SMART VILLAGES

Indian Realities, Opportunities, Way Forward

Y.S. Rajan

India has been a fascinating country over several millennia and is so even now. Being an ancient civilization situated in a geographic location conducive to support of biological diversity, it naturally grew as a great agricultural economy. Its people created habitats for themselves adapted to the local conditions of soil, weather and other features conducive to life. These were called 'GRAM' (villages) with different names in the different languages which grew over millennia. But it was not that India was without towns and cities. There were many mentioned in ancient epics and subsequent literature. However since Indian economy depended on the huge agricultural work force (as was with many old civilizations) which lived in villages, welfare of villages acquired a great significance in the minds of people who desired well being of all Indians.

INDIA LIVES IN HER VILLAGES

The person who made the above statement lives in the minds of most Indians. He is Mahatma Gandhi, the father of independent Indian nation.

In an excellent book specially compiled "to present to the reader as correct, coherent and comprehensive a picture of free India of Gandhiji's conception as possible" which is titled "My

Picture of Free India" edited by Anand T. Higorani (1965) (Ref 1) there is a chapter 11 with the above title. It contains quoted texts form Gandhiji's writings. The chapter starts with a piece he had written in 23 March 1947 (a few months before independence) "It is in the villages of India where India lives, not in the few westernized cities which are the citadels foreign power. (Harijan March 23, 1947 – Harijan was a weekly edited by Gandhiji)

"India lives in her seven lakhs of villages – obscure, tiny, out-of-the-way villages, where the population in some cases hardly exceeds a few hundred, very often not even a few score. I would like to go and settle down in some such village. That is real India, my India, for which I live. (Harijan, April 7, 1946)

"We have to make a choice between India of the villages that are as ancient as herself, and India of the cities which are creation of foreign domination. Today the cities dominate and drain the villages so that they are crumbling to ruin. My Khadi mentality tells me that cities must subserve villages when that domination goes. Exploiting villages is itself organized violence. If we want Swaraj to be built on non-violence, we will have to give villages their proper place. (Harijan, January 20, 1940).

"In the scheme of reconstruction of free India, its villages should no longer depend, as they are now doing, on its cities, but cities should exist only for and in the interest of the villages". (Harijan, August 31, 1947).

Though the policies, programmes, and projects of free Independent India respected the above mentioned powerful statements by Gandhiji, did not ignore the rapid industrialization of India and induction of science and technology.

The powerful operational vision of India's planned economy is largely derived from Jawaharlal Nehru, (first prime minister of independent India, from 1947 to 1964). In his address to the Indian Science Congress on December 26, 1937) about ten years before the Indian Independence) he said: "….It was science alone that could solve these problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people …." (Ref.2).

RURAL INDIA AND SCIENCE INPUTS

The word 'Science' here is used in the Nehruvian usage. It did not merely represent pure and basic research but all the applications of technology and engineering as well as scientific approach to solving problems. There was a general agreement that the major cause of rural poverty was due to stagnant agricultural lands which were rain fed and suffered due to the vagaries of monsoon. Most of them still suffer the same.

Naturally the first Five Year Plan of India gave the highest priority to agriculture.

But the problems facing India were many. The infamous Bengal famine (1943-44) which was man-made due to the needs of the colonial power ruling India during the World War II, had devastated Indian agriculture and rural economy. Even the towns and cities suffered. There was severe rationing of food. The independent India was dependent on food aid from some advanced countries to feed its urban centres.

Indian planners and politicians were in search of solutions. These are described very well in a series of three books by C. Subramanian " Hand of Destiny" Memoirs Volume 2 "The Green Revolution" published by Bharatiya Vidya Bhavan Bombay (1995) (Ref 3). C Subramanian, popularly called CS was the father of The Green Revolution in India. He played a key role in Indian Planning and other individual sectors like steel.

He was responsible for bringing the benefits of science and technology (S&T), sourced world wide to India, and to the rural economy. He brought in the methods of scientific approach to solving the problems of rural sector. Naturally modernizing agriculture and the related institutions received high priority.

It will be appropriate to read some quotes from his book. He describes in pages 114, 115 of the quoted book, the problems he faced as Minister of Food and Agriculture in the Central Cabinet. Lal Bahadur Shastri was the then Prime Minister (PM).

“Apart from the conflicts of views within the Cabinet, there were political opponents who were opposed to the new policy that I was advocating. It came in for attack from the communists and the leftists in the Congress Party….” (Congress Party had majority and was ruling in the centre and the States.)

“…As this new agriculture would be fertilizer intensive, the communists argued that we would be more and more dependent on the Western countries for the agricultural chemicals. I replied that while it was true that in the initial stages we would have to import fertilizers and chemicals, we could take up the production of these chemicals within the country as a part of our industrial development. In addition, I argued that we were now dependent on USA to meet our food deficit by importing food grains from that country. I stressed that I would rather import fertilizers and be agriculturally self-sufficient than depend upon an outside source for meeting the food requirements of our country. This political struggle continued for a long time …”(This was around late 1964 and during 1965. PM supported CS in general terms).

Lal Bahadur Shastri died and Indira Gandhi became PM on April 19th January 1966. Still the political difference continued but was resolved during 1966, since CS was also involved in drafting the new draft outline of the Fourth Plan in August 1966 some extracts:

"If our dependence on imported food grains has to cease, it is necessary to make far greater use of modern methods of production…"

There is a fascinating description of the issues involved in implementation. The democratic governance which India adopted had its complexities. They are true even today even if the issues may be different. Also whenever introduction of new methods are involved there are heated discussions. It is not that the farmers or rural people are against them! It is mostly the policy makers, the intellectuals and bureaucracy which place their arguments on different premises. In the current period of governance of India (@2016) Non-Governmental Organizations (NGO's), the courts mainly through public interest litigations(PIL's), social media, regular media and also commercial interests operating through many of these channels also influence the decision making process.

CS fought his political battles courageously during 1965 – 1967 to push through the agricultural modernization programme called the Green Revolution later.

A typical one: To quote (Pages 166 – 167)

"I had to deal with a resolution which looked innocent enough on the surface but had political overtones. The following was my reply (a small extract given here) "….We have got to realize today that it is not by mere revolutionary approaches or any other approach that we are going to change the pattern of

agriculture and increased production. Our experience has shown, the world experience has shown that it is by application of science and technology to agriculture and the transforming of traditional agriculture into modern and scientific agriculture that we can achieve results. That is the only way to achieve results…"

Page 179 "The new policy is whether we shall go on in the same way with the traditional agriculture or whether we break away from that and take to scientific and modern agriculture. This is the issue, the fertilizer, non-fertilizer issue, the plant protection, non-plant protection issue, the cow dung issue, the fertilizer issue. Some of us have been saying that we have been carrying on this agriculture for two thousand years, and that our peasants know everything in the world. No doubt they know everything in the world with reference to the traditional agriculture but modern scientific agriculture is not known to us, is not known to every one of us. We have to learn many new things. Therefore, the policy decision with reference to the question is that we are not going to stick to traditional agriculture. We are going to turn to modern agriculture on the basis of modern material input, based on science and technology".

