

# A Review of IT Initiatives in Rural India

Full Paper

**Aishwarya Bedekar**

Department of Computing  
Macquarie University  
N.S.W. 2109, Australia

[aishwarya.bedekar@students.mq.edu.au](mailto:aishwarya.bedekar@students.mq.edu.au)

**Peter Busch**

Department of Computing  
Macquarie University  
N.S.W. 2109, Australia

[peter.busch@mq.edu.au](mailto:peter.busch@mq.edu.au)

**Deborah Richards**

Department of Computing  
Macquarie University  
N.S.W. 2109, Australia

[deborah.richards@mq.edu.au](mailto:deborah.richards@mq.edu.au)

## Abstract

Empowerment may be at the individual, organizational or up to the whole of country level. This paper examines ICT initiatives as an empowerment enabler in rural India. One rural eHealth empowerment initiative is the Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP). An example of an eGovernance initiative is Bhoomi, while the rollout of computers will enable not only eGovernance but eEducation as well. Facilitating such schemes is the use of Solar Minigrids as a means of strategically adding to the electrical power supply, as a means of overcoming electricity shortages, which is even more of a problem in rural areas than it also happens to be in the urban centres of India. This paper not only explores these technological empowerment initiatives, but examines parameters aiding and hindering such stratagems, including issues surrounding resistance to change, gender role expectations in communities and lack of basic infrastructure.

## Keywords

Empowerment, Rural India, KIDROP, Solar Minigrids, eLearning, eGovernance, eHealth, Gender.

## Introduction

The government of India's "Digital Initiatives" (Anon. 2004) program is well underway. In the race to promote the digital empowerment of its citizens, major information technology players such as *Facebook*, *Google* and *Microsoft* are involved in a government sponsored awareness of digital connectivity and to make India, which is already home to the third largest number of internet users globally (Anon. 2013b; Anon. 2014a.), the second largest user market by the year 2016. In order to make this initiative a success, the government is launching workshops, education programs, distributing hardware and devices, as well as setting up kiosks in metropolitan and rural areas - in particular targeting the Indian rural communities that are spread across isolated areas of the nation (Digital India, 2015). Together with the government's eagerness to spread the vision of digital knowledge and equality to all across India, the *Ministry of Communications and IT* will soon roll out the *National Optical Fiber Network* (NOFN) to support and connect more than 250,000 villages around the nation with high speed broadband (Yap, 2012). Concurrent with the NOFN program, computer hardware is being distributed to rural underprivileged students, along with other communication strategies such as increasing mobile networks, providing an open information Kiosk, and developing mobile applications and hotlines for various rural communities.

In the context of such empowerment initiatives in rural areas, the impacts of the mass introduction of technology on society, communities and individuals are often overlooked. There are however some very real issues impeding the delivery of benefits including low literacy, lack of access to the most basic health and medical facilities, as well as the digital divide, such aspects being particularly pressing for rural parts of India. Certain isolated sectors face far worse situations due to the government focus on the progress of

the nation's urban and metropolitan cities, even though a substantial but decreasing proportion of national progress is contributed by the rural sectors and their efforts in agriculture, the output of agriculture has nonetheless increased (Anon., 2013a; World Bank, 2014). Addressing this imbalance, *Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity* (KIDROP) and *Computers and Solar Mini-grids* are initiatives that were introduced in urban and rural regions to promote growth and progress, as well as connect the rural sectors with the wider nation and the globe, and tackle the issues of low literacy, lack of basic health care and the distance to facilities. This paper reviews technology empowerment initiatives attempting to ascertain the impact of technology experienced by users. We begin with a brief discussion on empowerment.

## Background

Empowerment is a topic researched in education, social studies, community development, organizational research and psychology to name but a few disciplines (Perkins and Zimmerman, 1995; Rappaport 1987, Zimmermann, 2000). Comprised of a number of elements including that of power itself, empowerment may be studied with a view to the effects of technology as is the case here. Under the umbrella of empowerment a number of terms appear in the literature including control, self-reliance and independence (Narayan 2002). Also given that empowerment is researched from the individual through to national levels, processes, outcomes and developed frameworks vary widely in the literature (Alsop and Heinsohn, 2005; Rappaport 1984, Zimmermann, 2000). Importantly, one underlying belief is that goals can be achieved, and there is an awareness concerning available resources and factors that thwart or augment efforts to accomplish these goals (Alsop and Heinsohn, 2005; Zimmermann, 2000), for as people exert actual choice, they gain increased control over their lives. In line with the technological focus adopted in this paper, Information and Communications Technology (ICT) represents a key enabler of empowerment today, particularly so in rural areas where ICT creates more of a level-playing field, permitting rural populations to keep at least a better pace with their urban cousins. Numerous examples of such rural technological initiatives exist in the literature, such as the Egyptian Rural and Agricultural Development Communication Network (RADCON) project using an interactive community-based information network meeting the communication needs of rural farmers (UNICEF 2011), or the Indonesian 8villages project conveying information to mobile phones using social networks (Vaswani 2012), or the Indian e-Choupal project supplying farming information also via mobile phones (Radhakrishna 2011). And it is India that forms the focus of the initiatives discussed in the paper here.

