

Third Report

INAE Forum on Technology Foresight and Management for Addressing National Challenges



Indian National Academy of Engineering
October 2018

Third Report

INAE Forum on Technology Foresight and Management for Addressing National Challenges

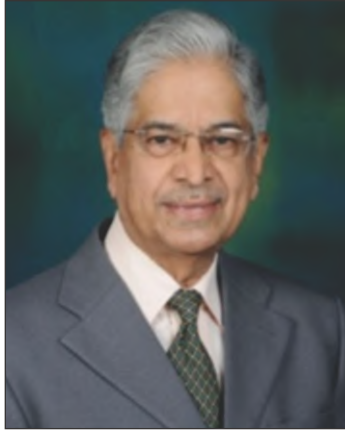


Indian National Academy of Engineering

October 2018

CONTENTS

Chapter No.	Title	Page No.
	<i>Foreword</i>	(III)
	<i>Preface 1</i>	(IV)
1.	Challenges of Rural Urban Continuum	1-61
2.	High Speed Rail for Sustainable Development in India	62-83



Foreword

I am delighted that the INAE Forum on “Technology, Foresight and Management for Addressing National Challenges” under the Chairmanship of Mr VK Agarwal, FNAE, has brought out the third Report on addressing pertinent issues and concerns regarding Rural Urban Continuum and development of High-Speed Rail in the country. Both the topics covered under the report are highly relevant in today's context are also among the thrust areas of national engineering interest for the Government.

The first topic on Rural Urban Continuum is appropriate as the Urban -Rural -Divide is a perceivable challenge that needs to be overcome for socio- economic growth and sustainable development. Urban India has witnessed great technological growth and there has been a paradigm shift for the better in the lives of the citizens in Megacities and Metros. However, there is a need for this technological revolution to percolate to the inhabitants of villages and rural areas as well. Appropriate technologies can offer the right solutions to many of the multi-fold challenges faced in rural areas such as ensuring sustainable agricultural practices, availability of potable water, physical & electronic connectivity, migration from villages to cities and provision of adequate sanitation and healthcare facilities.

Regarding the second topic of the report, it is pertinent to mention that there has been much debate in the recent past on the feasibility of development of High-Speed Rail systems in light of the first High Speed Rail Corridor being planned from Mumbai to Ahmedabad. I am happy that the report addresses all the issues, international experiences and lessons in creating of a High-Speed Rail system as this shall indeed transform the travel for rail passengers. There is a need to think out-of-the-box and evolve and also change the mind-set in adopting new technologies and High-Speed Rail has tremendous potential to revolutionize train travel in the country.

Technology Foresight is important for the policy makers to study, analyse the existing scenario and help them in planning and formulating of policies that shall make a difference in selected areas. It is a matter of pride that the INAE Forum on “Technology, Foresight and Management for Addressing National Challenges” has taken cognizance in addressing two areas of topical engineering concern.

I am confident that this report shall be of immense benefit to all stakeholders from the engineering community and the recommendations emanating shall be well accepted by all players dealing with Rural Urban Continuum and High-Speed Rail Systems in the country.

A handwritten signature in black ink, appearing to read 'BN Suresh', written in a cursive style.

Dr BN Suresh
President, INAE

P R E F A C E

1. A proposal to constitute a **Technology Foresight and Management Forum for addressing National Challenges**, composed as under, was discussed during the Governing Council meeting of the Academy held on July 27, 2012 at New Delhi and approval conveyed vide Indian National Academy of Engineering (INAE)'s Letter No. INAE/413/TFMF dt. 22nd August 2012 :
 - (i) Mr. V. K. Agarwal Fellow INAE – Chairman
 - (ii) Dr. Y. P. Anand Fellow INAE
 - (iii) Dr. Prem Vrat Fellow INAE
 - (iv) Dr. C. R. Prasad Fellow INAE
 - (iv) Mr. A. K. Anand Fellow INAE
 - (v) Mr. K. P. Singh Ex MD RITES & Ex. MD Tata Projects
 - (vi) Mr. S. C. Gupta Ex. Member Electrical, Railway Board
 - (vii) Mr. V. N. Mathur Ex. Member Traffic, Railway Board
 - (ix) Mr. A. K. Gupta Ex. CAO Railways & currently Editor, RITES Journal
 - (x) Mr. Pradeep Chaturvedi Fellow INAE (Joined the Group later viz. May 2017)

