4

ACHIEVING INCLUSIVE DEVELOPMENT THROUGH SMART VILLAGE

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ABSTRACT: Cities are being crowded at an unprecedented pace globally, 30% of the world's population was urban in 1950 with a projection of 66% by 2050 (World Urbanization Prospects, 2014). Lack of basic amenities and limited economic growth in villages leads toward uncontrolled migration from rural to urban area. Current scenario of urban living shows cities are struggling to cope up with the basic infrastructure like transportation, healthcare, housing and utilities. 30% of urban residents are living in slums. While upcoming urban development projects are focused on developing smart cities, development of smarter villages have been ignored. Rural development will avoid further migration and can help to bring the balance in the entire ecosystem.

KEYWORDS

Smart village, Village, Rural development, Holistic development

Introduction

Out of 6,50,000 villages in India, most of them have inadequate and rudimentary infrastructure which fails to fulfill the primary need of villagers. Villages and other remote locations have poor educational facilities, irregular water supply, electricity supply, improper sanitation, transport, road connectivity and infrastructure. India being a billion-strong nation has 68.84% of villagers less than 30 years old. Thus, a huge resource pool is underutilized and left with poor standard of living with meager wages. All these factors push villagers to migrate to towns and cities in search of better employment opportunities and quality of life.

Agriculture has been a major contributor to India's GDP since independence. It is decreasing year by year from 45.48% in 1950 to 15.79% in 2013 ("Sector-wise contribution of GDP of India", 2017) because of lack of strong policies and its execution at grass-root level. It has been the primary source of livelihood for villagers, which creates 50% employment followed by Small and Medium Enterprise (SME) sector with a share of 40%. Employment in India's agriculture sector has decreased considerably, from 60% in 1994 to 50% in 2013 (World Development Report, 2013).

Migration leads to overcrowding of cities in no time, it runs out of resources to cater everyone's needs. Infrastructure, deforestation and pollution is increasing at a faster rate. To deal with this situation, Government of India (GoI) launched 'Smart Cities Mission' across country with 100 cities in 2015. Infrastructure cannot be improved beyond a certain level so every existing and upcoming city has a limitation to deal with population problem. To avoid migration "smart village" is one of the most suitable options, which can be easily implemented with lesser-cost and small gestation period.

Rural development through investment in infrastructure will improve the situation. It will create platform to develop local entrepreneurship in villages to boost the rural economy. Electricity access in villages has been a

major challenge for its economic growth; globally, 1.3 billion people have no access to electricity whereas 70% of the poor people living in remote areas lack access to electricity (Holmes, Jones, & Heap, 2015). Suitable and cheaper "plug - n - play" energy solutions can be installed in rural homes (Holmes et al., 2015) to create smart village.

Cause of Migration

People from most of the backward states like Bihar, Orissa, Jharkhand, Uttar Pradesh, Rajasthan, and Uttar Pradesh are travelling to big cities like Kolkata, Delhi, Pune and Mumbai in search of better job opportunities. This is causing additional burden to the cities. Lack of job opportunity, limited economic activities, unavailability of better education and insufficient support from government has caused huge migration from village to cities. The 2011 Indian Census pegged Uttar Pradesh as the state with the most out-migration (26.9 lakh) followed by Bihar at 17.2 lakh. Migration in UP has also been a growing affair; between 2001 and 2011, over 5.8 million people between the ages of 20 and 29 migrated from the state in search of jobs ("Peedhiyon ka Palayan: In Uttar Pradesh's Bundelkhand survival continues to drive hordes to migration", 2018). Though there has been an initiative from GOI to develop smart villages but the ground level improvements is yet to be seen. NGOs and other international organizations are playing active role to develop smart village models. This initiative needs to be encouraged by providing government support and funds.

What is the Need of Smart Villages?

Holistic development of rural India is yet to come in shape because of declining agricultural output and absence of basic amenities. This has left the villages deserted with increasing slums in urban areas leading to poor health conditions and living standards. This imbalance will create a long term negative effect as more villagers are moving away from agricultural profession.