Such a long quote is necessary because such problems continue to be raised on various projects while modernizing the rural economy. CS was courageous yet tactful and

knowledgeable of the details and succeeded in making India self-sufficient in grain production, later in milk etc.

India's rural areas are much more prosperous than what they were during the 1960's. At the same time the nearly five-fold increase in population (due to modern health care systems and due to better food availability) has caused serious stress on individual farm holds which continue to become smaller and smaller over generations. Thus reduction in individual holdings is one of the major reasons of distress of most Indian farmers and agricultural workers.

A brief statistics on agricultural holdings would be in order here:

INDIAN REALITIES

Let us look at the ownership of lands amongst the farmers:

Total Agriculture Land in India is about 160 Million hectares (ha) (as per Agricultural census 2010 -11).

- Small & Marginal holdings below one ha form 85% of total operational holdings but 44% of the total operated area (see the following table for details)
- There are many landless labor as well who do circular migration between villages and cities.

AGRICULTURAL HOLDINGS

	GROUP	Av. Area held ha	% of holding	% of area
1.	Marginal < 1ha	0.4	61.58	17.22
2.	Small 1-2 ha	1.42	18.73	18.81
3.	Semi Medium 2 to 4 ha	2.73	12.34	23.85
4.	Medium 4-10 ha	5.84	6.14	25.34
5.	Large than > 10ha	17.21	1.21	14.79

(Source Agriculture Census : Indian Experience by A.K. Srivastava)

While overall grain production had grown substantially to about 270 million tonnes per year (@2016), farmers' incomes do not match with the requirements of their expenditures (which include several input costs and interest on the loans they have to take). In addition it is to be noted that bulk of the famers are marginal farmers.

It is clear that number of persons reported to be dependent on farming (landowning farmers including marginal farmers and the landless agricultural workers) are about 60% of the work force and their overall contribution to GDP is about 18%. There is a clear case of siphoning of a large number of them into other professions not directly related to agriculture.

Thus the need to focus on agriculture to reduce rural poverty, was the crucial policy initiative as articulated by CS for the 1960's & 1970's.Now the needs of rural economy to provide reasonable incomes to the rural population are around creating new opportunities for them to diversify into other income generating professions. There was a shift towards supplementary income generating professions like animal husbandry and poultry which was also traditionally a part of agriculture. The issue was to provide modern scientific and technical inputs to them: vaccination, artificial insemination, cross breeding etc.; as was done in the milk sector in which there were organizational innovations as well, as was done by Amul in a major way, led by Kurien.

While all the above were useful, still incomes of the rural population could not increase much. Therefore there was a large scale migration from village to towns and cities in an unplanned manner, leading to growth of huge slums all over India. There was also a circular migration in which the rural population would move from villages to cities for a period of a few to several months and returning to their villages for a couple of months to join their families (Ref 4)

The financial distress of the rural population was partly mitigated through these processes but the personal and social distress of a large segment of population increased many fold. Unfortunately the option for them was not to stay back in their villages which were unable to provide even a subsistence

income to them. In comparative terms (to urban incomes even in slums or through circular migration) income in villages for most of the marginal farmers and landless agricultural workers was of a serious concern.

Therefore when a major national exercise was done during the 1994-1995 by the institution called Technology Information, Forecasting, and Assessment Council (TIFAC), to arrive at a Technology Vision for India 2020 (it was meant to be 25 years from 1995 when the study would be completed), Agriculture, Agro-Food Processing etc were some of the key sectors which were considered. TIFAC's Governing Council was chaired by Dr. A.P.J Abdul Kalam who was then Scientific Adviser to India Defence Minister and chief of India's Defence R&D Organisation (DRDO) and the author of this paper was Executive Director TIFAC (equivalent to CEO).

The exercise resulted in a set of 25 volumes. (See TIFAC's website www.tifac.org.in). Later the contents with some additions to link to economics and practices of other countries, were compressed into a book "India 2020: A Vision for the New Millennium" by A.P.J. Abdul Kalam and Y.S. Rajan in 1998 by Penguin (Ref 5)

CONCEPT OF PURA

It was during these exercises the concept of PURA (Providing Urban facilities in Rural Areas) took a firm shape. One of the Task Forces under the TIFAC Study was on "Driving

Forces and Impedances". It was chaired by Prof. P.V Indiresan an eminent academician and former Director IIT Madras and Co-chaired by Rajive Kaul, an industrialist from Calcutta and former President of Confederation of Indian Industry (CII). Even before the work of this Task Force, Prof. P.V. Indiresan, a multidisciplinary thinker and writer had started exploring the needs of rural economy described earlier in this paper: How to improve the incomes of rural people towards the levels of those living in urban areas, thus solving the problems of rural distress and urban distress in the form of slums and unplanned excessive population. India being a democratic country it cannot restrict movement of people and their choices of professions. Therefore the methods to be used are to be based on modern "market economics" and incentive/ disincentive systems. Prof P.V Indiresan had, through his systems studies as well as study of experiences of Europe, was moving towards the direction of well connected villages (in an annular ring form) which in turn were connected to high speed roads or rails to nearby urban centres.

These ideas were further refined in the discussions of the Task Force and also through further follow up by Prof. Indiresan and TIFAC team with various States Govt administrators and village residents.

Dr. A.P.J Kalam was very much attracted to this concept of PURA and started advocating it. He did the promotion at much

great force when he became the eleventh President of India (July 2002 to July 2007) and later as well.

A good description of the concept of PURA and the direction for its implementation is given in the book India 2020 (Ref 5), in its last chapter 12, "Realizing the Vision" (Pg. 272 – 273 of rejacketed edition published 2014; the original book year 1998)

An extract as below:

"In order to achieve the vision, several crucial actions need to be taken to ensure speedier growth of infrastructure: energy, quality electric power in particular, roads, waterways, airways, telecommunications, ports etc. Several short term measures and some unconventional steps need to be taken. The long term action should be aimed at providing world-class facilities for all parts of India. Rural connectivity is crucial even in the short run if the boom in agriculture and agro-food sector is to be utilized fully. In addition, the progress in information technologies is leading to the possibility of very advanced world class industries and businesses being established in a village. Highly creative projects in software, information technology, design and other creative work can in fact be better done in a rural environment which has good facilities and good connectivity. The persons who live there should have access to the latest information available globally if they have to be creative and current. Such connectivity can be provided by electronic means even today. (Note: The original book came in 1998!). Thus there is a true possibility of many of our well connected rural areas becoming

world-class centres of excellence and also making for a lot of value added exports or vigorous domestic business, besides giving us food and other products which normally come from rural areas. There are also excellent possibilities that such well-connected rural areas can be host to a number of biotechnology factories which will produce value – added natural products for sale globally. But all these are possible only with an excellent rural connectivity which means good roads, telecommunications and of course quality electric power.