2. The broad **Terms of Reference for the Forum** were as under :
 - 2.1 Domain of National Challenges is very wide and also keeps on changing from time to time. However, this Forum would address the following as a broad guide but could suitably modify the list as required :
 - (a) Food Production and Utilisation and Conservation of Water.
 - (b) Energy Generation and Utilities.
 - (c) Manufacturing Technologies.
 - (d) Mass Transit Systems.
 - (e) Building and Construction Technologies.

 - 2.2 This Forum will evolve solutions keeping in view the issues of sustainable development, poverty reduction, and climate change in focus and suggest appropriate technologies accordingly. Further, suitable Engineering Management techniques will be employed to find cost effective and optimal solutions.

 - 2.3 For formulation of the Recommendations / Solutions the Forum could also invite Specialists as required and / or conduct Workshops as found desirable.

 - 2.4 Meetings of the Forum can be held at a frequency of say once in two months anywhere in the country as desired by Chairman of the Forum. Logistic support will be provided by INAE.

3. The Members of Forum (Group in short) during the initial meetings decided the line of action to be followed for effectively and speedily handling this daunting task. Even though the Forum will be working on the various National Challenges on a continuous basis it was thought prudent to select

some priority areas for directed attention in the first instance. Since the domain of National Challenges is very wide and keeps on changing with time, it was felt that use of expertise of domain 'experts' may be difficult and may cause avoidable delays in formulating recommendations. It was, therefore, the view of the Group to make use of the available data (published literature, reports, media information, INAE literature, data from internet, etc.) and contacts/knowledge of the Group Members with occasional interaction with the experts. The option to invite Specialists as required and/or conduct Workshops as found necessary was kept open.

4. To achieve commonality of approach and to have a common understanding of the various technical terms/issues, some of the areas, as discussed by the Group, are mentioned below:

- Solutions for addressing the National Challenges have to keep in focus issues concerning Sustainable Development, Climate Change, and Poverty-reduction / Inclusive Growth.
- Boundaries between Science, Technology, and Engineering have to be made more explicit. This is all the more necessary because of the growing role of Engineering and its close interface with Society/Nature.
- For Technology Foresight exercises to be more useful / effective it was necessary to bring together expertise in social affairs, business management, financial issues, and policy with the scientific, technological, and engineering issues.
- Too much emphasis on the authenticity of Data / Source was not a practical reality as the challenge was many a times to venture into new areas not only Scientific / Technological / Engineering but also areas concerning Social affairs / Business management / Finance / Policy and their inter-relationships.
- Dimensions of Project Management were becoming more and more complex and diverse and needed special attention. Our poor track record in Project Implementation amply testified this need.
- Expanding definitions of Growth / Progress / Development need to be taken into account (Gross Domestic Product – Human Development Index – Gross National Happiness).
- Ethical issues especially concerning the Environment needed to be addressed.
- Innovations needed to be such so as to achieve More from Less for More people (MLM) for sustainability and equity.
- Role of Technology was not only to be seen from the point of view of achieving the desired objectives but also from the point of view of its consequences.
- Many of the Challenges / Risks have Global dimensions and this had to be kept in view.
- Necessary inputs for Skill development and Training were needed to match the futuristic technologies. Quality of Engineering education especially for Tier II, III & IV colleges needed special inputs.

- Policy frame work will have to be in place to improve the 'image' and 'role' of Engineering to make it more effective especially in tackling social and economic development and for provision of commensurate infrastructure.