"Smart Village" is the rural analogy of "Smart City", which can bring overall development, sustainable and affordable utilities, access to good education, clean drinking water, sanitation and nutrition (Holmes et al., 2015). A smart village will facilitate:

- Entrepreneurial opportunities in agriculture and animal husbandry
- Improved education services
- Health services
- Focus on social welfare
- Enhanced democratic engagement
- Improved quality of life
- Technology as a means for holistic development

Even after 70 years of independence 25,722 villages are un-electrified across the country where 304 million people are left in darkness ("1.3 Billion are living in the dark", 2015). Use of kerosene for lighting lamps and wood for cooking causes household air pollution which is dangerous to health. Globally over 4 million people die prematurely from illness attributable to the household air pollution from cooking with solid fuels ("Household Air pollution and Health", 2016).

Access of electricity can be considered as a foundation stone for smart village as it helps to improve the socio-economic infrastructure of villages. Energy (electricity) and Information and Communication Technology (ICT) can go a long way to provide inclusive education to all and reduce social injustice (Ranade & Londhe, 2015). Government of India is running a drive to electrify all Indian villages, however there are many far flung areas where laying down the electrical grid is difficult. Extending existing grids to remote off-grid areas is highly expensive, which creates a need of local solutions using renewable energy sources (Bahaj, 2009).

Solutions Proposed:

Access to energy transforms the lives in a rural setting. Generally, daily activities of people living in rural areas are dependent on the availability of daylight hours. Children and house-wives use kerosene lamps to study and perform household works respectively, in late evening. Affordable and environment friendly solar lamps will encourage children to study during night. Solar streetlight system will promote a community life after sunset in villages. It will provide sustainable lighting solution for people who don't have access to conventional grid. It will increase safety on roads and streets thus allowing more economic activity (Soboyejo & Taylor, 2008). With help of available technologies like micro-grid, and renewable integration the purpose can be served. Governments have adopted policy and regulatory frameworks for establishing solar home systems (Holmes et al., 2015).

Infrastructure like roads, will ensure proper connectivity of village with outer world. This will improve transportation and means of business. Primary schools can be developed with proper infrastructure. With the help of ICT, primary education can be made smarter and digitized. Access to internet will create a leapfrog in village education as well as several other daily affairs. Mid-day meals and daily attendance should be monitored to encourage students to pursue education. It will help to decrease drop out ratio in primary schools.

Mostly villagers travel to town or cities for health treatment. Primary health centre can be constructed with adequate facilities in order to provide basic healthcare facilities. Vaccination camps along with general health awareness camps can be conducted to improve health awareness and avoid addiction to alcohol and drugs.

Natural disasters like drought, floods, earthquakes, etc. are very common in villages, necessary measures should be taken to cope up with the emergency. A Community Based Disaster Preparedness Plans (CBDP) has to be developed in all the vulnerable areas to prevent loss of life, livelihoods and property in case of such disasters. A Resource Inventory should be harnessed and enhanced for disaster preparedness and response (Bhagat, 2017).

Rain water harvesting should be promoted to conserve water at village level. Canals and ponds can be used for storage of water. Check dams can be utilized as reservoirs to ensure irrigation and potable drinking water.

Sewage infusion with fresh water bodies should be avoided. Public toilets and proper sanitation will avoid open defecation and will prevent epidemics.

Agricultural productivity has been a concern since long as Indian villagers use same old methods for it. Adaptation of new technology in field of agriculture will increase productivity. TV programs, Internet availability to explore better methods and market to sell the agricultural products will improve the situation. Subsidized animal husbandry and dairy farming, goshalas, renewable cold storage and processing plants will improve local trade and employment.

Vocational training will improve employment opportunities and will also create a platform for local entrepreneurship for villagers. Availability of banks and micro finance will support the eco-system for rapid economic growth.

Community centre in villages are being established as it can play a very important role in inclusive development of village. It can also act as a hub for basic health services, infrastructure, emergency response, agriculture, local trade, banking and microfinance and local participation. This will ensure overall development.

