usage, allowing them to select more than one activity (Figures 11 and 12). The pattern of usage shows specific preferences for downloading of music, social networking and email usage in the case of the Tamil Nadu sample, while there is a far more variegated usage pattern in the case of the Punjab sample, and evidence of usage of web-browsing. There is also far greater use of the Internet for job-searches and academic purposes among youth in Tamil Nadu, as well

Figure 11: Internet usage pattern in Tamil Nadu

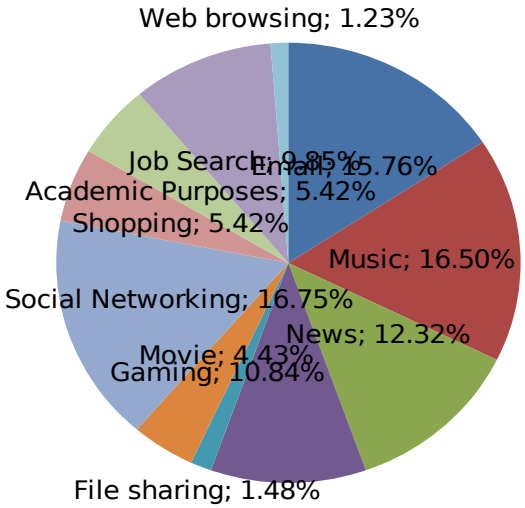
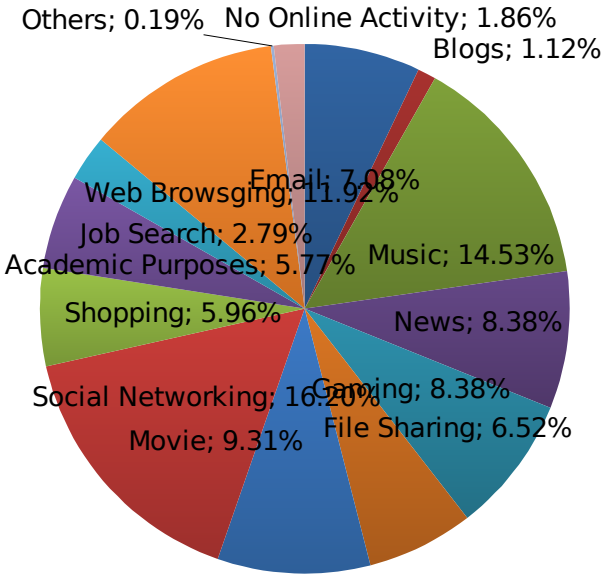


Figure 12: Internet Usage Pattern in Punjab



The pattern of applications used by youth is also indicates the importance of accessing information and Whatsapp, Facebook and Facebook Messenger are the most popular, with over 40 percent of the youth sample using Whatsapp, and 30 percent using Whatsapp in the case of youth in Tamil Nadu (Figures 13 and 14). Furthermore, when respondents were asked if they would use Wifi if provided as a free service, over 90 percent in both samples responded positively.

Figure 13: Activities Accessed on the Internet in Tamil Nadu

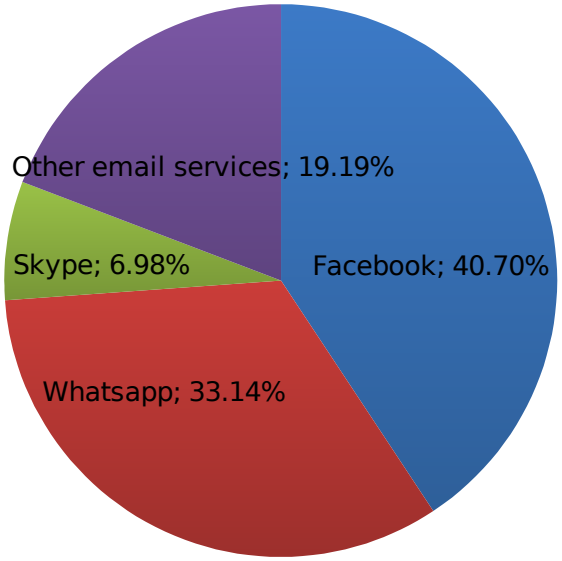
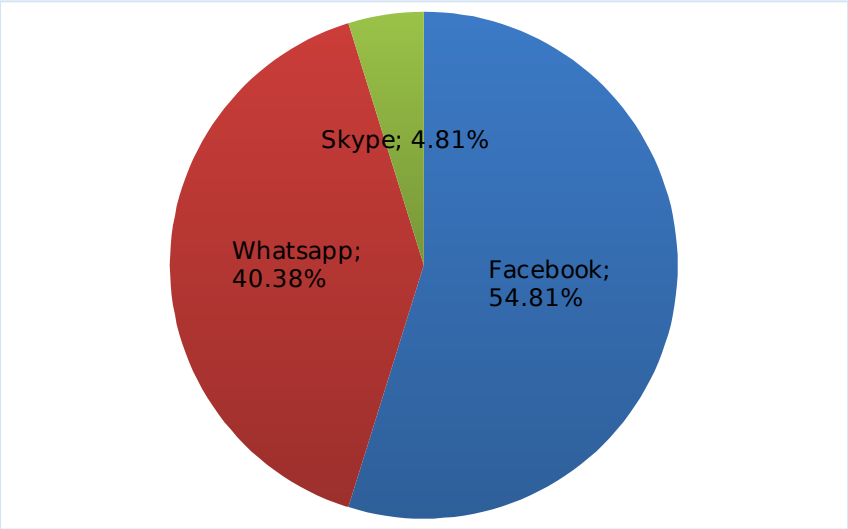