## Methodology

Secondary analysis (Payne and Payne, 2004) was used to research two variables – *rural India* and *technology* and its shared relationship - in order to analyze the reason behind the particular impact of technology. Secondary analysis in this case attempted to answer the question of whether improper and uninformed implementation of technology in rural India took place, or whether residents of rural sectors of India were not ready to accept change. In order to conduct the research, a structured way of gathering information via a key word search of *rural India* and *Technology* was conducted. The literature was then deconstructed and the main information regarding the impact of technology implementation on the rural sector was extracted, reviewed and summarized. The literature was divided into two categories: 1) literature about the needs, particularly informational, of rural India, and 2) the implementation technologies chosen for the rural sector. The literature contained in each of the categories was then matched to see if there were any dependencies or relationships between the rural villages and the chosen technologies that were deployed in the villages. The result of this secondary analysis led to the development of a conceptual model (figure 1) that illustrates empowerment parameters affecting the adoption of ICT in rural India. Although the initiatives illustrated for empowerment are limited to just three – eLearning, eGovernance and eHealth, these are by no means exhaustive and illustrate just some of the schemes in place by the government. Clearly electricity is the underlying mechanism through which empowerment can be achieved. One such example is the improved health of women in developing economies through the use of electrical stoves in the home, overcoming the daily inhalation of smoke from fires – characteristic of so many hearths in the unsophisticated home. Note also the positive and negative forces at play in bringing about empowerment – each can be seen from a different viewpoint with associated advantages and limitations. Let us now examine the initiatives by the Indian government.

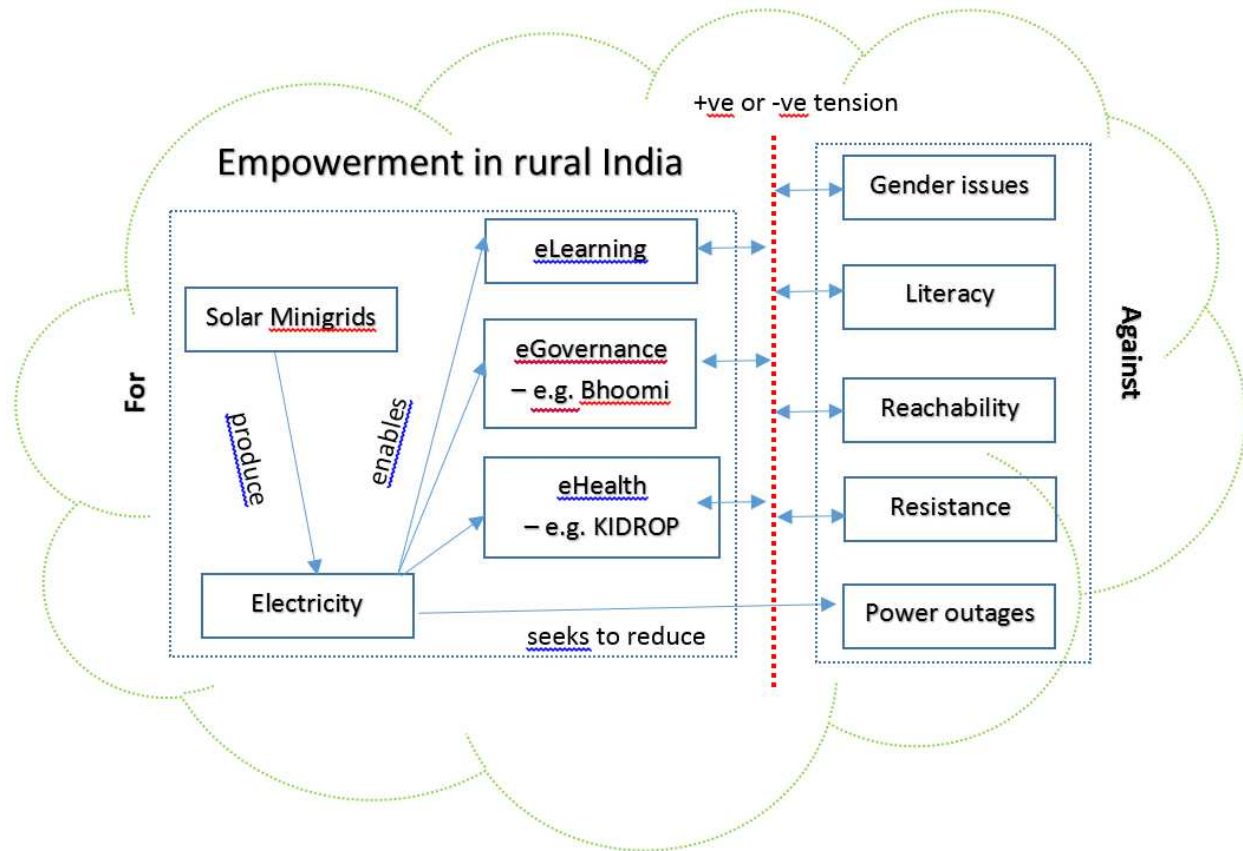


Figure 1: Illustrating technological empowerment and dis-empowerment forces affecting IT in rural India.