Our acronym for SMART should be:

S - Sustainable

M - Measurable

A - Affordable

R - Replicable

T - Technology

Key attributes of smart village include (Shukla, 2016):

- Homes with access to toilet, clean drinking water and affordable electricity.
- Diversified livelihood opportunities with micro – enterprise.
- Plans for development of people, assets, service centric information, revenue generation and maintaining its identity and cultural heritage.
- Interaction with government, NGOs, experts, social entrepreneurs, etc.
- Awareness of newer technologies which can be implemented in the village for its upliftment and holistic development.

With different schemes and drives government has done the preliminary job to setup a platform for smart village. There are several programs like Saansad Adarsh Gram Yojna, National Agriculture Development Program, Mahatma Gandhi National Rural Employment Guarantee Scheme, Mid-Day Meal Scheme, Integrated Child Development Scheme, Annapurna Scheme, etc. (Shukla, 2016). The output is not up to the mark since they are not being implemented in a cohesive fashion.

Smart village can integrate different programs to optimize the benefit of several schemes. The STERM (Science, Technology, Engineering, Regulations and Management) framework can be used to design and build these villages. We need to develop the ecosystem for each village depending on its location and investment climate (Viswanadham & Vedula, 2014).

Public-private partnership model is very suitable to develop smart village. There exists a tremendous potential for smart village in years to come. This can be replicated to millions of villages around the World; in India, China, Brazil and South Africa to name a few and this is in line with the inclusive growth that is being advocated by these Governments (Viswanadham & Vedula, 2014).

Case Study of Punsari Village

Punsari is a village located in Sabarkantha district in the state of Gujarat, India. Punsari has been dubbed as a "model village" by the state government ("Inside Punsari: A model Indian village", 2014). The village houses 6000 villagers.

- There is a 66kV sub-station that supplies power to the village. The village is producing its own electricity from the waste collected. Their aim is to generate surplus so that they can sell it to government and make revenues which ultimately will be utilised for the welfare of the people ("Punsari to generate green power", 2014).
- Sarpanch of the village has provided Wi-Fi connectivity in the entire village.
- Infrastructure and facilities of schools have improved with furniture, air conditioning, projectors for better teaching and CCTV cameras for surveillance. Mid-day meal scheme of the central government was very well regulated and the benefits of the scheme were being properly reached out to children. They have been successful in stopping the migration of children to schools in nearby towns. All this has collectively made school dropout rate to 0.
- Apart from schools, 25 CCTV cameras are installed at public places to keep surveillance.
- Mini-buses are used for transportation purpose within the village. A bus facility called the Atal Express has been started for women to collect milk from every house.
- For communication purposes, 120 waterproof speakers have been installed which the Sarpanch uses to inform people about new schemes and initiatives.
- Panchayat has installed a Reverse Osmosis (RO) plant in 2010 to supply clean drinking water to the village people ("This Smart Village in Gujarat Went from Having No Electricity to Wifi, RO Water Purification and Solar-Power Streetlamps", 2016).
- The village has a proper sanitation and drainage system which is completely underground.
- Every household has a toilet which is fulfilling the objectives of Swachh Bharat Mission.
- There are two banks in the village which have been successful in opening accounts of every household. This was possible through their awareness campaign in the village.
- The village has been successful in making Anganwadis, ATM for cash withdrawal and has even brought in skill development centres, health care centres, and even veterinary centre.
- The village has been successful in reducing the infant mortality rate and maternal mortality rate to 0. This is in itself a landmark achievement.
- There is a door to door waste collection two times in a day.
- They have even started a monthly newspaper called Kalam Sandesh newspaper to keep people updated with the development in the village as well as around the world.
- Vocational training for people of the village was carried out which ensured employment to every able villager.
- The last six years have been without any crime which has resulted in zero FIRs.

Case Study of Akodara Village

Akodara village near Ahmedabad is a fully digital village. The village of 1,200 people has been adopted by ICICI Bank and helped by the local administration.