Figure 14: Activities Accessed on the Internet in Punjab



The preferred areas that all youth were keen to access through the free WiFi related to entertainment and education in both Tamil Nadu and Punjab, where the preference for Entertainment was particularly marked in the case of Punjab (Figures 15 and 16). The pattern of application use and activity preference in rural Punjab is very similar to that in urban Punjab, and reflects the prognosis of recent reports that rural mobile phone users will increase as will their usage of applications and functionality (IAMAI, 2015).

Figure 15: Preferred activity if Wi-Fi is provided in Tamil Nadu

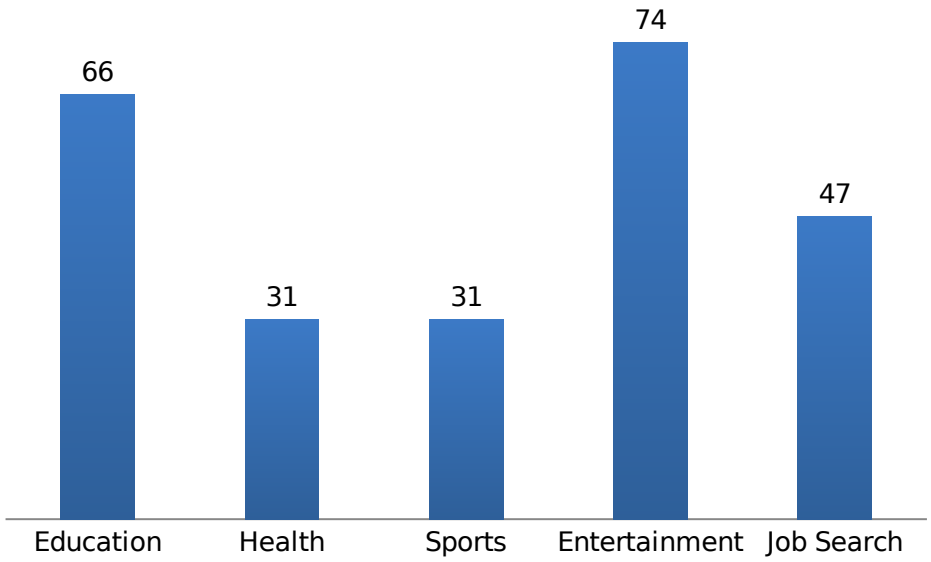
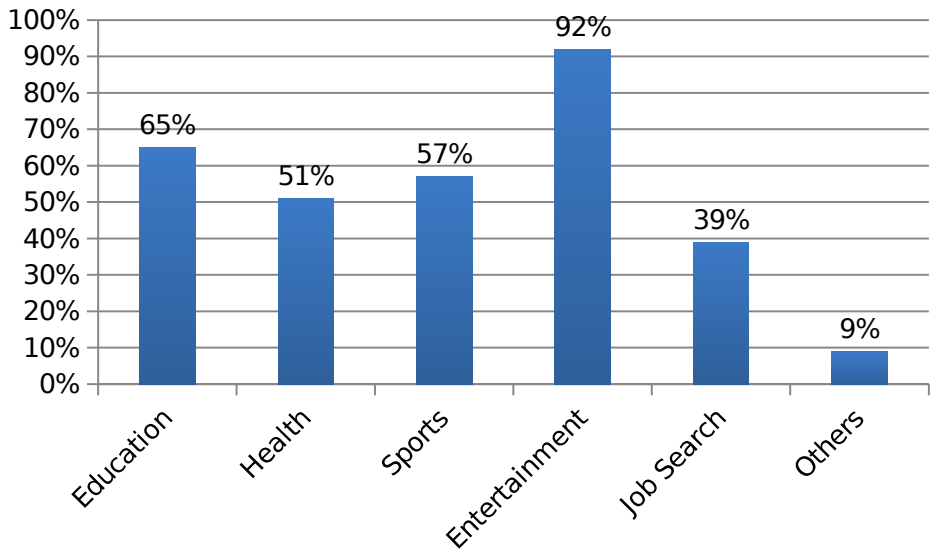