## Empowerment Initiatives

The government of India introduced the ‘Digital initiative’ in order to spread digital awareness via three different forms of technology – (1) KIDROP portable cameras, (2) Computers and (3) Solar mini-grids, addressing different user needs while attempting to eliminate problems faced by the community. The aim of these projects was not only to spread digital awareness among the rural population, but also grow user confidence through addressing issues currently faced by residents of rural communities. We review each project in turn, first providing a background summary then examining intended users of the technology, the benefits delivered to them and finally the limitations of the technology and/or its method of delivery.

### ***Technology 1 – Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP) – portable cameras***

The KIDROP project is the first tele-ophthalmology initiative in the world to use non-physicians, also known as ‘trained technicians’. KIDROP is used to capture images of the retinas of infants as young as one week old, to detect any potential blinding condition called retinopathy of prematurity (ROP) and validate, store, process and analyze the processed images at centers situated in the Indian rural districts themselves.

This system works in such a way that the processed retinal images are uploaded to a customized hardware/software platform that allows the technicians to remotely give access to experts to view the uploaded images taken of the infants eyes and report in real time on the condition of the child, via the medium of either a PC or smart phones (Vinekar, 2011, Vinekar *et al.*, 2014). KIDROP was pioneered by one of the leading private tertiary eye care providers in India – Narayan Nethralaya Postgraduate Institute of Ophthalmology, Bangalore, as part as of a social initiative to help millions of children who lose

their eye sight at a very early age due to negligence and inadequate access to health facilities provided to the under-privileged in rural communities.

### **Users**

The reported issue of Retinopathy of Prematurity (ROP) from all over India has been on the increase since 1995. However, the effects of ROP are far more severely felt by children and prematurely born infants belonging to rural communities, due to malnutrition which contributes to being underweight, along with the issue of inadequate health care facilities. Almost 47% of the babies born have low birth weight, or are subject to malnourishment making them at highest risk of ROP (National Neonatology Forum of India, 2005). Vinekar *et al.*, (2007) estimates that every three hours, three children in rural India require comprehensive ROP treatment however no adequate treatment facilities exist.

### **Benefits**

Due to the KIDROP project, the level of ignorance and negligence of the Indian rural sector has been exposed. At the same time the risk of vision impairment and the high chance of death from late medical attention due to distances between villages and the nearest medical facility were reduced. KIDROP is underpinned by the 3T's – *Tele-ROP*, *Training* of peripheral ophthalmologist (in order to attend the maximum number of patients in rural areas) and *Talking* to a neonatologist to increase awareness and minimize the effects of ROP amongst infants. Through the KIDROPs functionality, patients can be screened by their bedside by trained technicians and via the principle of “pattern recognition” the technicians can then process, store, analyze and report ROP. The images are then uploaded by which specialists can remotely access images in real time, anywhere via a PC or smart phones and send an immediate response on the child’s situation as well as advise on further procedures to be undertaken. With the system’s functionality dependent only on a portable camera, over 76% of the system services are offered for free - only those who can afford to pay are charged; this cost-free initiative encouraged thousands of parents to receive early medical treatments for their children. The initial successful implementation and benefits of KIDROP encouraged the Indian government to spread the system across more than 24 different states and open KIDROP screening centers. In one month more than 550 infants are screened in each center, of which 330+ are actually treated at the respective centers (Vinekar *et al.*, 2007).

### **Limitations**

Two key limitations of KIDROP were identified: the cost of infrastructure and resistance by care givers. Even though sponsored by the government of India, the *National Rural Health Mission* and the *Ministry of Health & Family* have entered into a public-private partnership, the cost of hardware constitutes more than USD\$135,000 per retinal camera alone. The *Narayan Nethralaya Postgraduate Institute of Ophthalmology* runs on a not-for-profit model, however due to the price of hardware, camera implementation is limited. Resistance also existed due to a lack of awareness and education, as well as inadequately trained personnel and a general unwillingness to adapt to innovation. A lack of education in rural areas, leads to an unwillingness to adapt to innovation, and is one of the prime factors practitioners face today. Parents are fearful of placing their children especially if underweight or premature under cameras, or to be handled by trainers as they believe the equipment being used or procedures followed may harm their children (Vinekar *et al.*, 2007).