- The first of such useful interventions is financial inclusion and access to modern banking.
- This digitization has promoted use of technology in education.
- Audio-visual devices, computers, electronic tablets and electronic attendance of students is employed in schools throughout the village ("At Akodara, India's first digital village", 2015).
- All normal transaction of the bank was made by their mobile phones through net banking.
- There's a community-owned RO based water treatment plant.
- Wi-Fi tower for internet connectivity have been installed in the village ("Demonetisation: Modi's cashless economy dream is a reality in this tiny Gujarat village", 2016).

Comparative Study of Smart Village

Based on the suitable indicators for a smart village, Punsari and Akodara villages is being compared. The objective of domain based comparison is to understand the scenario in which smart village can take shape and the gaps the needs to be taken care of. Following domains have been identified for comparison.

Infrastructure:
For any settlement, a basic infrastructure is always needed to thrive and grow. For villages to become smart, connectivity through roads, availability of transportation facilities, waste management systems and water conservation bodies like construction of lakes, canals, reservoirs, etc. from agriculture perspective is important.

Utility:
Availability of basic utilities is important. Access to electricity, drinking water, sanitation, basic healthcare, access to clean cooking fuel and access to internet is necessary to make a village smart.

Education:
From the social point of view, education is a very important domain as a society will become healthier, safe and economically independent with education. Primary education, skill development for local pool and community awareness will play an important role.

Security:
Security is one of the most important aspect; installation of CCTV camera for surveillance will help smart village to take adequate measures for social security.

Finance:
Availability of banking and micro finance facilities at village level will encourage villagers to participate in economic affairs and will help to grow local entrepreneurship.

Technology:
Use of technology is a key factor for making a village smart. Digital education and use of technology through mobile phones, mobile applications and computers, etc. will put smart village development on a faster pace.

Alternative Energy:
Alternative energy sources are important in areas where electrical grid supply is unavailable; as absence of electricity can hamper several basic activities. Integration of Renewable energy sources to existing setup will ensure affordable and reliable power when needed.

Disaster Management:
Emergency response comprising of a CBDP and resource inventory will make smart villages more independent to handle emergencies.

Parameters	Punsari	Akodara
Access of Electricity	✓	✓
Drinking water	✓	✓
Sanitation	✓	✓
Healthcare	✓	x
Access to clean cooking fuel	✓	✓
Access to internet	✓	✓
Connectivity	✓	✓
Transportation	✓	✓
Waste management	✓	x
Water conservation	✓	x
Primary education	✓	✓
Skill development	✓	x
Community awareness	✓	x
Security	✓	x
Banking / micro-finance	✓	✓
Digital education	✓	✓
Use of technology	x	✓
Clean energy integration	x	x
Emergency response	x	x

Access of power supply to Punsari village has ensured uninterrupted power. It has helped to improve the socioeconomic infrastructure of village. Power generated through waste collection has made village sustainable and independent, it has potential to create a source of revenue for village. Wi-Fi connectivity in village will bring transformation to access of information by villagers. This helps villagers to keep pace with agricultural assistance and trade and to understand the different schemes run by government. Primary school in village has set up the foundation for education. CCTV camera across village had made continuous surveillance possible and the crime rate is negligible. Availability of local transport system provides better connectivity to outer world and it has improved the economic activity of village. Availability of clean R.O water for village has improved the health condition. Availability of toilet and adequate drainage has improved the sanitation facility of village. Local skill development and Anganwadi has opened the door for employment in village. Healthcare centre and veterinary centre takes care of health issues of villagers and cattle. Infant mortality rate has reduced to zero. Monthly newspaper in village has improved awareness of villagers about own village and activities happening around.

There are couple of things which have been ignored like disaster management system for village and clean energy

integration. Such provision will make villages more responsive to emergencies and renewable integration will improve the reliability of power.

Akodara village lacks couple of facilities like health care, water conservation and waste management, skill development, community awareness, security, clean energy integration and emergency response. It has done pretty well in use of technology in banking and digital education.