Figure 16: Preferred Activity if Wi-Fi is Provided in Punjab



5. Discussion and Conclusion

The data analysis shows that youth in rural households in Punjab and Tamil Nadu are using their mobile phones to improve their access to educational and social informational features. There is considerable evidence that shows that rural youth are experienced users and that they have an established preference structure that is not dissimilar to that in evidence in Tier I cities in urban India. New opportunities that are becoming available to rural youth through mobile telephony and the ability of youth to use the Internet on a daily basis and to use a range of applications to achieve their aspirations indicate that there are new pathways that are being devised to improve their skills and employability. This analysis corroborates the argument that digital literacy can be achieved through greater participation in digital usage (Sharma et. al, 2016)

The ability of youth from theses rural households to exercise demands, based on their preferences and through accessing mobile technologies indicates that these groups are also accessing the good life (Appadurai, 2004:68). This pathway to empowerment is based on the ability of young people to participate in making better educational and employment choices, and can become an important opportunity for public policies that allow for more decision making through bottom up demand processes. The demand side research tools that have been used to in this research project focus on examining the role of youth participation in ICT use to understand how best to improve supply side ICT provision.

The aspirations of rural youth indicate that they have made choices based on well-defined preferences regarding the method and frequency of Internet usage. Their use of social media to acquire additional information about education, skills and employment, as well as creating a

social network for this particular demography is indication of a sophisticated consumer base. These findings indicate that digital technologies can provide opportunities for linking innovative technologies to improving the range of productive employment opportunities for rural youth. It is noteworthy that all rural youth do not regard farming as an attractive proposition and prefer non-agricultural rural employment, and these are indicated in they choice of English as the preferred language for SMS messages as a pathway to access more diversified forms of employment. It is also telling that the access to new technologies does not show strongly gendered usage, not does it fall off as youth move from education (18-25 years) to employment (25-35 years) and married life.

These findings could also be used to build on existing ICT initiatives that have had an impact in rural society, such as ICT enabled outsourcing using reduced cost and requiring minimal infrastructure facilities to set up rural BPOs in rural areas rather than forcing rural workforce to migrate for employment (DesiCrew) to urban areas (Jhunjhunwala 2013). There is also a valuable opportunity to draw on the youth demand for jobs by further diversifying rural non-farm employment by emphasizing high value agri-processing activities. This could be undertaken in conjunction with existing initiatives for increase ICT based extension services such as those provided by AGMARKNET, eChoupal, Mahindra KisanMitra, M.S. Swaminathan Research Foundation (MSSRF), Mobile Advisory Services by Krishi Vigyan Kendras (KVKs) of Indian Council of Agricultural Research (ICAR) (Raj, 2015).

The expansion of ICT initiatives into rural India has been hampered by the urban myth that rural households do not have the ability or the finances to participate in the digital revolution. The current study has used an innovative survey to show that this is an inaccurate economic understanding and that the youth in Green Revolution regions of rural India have a diversified demand and a well-established set of preferences for mobile services.[14] It is no longer the case that mobile telephone service providers and mobile sales packages should regard the rural economy as lacking the wherewithal to access high quality services. In fact, our data point out that it is the poor accessibility of 3G services that is the major impediment to the ability of rural youth to access the Internet on their mobiles.

The mobile phone revolution provides a powerful lever that can catalyse rural households into Smart Villages that are distinguished by their ability to use this new technology to improve education and employment prospects for rural youth. In the current scenario, where youth are using mobile phone access to increase their social information base, it is indeed possible that the new social media groups formed by rural youth becomes a powerful conduit for generating new employment opportunities. Finally, it appears as though the ability of youth to redraw their own lives through being able to choose preferred forms of information provides them a form of

[14] A recent cross-country study for African countries indicate that mobile phone ownership has a positive correlation for employment for rural youth both in rural self-employment and urban employment outcomes (Khan et.al, 2017).

bottom up governance that has not been previously recognized as a form of empowerment in rural India.

Keywords: Accessibility, digital inclusion, connectivity, youth aspirations, Smart Cities, Smart Villages, India, Punjab, Tamil Nadu

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