### **Technology 2 – Computer Rollouts**

The right to education, healthcare and government facilities is a primary right of all Indian citizens regardless of age, race, gender, caste etc. However 638,000 rural villages still struggle to access the most basic facilities due to a digital divide, reflected in the population ratio in urban vs. rural sectors, illiteracy, a lack of information, travelling distances and wage disparities (Roy, 2012). In recent years various organisations have sought to provide computers and ICT to address the lack of progress and development in these areas.

## Users

Due to a focus on agriculture in rural communities, more importance was given to the development of agricultural activities rather than initiating programs to increase village interest in education. However, recently there has been a major social push in advocating eLiteracy and eLearning via computer labs in schools from a grass root level (Arora, 2007). There is growing aspiration amongst parents of children to become computer literate and to move away from the hardships of agriculture. To tackle such issues, more than 80% of agricultural workers prefer their children to migrate away from villages in order to spare them from a life of agriculture, with 20% of parents preferring their children to stay in villages (Pal, Lakshmanan and Toyama, 2009). Parents see the introduction of computers in schools as a means of increasing their prospects of gaining various occupational options rather than staying with agriculture. The majority of the rural sector consists of farmers that were either pulled out of schools or had no opportunity to attend school to begin with. Literacy rates in rural areas are hence considerably lower. Furthermore, poor literacy means that residents of rural villages miss out on opportunities such as government provided services and administrative work. Access to information, opportunities and training via computers may be able to bridge the gap.

## Benefits

The introduction to computers in schools has delivered the greatest advantage for students belonging to rural communities as new learning techniques and self-development methods can now be adapted and taken advantage of via ICT and eLearning.

### 1.1.1.1 Bridge the gap between local and global

Through the medium of computers and the internet, students residing in rural India are able to collaborate with students from different villages, states and even countries (Dinesha and Agrawal, 2011). Students are enabled to learn about different cultures that reside outside of their periphery, gain access to the experiences of others, share their own thoughts to the wider audience as well as engage themselves with current world affairs in order to see what new things may be happening around the world.

### 1.1.1.2 Enabling eLearning through the medium of computers

eLearning enables children to learn at their own pace, time and place, anywhere and provides a learner-centered model where students take responsibility for their own learning and set achievable goals and objectives that enhance self-confidence and the determination to learn further (Nayak and Kalyankar, 2010). Finally eLearning strengthens the relationship between children and adults (teachers/parents) and helps assist adults in gaining a better insight into the way their children think. Typically adults in the rural villages are either ashamed or embarrassed to start studying after a certain age due to a social and community stigma, as they are required to sit in schools with local students half their age; eLearning by its very nature helps overcome these obstacles.

### 1.1.1.3 Introducing ICT to support language development

Using a “voice enabled” word processor as an example, young children in rural schools can better grasp native and global languages and learn to compose sentences and speech without needing to master written words. This will allow young children to express themselves better from a younger age and build upon their verbal expressions as they grow (Nayak and Kalyankar, 2010).

### 1.1.1.4 Better work prospects

In recent years many organisations nationally and internationally prefer candidates with computer literacy (Shiv and Preeti, 2013). Starting from an early age, students can now better access resources and make better informed decisions regarding their future.

### 1.1.1.5 eGovernance –Bhoomi<sup>i</sup>

With ICT, the government of India was able to implement the *Bhoomi* initiative better - providing residents of rural villages their right to food security, health and employment as well as every government facilitated services. Residents of the rural villages will be able to attain/ register important information

and certificates such as land certificates, birth certificates, administration work and lodging applications and queries without lining up in government centers.

## Limitations

### 1.1.1.6 Teacher availability

Lack of skilled teachers is one of the biggest problems faced, as teachers residing in urban centers are not interested to move to rural areas due to the potentially lower wages and inadequate facilities. Teachers also fear a threat to the integrity of their occupations (Nayak and Kalyankar, 2010). Due to the lack of government funding and generally low income of teachers, most teachers allocated for rural schooling are either absent from school or provide little attention to children in their classes.

### 1.1.1.7 Corruption

Corruption within government at numerous levels is ever-persistent. Governments every year allocate around 20 computers per school in each rural district, of which only 10 computers reach the schools, similarly schools may sign off for 20 textbooks, but will receive only 10 (Arora, 2007). There exists a lack of probity to question the absence of facilities in schools.

### 1.1.1.8 Lack of awareness on computers and ICT based education

Due to a lack of awareness of the benefits of ICT education, rural students fail to pay enough interest in computer-based education. Teachers involved in such education programs also fail to create an awareness due to their own personal motives, such as a relative lack of pay.