Case Study of Akodara Village

Quality of life in "Punsari" village has changed by many folds. People from middle class and above in the village has found the changes suitable, whereas people from lower class i.e., lower income group are the biggest beneficiary of smart village. Every facility provided is a boon for them.

Villagers have 24 hours of electricity access. They also have their own waste based power generation plant to produce surplus electricity. Because of unavailability of raw material it is not operational science last six months. RO based drinking water has improved the health condition. Now it is hard to find any water borne disease in village.

The village has a proper sanitation and drainage system, every house has a toilet and there is no public defecation. Water proof speakers across village has increased the speed of cooperative work in village. People are more aware and proactive for village development.

After having a branch of State Bank of India in village financial transaction has become very easy, everyone in village has a bank account. ATM for cash withdrawal has improved the ease of transaction. Earlier one had to travel 10 kilometres to reach the nearest bank.

Primary healthcare facility for villagers has reduced health complication, especially for women. Individual supervision of pregnant women and health education about child delivery has reduced the risk of maternal mortality, infant mortality rate has reached to zero.

Vocational training for villagers has improved their employability. It has also enhanced the scope of their skill development.

CCTV cameras has reduced the crime rate. Interestingly a theft case was detected and solved with the help of surveillance camera. It has improved the villager's security.

WiFi services has made internet available to everyone. Youths are much aware about internet application that can be downloaded to mobile for various usage. It has improved the cashless transactions in villages, during demonetisation period this village was well prepared for cash crunch and available alternatives for money transactions.

Minibus transportation across village and nearby places has solved a big problem for local transport, villages who traveled to sell their milk by their own convince can now reach to an identified place to sell their milk by spending only 2 rupees. Now females also can travel to sell milk with ease.

With good primary education facility in village school dropout rate has reached to zero. A considerable change has been observed after smart village implementation.

Couple of issues were observed regarding maintenance of the facilities. Once any system goes down it takes time to repair; in couple of cases the systems are not working since last 6 months.

By developing local entrepreneurship and trade, a fixed cash flow can be made available for maintenance of the systems. As every village is unique, a proper study of socio economic potential will lead to a sustainable smart village. Sustainability of smart village is an important aspect to look for. This can be scope for further study.

SMART VILLAGES'' can be the answer of current situation. This will help to reduce the migration from villages to towns and cities so the burden on cities will reduce in near future. It will create a suitable platform for villagers to have a sustainable life and economic growth and will improve quality of life for villagers.

A well planned smart village with micro and small enterprises can provide villagers ample opportunity of employment. The potential of young India can be unleashed by a little change in our development strategy by focusing more on rural economy. 'Smart Villages' can go a long way in strengthening country's untapped potential to bring inclusive development for all.

References

Bahaj, A.S. (2009). Delivering developing country growth: A new mechanistic approach Driven by the photovoltaic industry. Renewable and Sustainable Energy Reviews, 13(8): 2142–2148. DOI: 10.1016/j.rser.2009.01.029.

Soboyejo, W.O. and Taylor, R. (April 2008). Off-grid solar for rural Development. Researchgate. DOI: 10.1557/mrs2008.74

SireeshaKumar. P. D., Subhalakshmi M. (December 2016). Internet of Things (IoT) gateway to smart villages.

International Journal of Innovative Research in Advanced Engineering 2349-2763. Retrieved from *http://ijirae.com/volumes/Vol3/iss12/15.DCAESP90.pdf*

Shushma (2017). A Comparative Study of Smart City vs. Smart Villages Startup, Opportunities and Challenges. Asian Journal of Management, 2321-5763. DOI:10.5958/2321-5763.2017.00199.8

Ranade P, Londhe S. (July, 2015). Smart Villages through Information Technology – Need of Emerging India, IPASJ International Jounal of Information Technology, 3(7). Retrieved from *http://ipasj.org/IIJIT/Volume3Issue7/IIJIT-2015-07-10-2.pdf*