Given the devolution of power to the panchayats, they can also play a major role, with competition as well as co-operation between the village panchayat enhancing performance".

These words may indeed be considered as the "Manifesto for PURA" which Dr. Kalam was propagating since 1998.

IMPLEMENTATION OF PURA BY GOVT. OF INDIA

During the period when Dr. Kalam was the Principal Scientific Adviser (PSA) to Govt. of India (2000 – 2001) he chaired the group set up by the Planning Commission for formulating the Tenth Five Year Plan for the S&T departments; co-chair was Member (Science), Planning Commission Dr. D.N. Tiwari. Initial seed support for about 10 places for PURA, with all the connectivities was approved by that Group and the

Planning Commission. Before it could be operationalised Dr. Kalam left the PSA Office (Nov 2001). However in a few months' time, he was elected as the 11th President of India. In his acceptance speech as the President of India on 25July 2002 Dr. Kalam emphasized upon the importance of India becoming a developed country soon. It imbedded in it concept of PURA.

Soon thereafter then Prime Minister Shri Atal Bihari Vajpayee in a key speech from the Red Fort on August 15, 2002 (55th Independence Day) specifically mentioned the Vision 2020.

"Our aim is to free India from the curse of poverty and unemployment. It is to make India a Developed Nation by 2020.

"Come, let us make Development a powerful people's Movement..

"This fifty-fifth anniversary of Independence conveys one more message to us. And that message is that all of us strive to our utmost for the realization of the dream of making India a Developed Nation"

He followed up the call with several initiatives. One program was to give the mandate of linking India with broad high ways from North – to – South – to – West (golden Quadrilateral) to the National Highways Authority of India (NHAI). He created special empowering mechanism for NHAI. Such a connectivity is crucial for PURA as well because the connected villages have to be connected to a good nearby city; if it was connected to the

region/ nation, all the more better. In addition he launched Pradhan Mantri Gram, Sadak Yojana (Prime Ministers Village Road Plan), linking villages to a nearby road; this was given a special push. These two schemes have been very successful, still going strong.

For PURA per se, a scheme was approved in 2003 and budget head allotted. As it happens in a vast country, in a desire to sanction a project in all regions of India some 100 or more locations were to receive small amounts of money for each village. The concept of clustering, connectivities etc as elaborated earlier, was not adhered to. The term "providing urban facilities" was taken more in its normal meaning in English and each village was to have one or another "urban facility". So it become like any other rural development project being executed in India since independence without the holistic systems approach as expounded by TIFAC and as promoted by Dr. Kalam.

There was a change in Govt. Dr. Kalam continued as President of India and kept promoting PURA in his speeches. Many types of PURA were being propagated by different groups in India, and some were launched in the presence of the President of India Dr. Kalam who encouraged them in order to keep the idea alive.

But execution of PURA in a holistic and systematic way even in one place did not take place.

However PURA budget head with a small budget, continued in the central govt. budget each year. The Indian Ministry of Rural Development in it Vision/ Mission Statement defines PURA as "Holistic and accelerated development of compact areas around a Gram Panchayat (or a group of Gram Panchayats) through Public Private Partnership (PPP) framework for providing livelihood opportunities and urban amenities to improve the quality of life in rural areas".

Dr. Kalam even after his term of President-ship (which ended on 25 July 2007) continued to propagate the idea of PURA.

As given in the economic times. indiatimes.com dated February 24 2012 (Ref 6), the then Rural Development Minister Jairam Ramesh at Thrirussur (Kerala State) said that A.P.J. Kalam's PURA project was 'a complete failure' and therefore his Ministry was launching the restructured version of PURA. He said the focus of the project he would launch was to develop physical infrastructure in areas which were "neither rural areas nor completely urban areas". He also added that it was different from Kalam's knowledge connectivity. He described such areas as "Thrissanku" - a analogy from Indian mythology about a person who was in a special place neither heaven nor the earth. He said that there were 461 such areas in Kerala State and about 2600 such areas in India as a whole. He had added that 500 such areas would be taken up during the 12th Five Year Plan. Not much work had proceeded in these lines.

A new Govt was elected in May 2014. The Govt. of India (GOI) had launched a Shyama Prasad Mukherji RURBAN Mission (SPMRM) in 2016. Among the various descriptions about the Mission, it is stated that a predecessor to SPMRM was the PURA launched by GOI in 2003. (The coalition govt. then was National Democratic Alliance – NDA – and the govt. in power since 2014 is the same). Details are available in www.arthapedia.in Feb 15, 2016 (Ref 7)

The aim of SPMRM launched by GOI in 2016 is to deliver integrated project based infrastructure in the rural areas, which will also include development of economic activities and skill development. The preferred mode of funding is PPP while using various scheme funds (of Govt of India) for financing.

It is also described to be a Rurban model adopted in Gujarat. The reason given is that the RURBAN areas contain 69% of population. The govt. approved outlay in the budget on 16th Sept 2015 was Rs. 5142.80 Crores (Crores = 10 million). Since actual execution would be by the State Govt, GOI had asked for proposals. Detailed guidelines are given in the websites. Then selection from the proposals received, took place. PM launched a few selected projects on 21 Feb 2016.

For the purposes of SPMRM, Rurban areas refer to a cluster of 15 – 20 villages with about 30 to 40 lakhs (10 lakhs = 1 million) population. The clusters will be geographically contiguous to Gram Panchayats with a population of 25000 to

50000 in plain and coastal areas and a population of 5000 – 15000 in desert, hilly, or tribal areas.

For the first year of SPMRM mission that is, in 2016-17, 100 Rurban clusters will be developed.

The launch of SPMRM places Govt money into those schemes under SPMRM. The write up in arthapedia of Feb 15, 2016 quoted above (Ref 7) also states that PURA is treated as a "project" and not a govt. scheme. It appears, thus, to implement a PURA promoted as a PPP or Private Project by States or project by other entities, funds from SPMRM will not available

With a formal launch of SPMRM, the Ministry of Rural Development, Govt of India website, gives the formal name of the Mission as Shyama Prasad Mukherji National Rurban Mission (SPM NRuM). The Ministry website also gives FAQ's and answers.

There is a clear Vision Statement. The aim is to cover 300 rural growth centres across the country. "What is Rurban?" is described.

Important 14 desirable components recommended under the Mission are given. Since they form a useful reference they are given here.

i. Skill development and training related to economic activities

ii. Agro processing and Agri Services, Storage and Warehousing.

iii. Fully equipped mobile health unit

iv. Upgrading school/ higher education facilities

v. Sanitation

vi. Provision of piped water supply

vii. Solid and liquid waste management

viii. Village streets and drainages

ix. Street lights

x. Inter village Road Connectivity

xi. Public transport

xii. LPG gas connections

xiii. Digital literacy

xiv. Citizen-centric Services Centres for electronic delivery of citizen centric services/ e-gram connectivity.