### 1.1.1.9 Gender issues

An existing belief in rural areas is that educating girls and making them computer literate will have a direct impact on their marriage prospects and the demand for dowry will increase. Educating girls in villages is a matter of taboo, any formal education past fourth standard implies direct attributes of dominance. It is generally believed that educated brides are high maintenance and girls should get married and take care of the household (Pal, Lakshmanan and Toyama, 2009). Boys however often express a lack of interest in their studies - preferring to join the 'real world', after seeing their extended family work throughout the day. More than 56.1% of boys are not interested in continuing their studies (Siddhu, 2011).

### 1.1.1.10 Low kiosk usage

Registered daily kiosk use is noted to be on average less than five customers per day based on the gender of the computer kiosk operator. More females will visit kiosks if there is a female operator on the day, whereas if a male operator takes up the job, then almost no women will visit male-run kiosks due to existing cultural and societal barriers of opposite genders interacting outside of family relationships (Toyama *et al.*, 2006).

### 1.1.1.11 Computer Literacy rates

The biggest limitation for the complete adoption of computers and computer-based services between adults belonging to rural communities are computer literacy rates with such literacy rates in rural India as low as 6-7% (Singh *et al.*, 2013b).

### 1.1.1.12 Power Failures and Electricity outages

One of the leading problems India faces is load shedding, with electricity outages due to insufficient infrastructure (Singh, 2004). India typically loses electricity for at least 12 hours a day in metropolitan areas, with countless days in rural villages (Anon. 2014b.). One solution are solar panels, however due to lack of investor confidence it will take years before any energy based solutions can be considered. With the ongoing problem of power failures, running computers in Kiosks or computer labs will be challenging.

### **Technology 3 – Solar Mini Grids**

India is a growing economy however is second in the world for energy demand. It is estimated that 60% of India's rural population do not have adequate access to electricity and depend on fuels such as wood, diesel and kerosene (Thirumurthy *et al.*, 2012). It is estimated that India's rural sector on a yearly basis spends around US\$4.86 billion on energy consumption (Thirumurthy *et al.*, 2012). As a result of such factors, the government of India has decided to increase electricity infrastructure for Indian's rural population earlier than expected. It is estimated that India's demand for energy consumption will increase from 900 billion kilowatt-hours (kwh) to 1,400 billion kilowatt-hours by March of 2017 (Thomas, 2012).

#### **Benefits**

##### **1.1.1.13 Savings in household budgets**

On average, each household in rural villages spends US\$4 (240 rps) per month for the use of kerosene. With the introduction of new lighting solutions through solar mini-grids, residents of villages save 50% of costs and pay only US\$2 (120 rps) per month (Krishnadas, 2012). Another benefit of solar mini grids was a reduction in generator use, which was costing residents of villages high power fees. Shop owners in particular would spend and excessive amount running generators in their stores and incurred losses when customers did not show up.

##### **1.1.1.14 Water pumping**

With the increase in energy supply produced by solar grids, farmers are better able to pump water from bores, lakes, wells and rivers. The water can then be stored in underground storage facilities for later use, as opposed to being able to formerly pump only when electricity was available for a couple of hours (Thirumurthy *et al.*, 2012). Other villagers also benefit through a rich supply in drinking water, while minimizing the efforts of women walking miles from their villages to extract drinking water from wells.

#### **Limitations**

##### **1.1.1.15 Lack of investment**

Most companies involved in the production and implementation of solar mini-grids in India face a roadblock due to a lack of investment (Thirumurthy *et al.*, 2012). Financial institutions are hesitant to invest or lend finance in this sector as it is considered high risk for investors. Poor borrower backgrounds provide no guarantee for the abundant risks involved. As a result companies hesitate to approach villages often not consider them worth implementing the grids.

##### **1.1.1.16 Mistrust of solar technology**

Due to the demand for cheap solar panels, several local vendors and hardware stores have been selling cheap, negotiable and extremely bad quality solar panels that are usually non-operational or redundant within the first year of purchase, leading to a lack of confidence in the technology (XL Energy, 2015).

### **Summary of findings**

Through the research, it was found that there was a relationship between informational needs of rural India and the implemented technology, as whenever the users posed limitations or negative attitudes towards an implemented technology, any further deployment was limited, and new alternatives found. Equally if users hinted satisfaction in the implemented technology, then external entities were quick to build upon it. For example, users found it extremely difficult to take time out and wait in line to visit a computer kiosk in order to obtain e-governance services. Eventually the focus on implementing e-governance services via computers was shifted towards creating mobile, easy to use applications that could enable users to access e-governance services via their mobile phones anytime and anywhere.

Throughout the research it was found that technologies such as computers, KIDROP portable cameras and solar mini-grids were chosen by the government of India, NGO's, SME's and medical institutions to address various issues present in rural India today, such as poor access to health care and facilities, lack of information regarding government offered services, as well as power failures. Each of the mentioned

technologies targeted different users such as farmers and village children, however, they were implemented to bring about a positive change through the whole rural community as well as place India on the global digital map. However even with each of these obvious benefits for its users, it is equally evident that these technologies are yet to be completely accepted due to fear of change, insecurities, prior user-experiences and a lack of external trust in the potential for growth in rural areas. Table 1 below summarizes these points as covered in the paper. Until or unless the government and other external entities achieve complete user trust, a wider implementation of technology cannot be attained and the current problems in the rural areas will prevail.