5. After discussions, the Forum Members selected some Areas for examination and the First Report (March 2014) was published. The Report had Four Chapters as given under :

Chapter	Title1.
1.	Introductory / Explanatory Notes
2.	Waste Management
3.	Water – Meeting the Future Challenges
4.	Transport – Making it Greener

6. The Second Report (March 2016) covered the following three Areas :

Chapter	Title1
1.	Agriculture – Waste Reduction and its Use
2.	Energy – Major Thrust on Solar
3.	Mass Transit Systems

7. The **current Report (Third Report – October 2018)** covers the following two Areas :

1.	Challenges of Rural Urban Continuum
2.	High Speed Rail for Sustainable Development in India

8. The Group is currently working on Issues of Environment / Sustainability / Climate Change and some other selected areas.

9. It is hoped that Suggestions / Recommendations of the Forum will be helpful to Society / Nature / Policy-makers / Engineers / Administrators in addressing the Challenges in the studied / examined areas.

V. K. Agarwal
Chairman of the Forum

31st October 2018

Chapter 1

Challenges of Rural Urban Continuum

1.1 Introduction

1.1.1 The Title and Its Implications

The subject of this study being undertaken by the Technology and Foresight Forum was initially proposed under the title 'Urban/ Rural Divide/Equilibrium' in its 18th Meeting (19-07-2016). After discussion in the Forum, the title was finally reworded in the 20th Meeting (31-05-2017) as 'Challenges of Rural Urban Continuum'. Based on the inputs in the 21st Meeting (31-07-2017) and 22nd Meeting (28-09-2017), it was felt that a clear cut case for handling the challenges of the Rural - Urban Continuum be brought out emphasizing the need for greater inputs to the rural areas. These would cover recommendations on the core sectors, which *inter alia* would include the basic sectors of agriculture, energy, and transport. Further, relevant aspects of socio-economic independence should also be covered; these may necessitate inputs for ensuring right to education (provision of 'free and compulsory' school education), basic health care and employment opportunities.

Thus, the subject proposed to be covered essentially consists of studying the continuing economic and social backwardness of rural India as compared to urban India, i.e. the present Urban – Rural 'Divide', and formulating proposals for meeting the challenges

through sustainable development of Rural India in its various economic and social aspects so to make modern India into a vibrant Rural - Urban Continuum.

The need for community living prompted humans to inhabit villages and as the populations increased and needs multiplied, many of the villages developed into towns and cities. Almost all over the world population today lives in Villages / Towns / Cities. In the underdeveloped, the developing, and some parts of the developed nations of the world, more than 3 billion people live in villages (Rural areas) and balance in cities / towns (Urban areas). The people in villages often live in conditions of underutilization of available talents and resources, and of deprivation of opportunities and amenities as compared with the prevalent conditions in urban India. That is a major reason for migration from Rural to Urban areas, thus also accelerating the pace of Urbanization.

The mode of classification of villages, towns and cities may vary from country to country. However, there are some broad definitions, used hereinafter, which have been given in Annexure I. The Rural -Urban Continuum will be broadly examined in the context of growth scenarios from Villages to Village Clusters to Towns to Cities.

The villages / cities / towns must have

proper facilities for meeting the basic needs and enabling growth of their inhabitants and these must be effectively / efficiently managed and modified to meet the changing / growing needs. The attendant infrastructures may include areas covering Water, Food (Agriculture), Energy, Transport, Waste Management, Housing, Health Care, Education / Skill Development, Jobs, ICT Network etc. **Sustainable development of villages / cities / towns is a *sine qua non* for a sustainable and happy human society.**

A rural area may be broadly identified by its primary production base being largely agriculture or other similarly land-based professions such as horticulture, floriculture, forestry and mining, and the associated professions such as animal husbandry, dairying, fishing, and handicrafts.