Note: Components pertaining to agriculture and allied activities would be required to be given special emphasis while developing these clusters.

The items listed are very important and these have been much close to Vision 2020 documents and description of PURA given there in. However this new Mission has spelt out specific

items needed for villages. In addition it also emphasizes newer aspects emerging from India's growth and resultant aspirations of people – like LPG, street lights, piped water supply, etc. It is also to be borne in mind that the mega Mission of PM namely "Digital India" has been embedded in specific terms in most of the components of the Mission.

INDIAN REALITIES

In terms of receiving govt. support, it would be clear from the above that the proposals have to be tailored around the SPM NRuM and the focus given therein.

However many persons who show interest in Indian rural development, or PURA or SMART VILLAGES, an idea newly emerging in the context of India's announcement of SMART CITIES, are not fully aware of Indian realities. It is fashionable to combine all 1.25 plus Indians as one homogenous entity. Also there are still people who are enchanted by the earlier writings on India's villages such as "India Lives in Villages" "Village Republics" etc. It is to be noted that Indian villages are no longer isolated republics. With NHAI fully connecting the Golden Quadrilateral, the largely increased surface transport and above all, wide spread mobile telephone connectivity all over India, villages and rural people are no longer the same. There are very rapid changes. In addition about 300 TV channels in

many Indian languages including a number of foreign channels have made a revolution in the expectations of persons living in villages. The push by the current Govt of India for “Digital India”, especially digital money transactions, etc is revolutionizing the village connectivity.

However the basic demography of India in terms of assets and incomes enjoyed by people and their families has serious inequalities. The severely unequal income levels naturally lead to different types of pragmatic markets: For example while the penetration of mobile telephones is very high even in rural areas, internet penetration is still very small. Hopefully if Digital India is executed as announced, things may change. In terms of quality education, availability of quality electricity, or health services the sharpness of inequalities is very high. Especially quality electricity will determine the possibility of smart solutions.

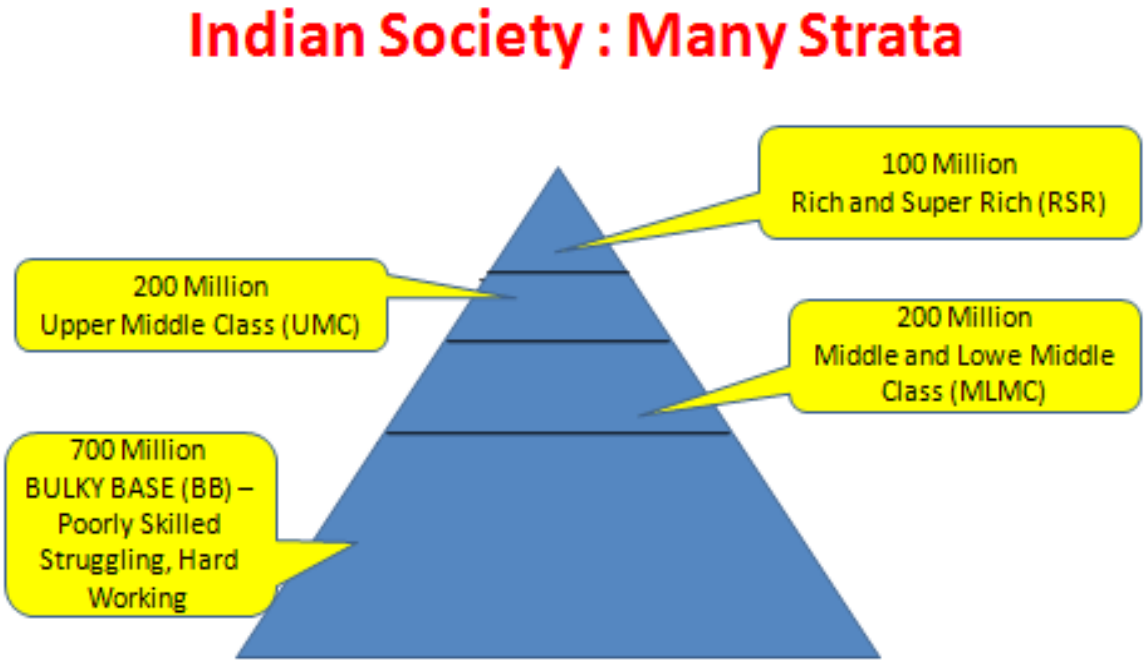
It is, in this context, useful to look at a few aspects of Indian realities.

If one approximates the distribution of Indian Society in terms of incomes/assets for families (See Fig 1)

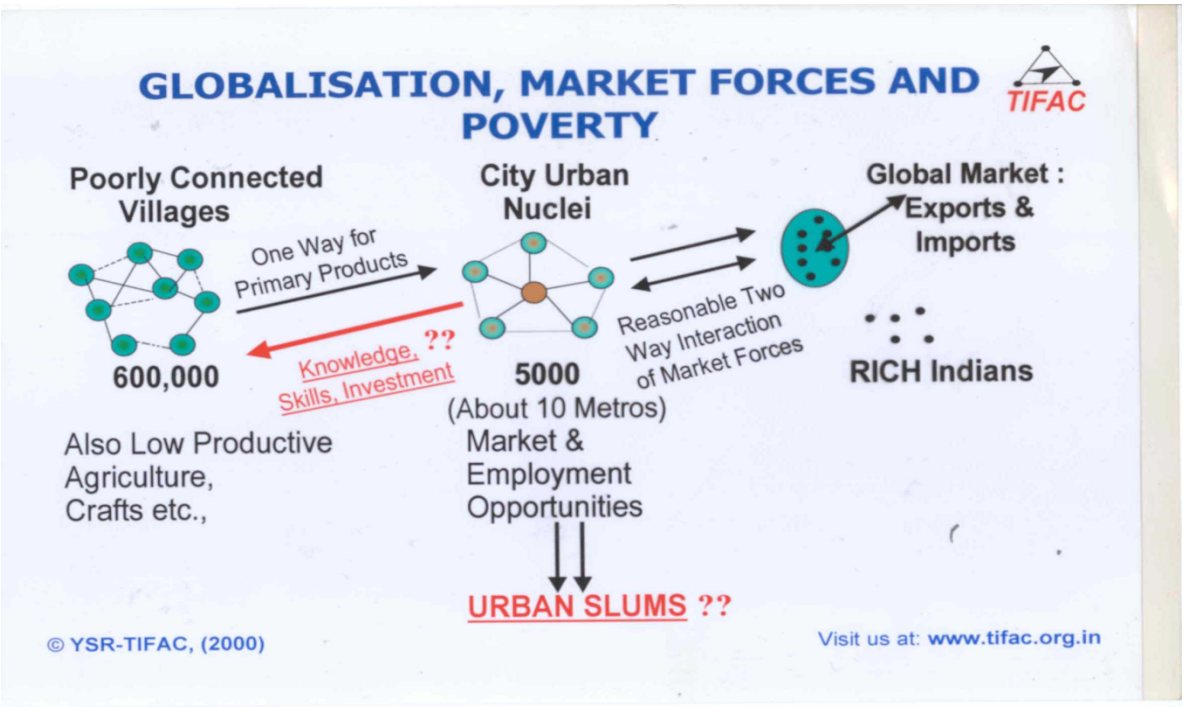
The top 100 million Indians will be rich or super rich (RSR) in the Indian context. These RSR persons are distributed all over: even in rural areas, small towns, cities and metros. Not all the wealth is seen as the formal economy where taxes are paid. Agricultural incomes are not taxed. Also lots of money had been