<b>Technology</b>	<b>Users</b>	<b>Benefits</b>	<b>Limitations</b>
<b>KIDROP</b>	<ul style="list-style-type: none"> <li>• Infants</li> <li>• Parents</li> </ul>	<ul style="list-style-type: none"> <li>• Raise awareness of the lack of medical facilities in rural villages.</li> <li>• Minimize the effect of ROP in infants.</li> <li>• Saving in parents travelli can be utilized in infant's medical treatment.</li> <li>• Bring facilities closer to patients.</li> <li>• Increase expertise in the area of ROP.</li> <li>• KIDROP in 24 different states with &gt; 550 infants screened in each center.</li> <li>• Have access to early medical treatments.</li> </ul>	<ul style="list-style-type: none"> <li>• Barriers imposed by costs and lack of infrastructure to set up cameras.</li> <li>• Attitudes of care givers and parents of infants facing ROP.</li> </ul>
<b>Computers</b>	<ul style="list-style-type: none"> <li>• Local school children</li> <li>• Other residents of rural villages</li> </ul>	<ul style="list-style-type: none"> <li>• Bridge the gap between local &amp; global.</li> <li>• Enable eLearning.</li> <li>• Introduce ICT to support language development in children.</li> <li>• Increase employment prospects.</li> <li>• Open avenues to e-Government services.</li> <li>• Allow flexible and user-oriented education resources anytime and anywhere.</li> </ul>	<ul style="list-style-type: none"> <li>• Low computer literacy rates.</li> <li>• Low kiosk usage rates due to cultural barriers.</li> <li>• Lack of interest in education in males.</li> <li>• Gender division in the use of computers.</li> <li>• Lack of computer awareness and ICT based education.</li> <li>• Corruption.</li> <li>• Disinterest of teachers.</li> </ul>
<b>Solar minigrids</b>	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Small Business Owners</li> <li>• Village residents</li> </ul>	<ul style="list-style-type: none"> <li>• Savings in household budget and costs.</li> <li>• Reduction in water pumping problems.</li> <li>• Power running of different technologies implemented.</li> <li>• Generate energy to keep business operational.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of investment</li> <li>• Mistrust in the use of solar technology</li> </ul>

**Table 1. Summary of findings**

## Recommendations

With the introduction of mobile phones to India in around 1993 (Yajnik, 2011), rural populations along with their urban cousins have been keen on purchasing user-friendly mobile phones that are low price and less sophisticated. Such phones are now being introduced to communities by local phone providers, giving governments an opportunity to further connect with its citizens and make rural community members a part of the nation through making their voice heard. These applications take e-governance to a new level and can enable users and government agencies to broadcast messages through social networks, hold opinion polls, post feedback and attain information. Villagers will no longer have to be tied to kiosks or long waiting hours to make their voice heard. Through such phone applications users can also access health care information and educational resources from anywhere (Bidyarthi and Kuchar, 2011).



Re-examining figure 1, the reader will have noted there are a number of parameters affecting empowerment through ICT. One parameter noted in the literature were issues relating to electrical power uncertainty given at times sub-standard infrastructure particularly in rural areas of India. Lack of infrastructure also means it was difficult to reach remote villages with eHealth, eLearning and eGovernance initiatives. One way to overcome this lack of reachability is through mobile ICT, which by definition is wireless, at least partially negating the impact of lack of technological infrastructure in the form of wires. Gender was a mixed issue where ICT-enabled empowerment could be perceived as a positive or negative influence. In a positive sense, ICT could empower women to achieve more than was traditionally expected of them. However, negative attitudes towards empowering women existed. These attitudes also extended to eLearning where education in general is often seen as of less value to women by the wider community, whilst surprisingly males were often less interested in further education - preferring employment instead. Increased learning means increased awareness and so in a positive sense - resistance to change, and the adoption of eLearning, eHealth and eGovernance is also addressed (figure 1). Finally, improving health is a key aspect to societal development along with education, and the KIDROP initiative certainly empowers villagers to take greater control of their lives - note again control was an attribute in the literature of empowerment. This paper has sought to create a better understanding of the forces at play, thus providing some means of alleviating the negative aspects - including cultural obstacles, to the empowerment of rural villagers through the use of ICT.

One recommendation is before implementing any form of technology, it is important that a close analysis of the pros and cons be considered. The technology implemented ideally should benefit residents of the villages rather than the organizations implementing them; this will create a positive attitude of villagers towards the implemented technology and grow to adapt to new forms of technology each time an implementation is done. Finally, we recommend seeking villagers' opinions regarding the changes they would like to see in their villages; and consider users acceptance to change.