1.1.2 Scheme of the Paper

The presentation below attempts to cover the subject of the Paper under five sections (paras 1.2 to 1.6). It starts with 'The Present State of Rural-Urban Divide-cum-Continuum in India' (para 1.2), dealing with the issue of distribution of population in rural-cum-urban areas of different categories according to 2011 census of India, and also explaining the concept of 'Rurbanisation' as related to the current rural - urban growth process. It then tries to give an outline of the 'Persistent State of Relative Socio-Economic Backwardness of Rural India' (para 1.3), both before India's Independence in 1947, and then since Independence till now. This is followed by a review of the 'Requirements Essential for Sustainable Development of Rural India' (para 1.4), covering multiple aspects, such as, the need for appropriate technological choices as well as for

planning and execution of necessary projects, and also defining the concept of 'Sustainable Rurbanisation' as an alternative approach in the context of the prevalent situation in India. Under the next section are presented 'Important Examples of Suggested Proposals for Overcoming the Prevalent Backwardness of Rural India' (para 1.5). These cover a representative spectrum of current ideas, including the widely known and appreciated proposal of 'PURA' system evolved by Dr. A.P.J. Abdul Kalam, the concept evolved by Rural Technology Group under Government of India, and Prof. Gangadhar Rao's concept of 'Smart Village' Trajectory of Andhra Pradesh via Gandhian Mode'. Then is presented a gist of important 'Current Government Proposals/ Plans/ Programmes for Sustainable Development of Rural India' (para 1.6), including a broad review of the current Government initiatives, and more specifically the recent 'Seven-Point Strategy to Double Farmers' Income by 2020', and the wide range of proposals being advocated by the NITI Aayog under its 'INDIA: Three Year Agenda (2017-18 to 2019-2020)' for sustainable development of rural India for a vibrant 'Rural-Urban Continuum'. The Paper ends with a 'Summary and Conclusion'.

1.2 The Present State of Rural-Urban Divide-cum-Continuum in India

1.2.1 Data according to the Census of India, 2011, Classification of Villages / Towns / Cities

Details about Towns / Urban Agglomerations (UA) / Out Growths (OGs) and Villages can be seen in **Annexure 2**. This is based on the latest Census of India 2011. Some salient details are as under:

- Total urban population in the country is more than 377 million constituting 31.2% of the total population, the balance 68.8% being rural population.
- There are 4,041 Statutory Towns and 3,894 Census Towns, the total number of Towns being 7,935.
- **Class I UA / Towns which have at least 1,00,000 population each are 468 in numbers, constituting 70% of urban population.**
- Out of 468 Class I UA / Towns, **53 UAs / Towns each have a population of one million or above (known as Million plus UAs / Towns)** and are the major urban centres of the country, constituting 42.6% of urban population.
- Among the million plus UAs / Cities, there are three very large UAs each with **more than 10 million persons known as Mega Cities. These are Greater Mumbai UA, Delhi UA and Kolkata UA.**
- India has a large number of villages (more than 6 lac villages) and these house 68.8% of total population. Demographers, geographers and planners have been puzzled by the 2011 Census data which instead of indicating the phenomenal increase of urban population, suggests a sluggish growth rate of urbanization.

1.2.2 Rurbanization as a Concept of Complementary Rural-Urban Growth Process

We have to acknowledge that urbanization is inevitable. India is in an urban transition. While estimates of the size of urban population vary, depending on how the rural - urban divide is defined, according to the Census 2011 of India, urban population was about one-third and rural population about two-thirds. A report suggests that southern and western Indian states have already

over half the population as urban. Different debates suggest various new aspects of urban life, such as, shadow settlements, transactional spaces, the logistical city, rurbanization, subaltern urbanization,, engine urbanization, post-national urbanism, inclusive urbanization, and sustainable urbanization.

Vide Census of India, 2011, based on population figures, urban India is divided into small and medium towns, metropolises and megacities. It also suggests a growth in the number of 'census' towns (population over 5,000, 75% males employed in non-agricultural activities, and population density of over 400 per sq. km).