transacted over the 70 years in informal sector as it was under the colonial rule and earlier. Also the complicated governance systems have led to generation of wealth through 'corruption' in the hands of many persons who are in the "approval loops" of govt. regulations. Despite some drastic measures taken recently by GOI in terms of demonetization and other related measures, it is difficult to envisage that these 100 million RSR persons will disappear or reduce in number. In terms of economic growth, it is essential to have some rich persons to invest!

Just below the RSR are those who form the Upper Middle Class (UMC). Mostly those with higher education aspiring to have the standard of living as in the developed nations such as USA, Canada, UK etc. are in UMC. Many of these persons have reached such a stage mainly after the liberalization of the economy in 1991 and the ICT revolution taking place globally making India a major outsourced hub, with its famous IT Industry. In fact towards the close of the 20th century many Indian economists, analysts, media persons etc started predicting a services sector led new economy for India, almost totally neglecting agriculture and much of the manufacturing sector calling them "sunset industries".


Indian Society : Many Strata
100 Million
Rich and Super Rich (RSR)
200 Million
Upper Middle Class (UMC)
200 Million
Middle and Lowe Middle Class (MLMC)
700 Million
BULKY BASE (BB) – Poorly Skilled Struggling, Hard Working

(Fig 1)



(Fig 2)

Thus two huge sectors of economy which could give reasonable incomes to Indian people (most of whom about 90% do not have higher education, about 80% not having a full school education) were neglected.

The Indian pyramid based on incomes and assets, has on its top RSR 100 million and about 200 to 250 million UMC (UMC's mostly generated by globalization). These two sections of India propel the Indian economy and the process of globalization.

Due to some spillover effects of the globalization and market forces, another 200 – 250 million Indians have been lifted above, forming the middle/ lower middle class (MLMC), from

the Bulky Base (BB) which would be about 700 million. The MLMC mostly stay in cities/ urban areas and many of them in the slums. Any major set-back to their jobs or health of an earning family member would push them into BB. Most of BB lives in rural areas/ tribal areas. To propose SMART solutions for their better lives need to be done with great care, fitting to the local contexts in which they continue their subsistence living. Many of the marginal farmers belong this category, not just landless agriculture labour. Their marginal lands are of little value as an asset because incomes from these lands are marginal; also the marginal farmers get indebted in the process of doing agriculture operations in these lands, though they often perform tasks as agriculture laborers as well.

To visualize the totality, pyramid in Fig 1 may be referred. To be sure, the growth of RSR and UMC's in their numbers and in their incomes is vital for the Indian economy. The key to solve the challenges of Indian poverty lies in raising those in BB into MLMC and in the process some percentage of MLMC would graduate to UMC. It is such an organic process that needs to be done in providing any SMART solutions for them. No doubt if carefully worked out, with attention to details, some really innovative ICT and SMART solutions can emerge and spread to all of them, thus speeding up the process of raising the quality of life for ALL Indians.

Again to understand linkages between various levels of the society in the context of globalization, we may refer to Figure 2,

titled “Globalization, Market forces and Poverty”. This figure was generated around the year 2000 for various talks. Details about thus fig 2 explained in (Ref 8) a book “Charkha and Chip Rural Industrialization and Technology”, edited by Kamal Nayan Kabra and Laxmi Dass published by Gyan Publishing House New Delhi (2006) in its chapter 5 “India’s Rural Poverty and Possible Solutions” by Y.S. Rajan Pg 51 – 72. Charkha represents the traditional village technology advocated by Mahatma Gandhi. The book is an attempt to reconcile that status to modern technology “chip”. The essence of the idea of SMART VILLAGES may very well be captured by the metaphor: SMART VILLAGE = Charkha+Chip. A brief explanation is appropriate here for continuity. The right side of the figure 2 represents Global Markets through exports and imports. The metro cities of India and RSR Indians are already integrated with it; UMC’s are also a part of these processes. That is why they get better incomes. They also match in skills, the requirements of global, that is, developed nations’ markets.

This right side of the figure is reasonably well connected in terms of two way interaction with cities and urban nuclei (about 5000 in number). In fact these linkages provide to the metro polis and the companies operated by RSR there to get “wage – advantage” in the global market. Some UMC’s and many MLMC’s stay in these towns and cities. They also house many colleges to provide low cost skilled labor imparting higher education. These interactions are taking place in India despite

relatively poor physical infrastructure and complex administrative procedures. These cities and metros also have huge slums which are habitats of many LMC's and a part of BB migrating from rural areas. These SLUMS should not be forgotten while considering solutions for villages, as these are but an extension of villages, due to severe adverse economic pressures on the rural people.

Coming now to the left side of the figure: These are poorly connected villages (about 600000). There is one way transaction of primary products from them to the cities and towns and through them metros and even global markets. But the other way red arrow indicates very poor linkages in terms of Knowledge, Skills and Investment. In addition, the villages suffer from low productive agriculture, crafts etc. If some value addition is done to them in terms of agri – processing, they take place in towns, cities or metros. Most of BB stay in these villages. No doubt there are some rich farmers and some middle income farmers in these villages. But they are also under severe economic pressure due to the impacts of globalization, changing demands of the urban and metro markets and even global markets.

Such an asymmetry of interaction has resulted in an exploitative situation. The rural persons are being impoverished in relative standard of today though the absolute famine-levels of poverty are things of past. Also the spread of TV's to most villages, leads to increase of aspirations and sharp pains of realties!

To quote from the chapter 5 in the book (Ref 8) quoted above "Also their expectations through TV and other media are going to go up and they can legitimately aspire for more. It is a human volcano getting ready. Such a strong language is used to draw attention to the serious situation.

"In order not to have such a serious outcome, the solution is to generate linkages of knowledge and skills and investments into villages not merely as small doles or as some things which are given in the name of appropriate technology keeping them in subsistence level, but in substantial manner with a new approach so that larger value addition even within the limited investment level possible for them is done the villages".