## Conclusion

It is often the case that problems encountered need to be addressed from a grass roots level. In the rural environment, education is a major problem due to poverty and lack of access to resources. As agriculture is the major lifeline of India, villagers in those areas place less importance on education. A consequence of such attitudes is that people belonging to villages are not as empowered to make decisions for themselves whilst lacking problem solving and analytical abilities. Such problems have arisen through less attention being given to education with low quality educational facilities. Students require high quality educational services with guidance and expertise from qualified teachers. Providing textbooks alone are not an effective enough source of knowledge. Female students in particular, belonging to rural villages are enthusiastic, knowledge driven and extremely hard working and if their positive capabilities are channeled in the correct direction this will help villages to prosper. In order to achieve the right quality of education, virtualization technologies such as cloud computing Singh *et al.*, (2013a) and eLearning platforms such as Moodle™ can provide on-demand education with educational materials, e-books, and expert advice from around the world providing an enriched global experience. This experience will enable students to look at education in a different light and grow an interest through which they can secure their future without any costs. If such changes occur at an early stage the acceptance to technology amongst children, parents and the wider community will grow due to its evident benefits, and villages will be able to trust the impact of technology enabling future growth and employment opportunities inside villages seeking employment in urban environments (Dinesha and Agrawal, 2011).

## REFERENCES

- Alsop, R., and Heinsohn, N. 2005. *Measuring Empowerment in Practice: Structuring Analysis and Framing Indicators*, World Bank.
- Anon. 2004. *Implementing E-government: Report of the Regional Workshop* Bangkok, 31 May-4 June Asian Development Bank United Nations. Economic and Social Commission for Asia and the Pacific 147 pages.
- Anon. 2013a. "Agriculture's share in GDP declines to 13.7% in 2012-13" *The Times of India: The Economic Times* (URL: [http://articles.economicstimes.indiatimes.com/2013-08-30/news/41618996\\_1\\_gdp-foodgrains-allied-sectors](http://articles.economicstimes.indiatimes.com/2013-08-30/news/41618996_1_gdp-foodgrains-allied-sectors) accessed 12/1/2015).

- Anon. 2013b. "India is now world's third largest Internet user after U.S., China" *The Hindu* August 24, 2013 (URL: <http://www.thehindu.com/sci-tech/technology/internet/india-is-now-worlds-third-largest-internet-user-after-us-china/article5053115.ece> accessed 9/1/2015)
- Anon. 2014a. *Internet Users by Country* (URL: <http://www.internetlivestats.com/internet-users-by-country/> accessed 9/1/2015).
- Anon. 2014b. *Issues in International Energy Consumption Analysis: Electricity Usage in India's Housing Sector* November U.S. Energy Information Administration U.S. Department of Energy Washington, DC 20585 p. 1-22.
- Arora, P., 2007. "The ICT laboratory: An Analysis of Computers in Public Schools in Rural India", *Association for the Advancement of Computing in Education (AACE) Journal*, (15:1) p. 57-72.
- Bidyarthi, H., and Kuchar, P., 2011. "Sweetening Bitter Pills to be Swallowed" *E-Governance Techno-Behavioural Implications* excelpublish.com p. 261-268.
- Digital India 2015. *Digital India* Department of Electronics and Information Technology. (URL: [http://deity.gov.in/sites/upload\\_files/dit/files/Digital%20India.pdf](http://deity.gov.in/sites/upload_files/dit/files/Digital%20India.pdf) accessed 9/1/2015).
- Dinesha, A., and Agrawal, V., 2011. "Advanced Technologies and Tools for Indian Rural School Education System", *International Journal of Computer Applications*, (36:10), p. 54-59.
- Krishnadas, G., 2012. "How Small-Scale Solar is Helping One Rural Indian Community Thrive" *Earth Island Journal: News of the World Environment* May 24, (URL: [http://www.earthisland.org/journal/index.php/elist/eListRead/how\\_small-scale\\_solar\\_is\\_helping\\_one\\_rural\\_indian\\_community\\_thrive](http://www.earthisland.org/journal/index.php/elist/eListRead/how_small-scale_solar_is_helping_one_rural_indian_community_thrive) accessed 12/1/2015).
- Narayan, D., 2002. *Empowerment and Poverty Reduction: A Sourcebook* World Bank June.
- National Neonatology Forum of India, 2005. *National Neonatal Perinatal Database*, New Delhi.
- Nayak, S., and Kalyankar, N., 2010. "e-Learning Technology for Rural Child Development" *International Journal on Computer Science & Engineering* (2:2) p. 208.
- Pal, J., Lakshmanan, M. and Toyama, K., 2009. "My child will be respected: Parental perspectives on computers and education in rural India", *Information Systems Frontiers* (11:2) pp.129-144.
- Payne G., and Payne, J., (2004). "Secondary Analysis" *Key Concepts in Social Research* Sage Publications p. 214-219.
- Perkins, D., and Zimmerman, M. 1995. "Empowerment Theory, Research and Application," *American Journal of Community Psychology* (23:5) pp 569-579.
- Radhakrishna, R., (2011). "e-Choupal transforms Indian agriculture" *Appropriate Technology*, (38:4) p. 48.
- Rappaport, J., 1984. "Studies in empowerment: Introduction to the issue" *Journal of Prevention in Human Services*, (3:2-3) p. 1-7.
- Rappaport, J., 1987. "Terms of empowerment/exemplars of prevention: Toward a theory for community psychology," *American Journal of Community Psychology* (15:2) p. 121-148.
- Roy, N., 2012. "ICT-Enabled Rural Education in India", *International Journal of Information and Education Technology* (2:5), p. 525-529.
- Shiv, K., and Preeti, M., 2013 "Computer literacy and student demographics: a study of select Indian universities" *Library Hi Tech News* (30:10) p. 21-27
- Siddhu, G., 2011, "Who makes it to secondary school? Determinants of transition to secondary schools in rural India", *International Journal of Educational Development*, (31:4) p. 394-401
- Singh, N., 2004. *Information Technology and Rural Development in India* UC Santa Cruz Economics Working Paper No. 563, March p. 1-35.
- Singh, A., Anurupam, K., Sagar, R. and Rai, S., 2013a. "Governance Through Cloud in India (GCI)" *International Journal of Advanced Research in Computer Science* (4:4) p. 129-136.
- Singh, N., Zhou, Y., Williams, K., Kendall, J. and Kaushik, P., 2013b. "Bridging the Digital Divide in Rural India Lessons from a Survey in Four States" *Review of Market Integration* (5:1) p. 1-42.
- Thirumurthy, N., Harrington, L., Martin, D., Thomas, L., Takpa J. and Gergan, J., 2012. *Opportunities and Challenges for Solar Minigrid Development in Rural India*. National Renewable Energy Laboratory Technical Report U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, U.S.A.
- Toyama, K., Kiri, K., Menon, D. and Sethi, S., 2006. "PC Kiosk Trends in Rural India", *E-Learning and Digital Media*, (3:3) p. 317-324.
- UNICEF (2011). *Communication for Development: Strengthening the Effectiveness of the United Nations* (URL: [www.unicef.org/cbsc/files/Inter-agency\\_C4D\\_Book\\_2011.pdf](http://www.unicef.org/cbsc/files/Inter-agency_C4D_Book_2011.pdf) accessed 28/4/2015).