Bailey, M, Henriques, J., Holmes, J., & Jain, R., (2012). Providing Village-Level Energy Services in Developing Countries "Smart Villages Initiative. Retrieved from *http://e4sv.org/wp-content/uploads/2014/02/Scoping-report-final-230113with-logos.pdf*

Heeks, R. (2002). Information Systems and Developing Countries: Failure, Success, and Local Improvisations. The Information Society, 18(2), 101-112. DOI: 10.1080/01972240290075039

United Nations (2014). Report on World Urbanization Trends 2014: Key Facts. World Urbanisation Prospects. Retrieved from *https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.pdf*

World Development Report 2013: Report on Jobs - World Bank Group. Retrieved from *https://siteresources.worldbank.org/EXTNWDR2013Resources/8258024-1320950747192/8260293-1322665883147/WDR_2013_Report.pdf*

Holmes J., Jones B., Heap B. (2015, February). Can Smart Villages help to stem biodiversity loss? Retrieved from *http://e4sv.org/wp-content/uploads/2017/05/TR15-Can-Smart-Villages-help-to-stem-biodiversity-loss_web.pdf*

Shukla, P. (2016). The Indian smart village: Foundation for growing India. International Journal of Applied Research, 2(3), 72-74. Retrieved from *http://www.allresearchjournal.com/archives/2016/vol2issue3/PartB/2-2-111.pdf*

Viswanadham, N., & Vedula, S. (2014). Design of Smart Villages. Computer Science and Automation. Indian Institute of Science, Bangalore. Retrieved from *http://drona.csa.iisc.ernet.in/~nv/Mypublications/C/z.pdf*

1.3 Billion Are living in the dark (2015, November 6). The Washington Post. Retrieved from *https://www.washingtonpost.com/graphics/world/world-without-power/*

Household Air pollution and Health (2016, February). WHO Fact Sheet – February. Retrieved from *http://www.who.int/mediacentre/factsheets/fs292/en/*

Bhagat, S. (2017). Community-Based Disaster Management Strategy in India: An Experience Sharing. Journal of Energy and Management, 2017 (11-17). Retrieved from *http://www.pdpu.ac.in/downloads/1%20Community-Based-Disaster-Management.pdf*

Sector-wise contribution of GDP of India (21 Mar 2017). Statistics Times. Retrieved from *http://statisticstimes.com/economy/sectorwise-gdp-contribution-of-india.php*

Peedhiyon ka Palayan: In Uttar Pradesh's Bundelkhand survival continues to drive hordes to migration (2018, April 26). Firstpost. Retrieved from *https://www.firstpost.com/india/peedhiyon-ka-palayan-in-uttar-pradeshs-bundelkhand-survival-continues-to-drive-hordes-to-migration-4445053.html*

This Smart Village in Gujarat Went From Having No Electricity to Wifi, RO Water Purification and Solar-Power Streetlamps, (2016, September 2). The Logical Indian. Retrieved from *https://thelogicalindian.com/story-feed/get-inspired/this-smart-village-in-gujarat-went-from-having-no-electricity-to-wifi-ro-water-purification-and-solar-power-streetlamps/*

Punsari to generate green power, (2014, October 4). The Times of India. Retrieved from *https://timesofindia.indiatimes.com/city/ahmedabad/Punsari-to-generate-green-power/articleshow/44325232.cms*

Inside Punsari: A model Indian village (2014, November 24). BBC News. Retrieved from *http://www.bbc.com/news/world-asia-india-29914208*

At Akodara, India's first digital village (2015, July 14). The Hindu. Retrieved from *http://www.thehindu.com/opinion/op-ed/at-akodara-indias-first-digital-village/article7418012.ece*

Demonetisation: Modi's cashless economy dream is a reality in this tiny Gujarat village (2016, November 28). Firstpost. Retrieved from *https://www.firstpost.com/india/note-ban-akodara-the-future-of-narendra-modis-cashless-villages-is-here-3127506.html*

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