It further points out that it would not come about without substantive public investments for economic, knowledge and skill linkages. It is further hoped there in that a focused implementation over 10 years would make the left side fairly well connected two ways .

A decade had passed since that write-up. That was also a period when Dr. Kalam, as President of India was propagating it.

Though the PURA concept which is explained in detail by Dr. Kalam and others, unfortunately it started with small "doles" in 2003 and stagnated thereafter. The fact that PURA's did not come about, was not because of idea but because it was not implemented in a systemic way; funding was sub-critical.

SMART VILLAGES AND SPM NRuM MISSION

Under these circumstances, the major option left for those who would like to bring about a large transformation in terms of quality of life and standard of living for people in rural India, is to be a part of the projects under the current govt.'s scheme of SPM NRuM mission. Even while there is a restriction of its being a RURBAN mission, the definition includes many villages. As described earlier, the components of the mission provide for a holistic approach which can ensure good end results. They also contain many avenues of introducing "SMARTNESS" as is currently understood. In addition, the website on NRuM mission mentions that its areas of coverage have about 69% of India's population. The mission had thus a potential for a large impact, if implemented well. "RURBAN" in terms of Fig 2 would cover the villages in the left and many towns/ cities in the centre and the slums in those cities and towns.

It is also to be noted that GOI has left the door open for PURA in a project mode to be executed as PPP venture. It is not covered under NRuM as receiver of fund under the scheme. Thus those who are keen in the execution of PURA in its "pure" mode as propounded by Prof. P.V Indiresan through TIFAC and promoted by Dr. Kalam, can still do so with corporate funds and under some funds available with local Govt.'s. These can well supplement some items not covered in a particular RURBAN project. As India is a country with immense diversities, if a

PURA project can be conceptualized around a scheme being planned under NRuM, it can leverage on many advantages of connectivity's being provided under NRuM mission.

SMART PROJECTS FOR SMART VILLAGES

Having gone through the broad frame work about availability of schemes and projects which can attract Govt. of India funds or local funds, let us look at some specific projects. It is also wise to keep in mind the 14 components given in SPM NRuM Mission and the "Note" therein which emphasizes agriculture related projects. There is a lot which can be done to make agriculture in rural India "smart" without necessarily "leap frogging" into "Precision Agriculture" which can be considered as a standard example of Smart Agriculture.

AGRICULTURE FOR SMART VILLAGES

Even while most persons would agree that the rural areas and agriculture are being neglected, many persons would not be aware that 80% of the water in India (surface plus ground) is being used by agriculture. In terms of water from surface dams only about one-third of the land- under- agriculture receives such an irrigation but most others depend upon monsoon rains. It is difficult to provide even now with much more knowledge of

monsoon processes and sensors, as to how much rain a particular village and most importantly when. Thus each farmer in such areas dependent upon rains, makes decision with uncertain data. And he uses ground water through pumps depending on erratic electric supply. Some of them have additional pumps fuelled by diesel, if they can afford. Even under such severe shortage conditions, bulk of the water used for agriculture is wasted after flooding the fields. This practice is because of age old traditions of using water and serious lack of agricultural extension services, which can introduce modern tested technologies to the farmers, as was done during the introduction of Green Revolution.

In addition the concept of reuse of used waste water by recycling methods, is not picking up though they were introduced successfully in a few places in India in cities, about three decades ago. There are a few water industries which offer full solutions to the final stage of "build, operate and transfer" Only recently industries and some domestic sectors have been forced to do such recycling through govt. rules. But industrial use of water is only about 8% of total consumption of water in India. Practically no one thinks of reusing the agricultural waste water. But it is crucial for India. Along with that, various water saving methods like Drip Irrigation, and Sprinkler Irrigation have to be introduced to the lands of marginal farmers.

These are briefly described in a book "Mission for 21st Century (Living with Nature in The Modern World) by Y.S.

Rajan (2014) published by Ocean Books Pvt. Ltd (Ref 9) Chapter 3: Water: For Life and Growth. The book is based on a series of articles written for a magazine Kisan World (Farmer's world). Some quotes:

"We will now continue our planned trajectory about technological, infrastructural, and support systems needed for agricultural prosperity…

"But large parts of agricultural fields in India have poor or no irrigation systems…

"Speedily implementable and imaginative technologies and support systems are required to make these areas prosperous. We have enough surveyed information (by satellite remote sensing and ground surveys) about availability of dry or wet lakes or ponds (some even inundated) in such areas; and also about ground water potentials…Dig up these the lakes or ponds and ensure channels of flow of sparse rain water to these lakes and ponds. Also dig wells close to the fields.."

Then the chapter describes the actual available systems, and also about Energy needs such as Electricity & Diesel. It also addresses the issues of economic viability and Return on Investment (ROI).

Then a section describes the modern Information Systems and their specific roles. A brief quote:

“We can also classify lands in terms of better, medium and poor capabilities. The social dimensions can be brought through Geographic Information Systems (GIS), as we have fairly good census data about people, their incomes, geographical distribution etc. These multiple socio- economic data overlays can be used to select areas where such enabling of water access described above has to be prioritized by balancing the ROI considerations and the large social impact dimensions. In addition to ground level monitoring, satellite-based remote sensing monitoring can very well assess as to how well water access and resultant growth of crops are taking place. Supervision is essential in India!...

“With the availability of GIS one can easily overlay the govt. schemes under operations so that financial resources can also be optimized by restructuring / fine tuning the ongoing programmes..”

SPM NRuM areas can thus be identified well and any initiative for SMART VILLAGES can be optimized within it or around it. It is essential for all the initiatives to have some elements of agricultural-prosperity-enhancing projects embedded in them. Making agricultural operations by the farmers – rich, medium and marginal ones – at the village levels more productive and efficient through increased agricultural technology inputs and other SMART elements of ICT, will largely enhance income levels within villages, which is crucial for all other SMART elements of the projects.

QUICK WALK THROUGH OF NRuM AND ELEMENTS FOR ADDING SMART FEATURES

After discussing briefly about agricultural related projects which are specifically mentioned in the note of NRuM criteria, it is good to look at all the fourteen desirable components of NRuM, as it would help us to identify items which are amenable to SMART technologies. It is obvious that we revolve around NRuM as the projects weaved around it have a greater chance of acceptability. As described earlier, it is easily possible to do so as the concepts of PURA or the ideas above SMART villages, are not in contradiction with NRuM desirable components. In fact one can say that they intertwine very well with the desirable components of NRuM.

Before doing so it will be good to refer to a recent article in Times of India Saturday 10, 2017 by a very senior minister of the present Govt. of India, Venkaiah Naidu (Ref 10) titled "Don't Politicize Farmer's Issues". It describes very well the projects/ initiatives under way to enhance the well being of rural people and farmers.

It would be useful to have some quotes from that article as relevant to our subject of SMART VILLAGES.