- Vaswani, K., (2012). "Indonesian farmers reaping social media rewards" BBC News: The Technology of Business (URL: <http://www.bbc.com/news/business-18193993> accessed 28/4/2015).
- Vinekar, A., 2011. "IT-enabled innovation to prevent infant blindness in rural India: the KIDROP experience", *Journal of Indian Business Research*, (3:2) p. 98-102.
- Vinekar, A., Dogra, M., Sangtam, T., Narang, A. and Gupta, A., 2007. "Retinopathy of prematurity in Asian Indian babies weighing greater than 1250 grams at birth: Ten year data from a tertiary care center in a developing country", *Indian Journal of Ophthalmology*, (55:5) p. 331-336.
- Vinekar, A., Gilbert, C., Dogra, M., Kurian, M., Shainesh, G., Shetty, B., and Bauer, N., 2014. "The KIDROP model of combining strategies for providing retinopathy of prematurity screening in underserved areas in India using wide-field imaging, tele-medicine, non-physician graders and smart phone reporting" *Indian Journal of Ophthalmology* (62:1) p. 41-49.
- World Bank, 2014. *Agriculture, value added (% of GDP)* The World Bank (URL: <http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS> accessed 12/1/2015).
- XL Energy Ltd (2015) Management Discussions IXL Energy url: <http://www.indiainfoline.com/markets/company/fundamentals/management-discussions/xl-energy-ltd/17099> accessed 23/2/2015).
- Yajnik, N., 2011. "e-Governance and Mobile Devices: Possibilities for India" *E-Governance Techno-Behavioural Implications* excelpublish.com p. 113-117.
- Yap, J., 2012. "India plans telecom links in all villages by 2014" March 26, 2012 (URL: <http://www.zdnet.com/article/india-plans-telecom-links-in-all-villages-by-2014/> accessed 9/1/2015).
- Zimmerman, M., 2000, *Empowerment Theory: Psychological, Organisational and Community Levels of Analysis*, Kluwer Academic/Plenum New York.

---

<sup>i</sup> "Bhoomi (meaning land) is the project of on-line delivery and management of land records in Karnataka. It provides transparency in land records management with better citizen services and takes discretion away from civil servants at operating levels" (URL: <http://www.bhoomi.karnataka.gov.in/landrecordsonweb/> accessed 23/2/15)