"Providing electricity to all unelectrified villages has been taken up as a major mission, apart from accelerating rural road connectivity for faster transportation of agri-produce by farmers…Doordarshan has also started an exclusive Kisan

channel to educate farmers on new technologies and keep them abreast of latest issues”

(Note: Doordarshan is govt. funded national TV channel which has large number of viewers and has programs in Indian languages.)

Now coming to the 14 desirable components of NRuM the two elements connected to physical connectivity are:

- Inter-village Road Connectivity
- Public transport.

Physical manufacturing and logistic support systems which would be and benefited by the above are:

- Agro-processing, Agri-services, storage and ware housing.

These have many elements amenable to introduction of SMARTNESS in the Indian rural context (right from information on availability to having excellent maintenance of facilities which are severely lacking in India).

The other items of physical nature are:

- Sanitation
- Provision of piped water supply
- Solid and liquid water management
- Village streets and drainages

- Street lights
- LPG Gas Connection

Innovative persons can enhance the benefits from the above by adding relevant SMARTNESS – such as monitoring leakages to monitoring reliable functioning of Sanitation facilities etc.

Then the stand alone health care system relates to :

- Fully equipped Mobile Unit.

There has been successful demonstration by TIFAC of extending modern health care to rural people in some of the difficult terrains as in Uttarakhand. A brief description of the achievements and potentials for all of India is given in (Ref 11) "Beyond 2020, A Vision for Tomorrow's India" by A.P.J Abdul Kalam and Y.S. Rajan, Penguin (2014), chapter 11,pp 176-180. If executed well with availability of good quality medical diagnostic equipment in the mobile vehicle it is possible to attract good doctors to work at the village level, because of the mobility of vehicle; doctor can stay at towns nearby and do a ten day continuous tour and return home for a few days and start tour again for other villages. The mobile unit can easily be fitted can be easily to provide telemedicine support. The potential of enhancing SMARTNESS in these mobile units is very high.

The other four items are:

- Skill development training related to economic activities

- Upgrading school/higher education facilities
- Digital literacy
- Citizen Service Centres for electronic delivery of citizen centric services/ e- gram connectivity.

Note: If done well, these are the core of SMARTNESS of villages. They can make the SMARTNESS of villages self sustaining.

It is not necessary to explain each of the above with examples. A reasonable degree of imagination can provide multiple options for introducing SMART elements into VILLAGES and RURBAN areas.

The above elements are really straight forward and would have been repeated in India for over a few decades as desirable components for rural economy and society. Introduction of SMARTNESS would be recent additions as the technologies available in the world and adapted in India, allow such possibilities. All these are vital and form the very foundation of SMART villages or PURA or NRuM.

But there are several other possibilities which are emerging given the new spirit of celebrating entrepreneurship in India with slogans such as “Start Up and Stand Up”. There are funds available from various investors to commercialize really exciting and viable projects.

We would give some examples in the following. If such ventures pick up the concept of SMART VILLAGES, they can go beyond the usual structured projects be it PURA or NRuM and break new grounds not thought of till now. We need to keep an open mind in modeling any scheme of SMART villages or for making policies or governance systems for them.

Here are some examples:

RURAL INDIA – NEW OPPURTUNITIES

We had described earlier about the "Internal Circular Migration", that is, going from villages to nearby or far away cities in search of work in short spells of a few to several months and return to the villages once or twice in a year and again return. Often times the families are left behind. There are also cases of circular migration in which the man and his wife with or without children go for work through the circular migration route. Though painful, this provides much better incomes for the workers. More details are available in an article in the Kisan World referred to earlier (Ref 4). The number of such persons would be about 100 to 150 million. One of the major ideas behind PURA was to reduce such circular migrations and also permanent migrations into the slums.

But such a large size of Indian work force indicates a good opportunity of utilizing them more productively and in a more systematic way thus creating a large enterprise. In fact it is an indication that Indian agriculture cannot sustain the current work

force engaged in it. There is a need to siphon off persons from their current low income agriculture-dependent work. By modernizing Indian agricultural practices on the lines indicated in the earlier sections, a large percentage of work force can be released for other parts of Indian economy. That would also need providing them with enabling skills which is significant component of the SMP NRuM mission.

If one studies carefully the fourteen components of NRuM given in earlier section, the human resources required to execute them are themselves persons who will not be dependent upon agriculture. Thus those who are left for work in agriculture would get more incomes; but persons who do not do agriculture but do many parts of the NRuM mission components would from mostly newer forms of services sector which would give them better incomes. There would thus be a significant increase in GDP.

But for creating such enterprises out of the current human resources

a. Who are grossly under utilized in rural areas
b. Partly utilized in circular migration, and
c. Utilized in a difficult social conditions as in slums,

requires really innovative thinking. It can't be on "Charkhas" nor a huge infusion of "Chips" – a metaphor we have explained before in the Indian context.

When India started with textile boom post liberalization in 1991, Tiruppur based textile industry provided a very good model ;part of it depended on exports. But improved technologies and competition from foreign imports have saturated Tiruppur's capability to absorb more human resources. Post 1971, large number of Indian work force (technicians, nurses etc) went to Gulf countries; they enriched India by their remittances. Those avenues are also reducing. Thus the new types of enterprises need to be created built around Indian needs: by doing things which are already going on in a SMARTER way, thus improving overall productivity and individual incomes. Fortunately some entrepreneurs have started building up such enterprises. If many such items are done – the VILLAGE, RURBAN, and SLUMS – trio – will become a powerful economic machine for a new phase of growth of Indian economy. Those who would benefit most will be those who are in BB and MLMC, now. But UMC's and RSR will take greater share of wealth as they would bring in technology and investments for such enterprises. Current Govt. and future Govt.'s would encourage FDI (foreign direct investment) in such enterprises. Also the foreign technology companies would mostly be the supplier of high technology elements of such

SMART enterprises thus giving them a good business opportunity utilizing ordinary Indian human resources.

Examples follow:

"DRIVE IN INDIA"

Indian logistics, especially the movement of economic goods, depend on road transport. About 80% of the goods are moved this way in all parts of India. Some trucks move from Kashmir to Kanyakumari and from Ahmedabad to Kolkata and more. The NHAI's golden quadrilateral high ways and other state and rural road help (though the later two need more improvements)

But the life of a truck driver is terrible. For several days they have to be away from their homes (about 25 days in a month); live in odd places along the road sides; they are over worked; there are accidents; they often suffer from HIV/AIDS etc. Current additional problem for them is that their marriages are a problem. Prospective brides do not like to marry them. Thus many young men avoid becoming truck drivers. But driving trucks safely becomes a priority for modern Indian economy!

A new enterprise which has been created is an innovative one. An economic need, social need and some elements of SMART technologies have been combined to source good drivers from villages themselves and some "rurban areas". A good account is given in an article in Times of India (Ref 12)

“Drive in India” can generate more jobs than “Make in India” by Swaminathan Anklesaria Aiyar 26 Feb 2017. He has described about a new generation logistics company Rivigo. “Each driver drives 4.5 hours. The relay continues till destination. Each driver from a pit stop catches a truck in the return direction to GET HOME BY NIGHT. Social Stigma Lowered”.

It is reported that productivity had gone up: typically “this cuts delivery time for Delhi – Chennai from 96 hours to 48; for Bengaluru – Kolkata from 110 hours to 44. This is twice the speed of some couriers companies and maximizes truck utilization”.

To quote further

“It can end today’s chronic shortage of drivers, and stop veterans from switching to city driving jobs. Villagers with limited education are being trained both in house and in institutes to become skilled, safe drivers. Cell phones and electronic monitors enable managers to monitor every aspect of the truck movement and solve problems.

“The model is likely to become the future of trucking..”

RATION SHOPS AS BANKING OUTLETS

We just saw how a traditional “lowly” profession was being converted by SMART inputs into a vibrant enterprise, elevating the social status of truck drivers and also helping them to stay in their own villages.

Another institution with all India presence is ration shops which started in India during the World War II under British rule. Post - independent India, due to severe food shortages, had to expand the outlets for rationed food; later they also became outlets for rationed sugar, kerosene etc. They are called Public Distribution System (PDS). While these helped the poor people and lower middle class, over a period they had fallen into disrepute due to corruption and "leakages" of the supplies to open markets instead of reaching the beneficiaries. The present Govt of India had taken several steps to reduce these leakages and to reach the poor (beneficiaries) persons directly with necessary subsides. This is called Direct Benefit Transfer. In addition GOI is encouraging e-transfer of money so that the "leakages" and corruption of the intermediates are eliminated. GOI has enabled every Indian family especially the poor rural persons who were mostly out of the banking system to have bank account in their names – Jan Dhan (Peoples' Money) scheme. Digital banking is also being encouraged. Several enabling mechanisms have been put in place.

A govt. bank IDFC had used an innovative method for increasing their outreach. Instead of trying to make its own infrastructure, which would have been a costly and time consuming route, it had decided to use the ration shops of PDS as its banking channel. See for detail, a report in Times of India 27, Feb 2017 (Ref 13) "IDFC Bank to turn ration shops into outlets for banking" They plan to achieve it by recruiting Public

Distribution Systems (PDS) agents as business correspondents. This will require skilling them suitably and using simple-to-operate Digital modes. To quote:

"In rural and semi urban areas, where customers need 'assisted digital' banking IDFC's Bank's Aadhaar merchant solution is a perfect fit… It has no merchant discount rate".

Aadhaar is a Unique Identification card issued to all Indians with biometric markers also included; thus it would help in reducing fake cards taken by the non- beneficiaries earlier which were the paths for leakages and corruption. Also verification processes in the banks have been speeded up with a single card. In addition an important incentive (lack of which inhibits many digital transactions by the small merchants) has been incorporated by removing the merchant discount rate. Thus e-transactions can be done by small merchants and poor rural persons without loss by their money.

Such systems may be followed by others in competition to IDFC. But on the whole 'assisted digital banking' will expand fast and lead to many new enterprises to come up as payment has been made easy. So the "rural economic soil" has been made rich to adopt SMART solutions.

Look At Micro – Details

If one studies the key feature of both the above examples which are commercial ventures, one thing is common: LOOK AT THE MICRO-DETAILS WHICH USUALLY PREVENT ADOPTION

Also one should not use only technocratic solutions used abroad. The local economic and social contexts need to be understood carefully before adopting specific e-solutions (You have to be smart about local contexts to provide SMART solutions!). Often one – shoe – fit – all solutions do not work!

INDIA POST BANK

This is another example of using such an approach. Post and telegraph services were introduced in India by the British to help their rule in India.

Post office building /offices are about 2, 25,000 in India. That is, one in three villages has an access to a P&T office. Post offices have several roles now in independent India: to transfer money through Money Orders (now done by e-mails) to help small savings, to be courier services etc. Recently India Post Pay Bank (IPPB) has been upgraded in status to fulfill some retail banking services. This is a crucial step in financial inclusion. A recent repot in Times of India 27 Feb 2017 (Ref 14) titled "India Post Bank is likely to tap World -War -Era tech to garner biz" gives some details.

The aim is to target a customer base of around 850 million, which either have no access to telephony or still depend on feature phones. A key focus area for IPPB is one billion bills that are paid every month, with average ticket size of Rupees Three Hundred. This is where Giro – an electronic fund transfer

tool used in Europe and Japan will come in handy…Migrant worker can transfer money to his wife, parents etc in village."

There are hundreds of such viable, SMART enterprises in the basket of village and RURBAN economy, to be "discovered" and converted into businesses. Those interested in SMART villages, SMART solutions to poverty, SMART tribal habitats etc, have a great opportunity before them.

SUPPORT FROM GOVERANANCE SYSTEMS

Much of these opportunities can be captured speedily only when the governance systems are changed or fine tuned to support these enterprises to emerge, based on SMART village concepts. It is not enough for the govt. to launch SPM NRuM mission and place all projects under it. Experience from the past shows that it would at best lead to limited success only. It is necessary to open up the village and RURBAN economy to allow for new and SMART technologies to be applied there. For tribal habitats more careful advantages need to be given to those who venture to try SMART solutions there.

Some crucial actions by Govt (Central and State) needed are:

* Provide tax incentives (e.g. exemption of service tax) to make it attractive for investors/ entrepreneurs and through simple regulatory processes encourage simple innovative solutions by commercial entities. Let these not be an exercise in making a centralized solution at the Central / State Govt levels. Let it allow enough leeway for new ideas to be experimented with,

especially for tribal areas where much more contextual flexibilities are required.

* Provide nation wide satellite-to-mobile phone broad band communications, as quickly as possible, even through foreign satellites to cover all villagers, (note villagers not just villages) just as satellite TV started covering India since 1980's through Govt provided INSAT – 1 satellite. Now, DTH satellite TV services have reached remote corners. More than 300 TV channels in many Indian languages operate commercially giving excellent revenue for govt.'s and also huge employment (and entertainment).

Ten years of free service by Govt., that is, Govt. providing for satellite and its maintenance free of charge, and allowing other entities to use it commercially or otherwise for creating SMART VILLAGES(S) thus transforming the country to SMART INDIA. The new types of slogans can be SMART VILLAGES, SMART RURBAN AND SMART INDIA.

The tasks outlined here can be executed in about 10 years if all items are activated simultaneously instead of waiting for one Govt scheme to another. If necessary even FDI (Foreign Direct Investment) should be encouraged to cover many items mentioned here and even beyond that, as this paper could not cover all possible items even at aggregated levels.

The focus should be to unleash innovation into rural and urban sector in a way that would fit into the lives of people

living there and elevating them to higher social and economic levels.

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