[The Contemporary Urban Conundrum, New Delhi: India Intl. Centre, Quarterly; Winter 2016- cum-Spring 2017 issue; Editorial, Foreword, & Introduction: p.ix-xii & 1-14]

In order to appreciate the evolving concept of 'Rural-Urban Continuum', we refer here to two very relevant views. Prof. Amitabh Kundu [Rurbanization: An Alternative Development Paradigm, *ibid*, p.17-27] mentions that there has been slowing down of growth in metropolitan cities because of the slump in the global capital market. Of the 25 largest cities, all except five report decline in growth, much more than can be attributed to natural factors. More important is the realization that the decline would have been much sharper had there been no alternate processes outside the metropolises compensating for the loss. **He mentions that 'Rurbanization' (which may be described as a process of rural settlements acquiring urban characteristics while retaining their rural socio-economic base) has helped in sustaining overall urban growth.**

Another explanation is that by Partha Mukhopadhyay *et al* [Subaltern Rurbanisation Revisited, *ibid*, p.28-40] **suggesting that it is due to 'Subaltern Urbanization' which refers to the autonomous growth of settlement agglomerations – large clusters of people living in close proximity, which may or may not be classified as urban by the Census of India or the relevant State government.**

Both these perspectives have attempted to capture the complex set of forces associated with urbanization unleashed in India in recent times. Both attest to the rapid rise of urbanization in the form of expansion of roads, transport and communication networks, and of economic activities, social infrastructure such as housing, health and education, and new lifestyles. They suggest that these processes are leaving a deep imprint on all the regions of the country. **As a consequence, it is becoming increasingly difficult to delineate what is non-urban.**

1.3 Persistent State of Relative Socio-Economic Backwardness of Rural India

1.3.1 The State of Relative Backwardness of Rural India before Independence

Impoverishment, exploitation, and relative backwardness of rural India under the British rule had also been a major issue during India's freedom struggle under Mahatma Gandhi, who had undertaken village uplift as a vital part of the freedom movement itself. In this regard, some indicative references are given below, which would give historical background of the poor state of rural India under the British rule:

Gandhiji continuously defined and pursued the concept of *Gram Swaraj*

('Village Self-rule') as an essential part of the struggle for *Swaraj* (Self-rule), as nearly seven-eighths of India then lived in villages. His movement for *Khadi* itself was essentially to provide employment in rural areas.

The 18-point 'Constructive Programme' pursued as an essential part of freedom movement and "designed to build up the nation from the very bottom upward", included: points 4. Khadi, 5. Other Village Industries, 6. Village Sanitation, 14. Kisans, and 16. Adivasis, as items exclusively concerning rural areas, and most of the other points also, such as, 7. New or Basic Education, 8. Adult Education, 9. Women, 10. Education in Health and Hygiene, and 13. Economic Equality, too were related largely to rural areas.

In 1934, Mahatma Gandhi set up 'All India Village Industries Association' (AIVIA) at Wardha, with J.C. Kumarappa as its executive Director. Influenced by Gandhiji, J.C. Kumarappa, a foreign educated economist, had devoted himself wholly to working for the welfare of rural India. His numerous writings related to the development of rural India include his well-known books: 'Economy of Permanence', 'Why the Village Movement?', 'An Overall Plan for Rural Development' and 'An Economic Survey of Matar Taluka'. His writings and works for rural India remain a subject of active study today also, as indicated by the publication of the books, 'J.C. Kumarappa—Mahatma Gandhi's Economist', by Mark Lindley (2007), and 'The Web of Freedom—J C Kumarappa and Gandhi's Struggle for Economic Justice', by V.M. Govindu & D. Malghan (2016).

E.F. Schumacher, the British economist, who wrote the famous book: 'Small is Beautiful—A Study of Economics as if People Mattered' (1973), had also dealt

with the need for the development of villages.

Gandhi-Nehru Debate on the Role of Villages in India

As the freedom struggle progressed and India approached freedom from British rule, there was an interesting debate between Gandhiji and Pandit Nehru in regard to the essence of required rural development. Jawaharlal Nehru had expressed differences with Gandhiji's insistence on revival of the villages and treating it as the basis for having a non-violent social order. In this context he also expressed doubts about Gandhiji's views expressed in the *Hind Swaraj*. Gandhiji wrote to Nehru (on 5.10.1945) regarding this 'sharp difference of opinion between us': 'I fully stand by the kind of governance which I have described in *Hind Swaraj*. ---

I believe that if India, and through India the world, is to achieve real freedom, then sooner or later we shall have to go and live in the villages—in **huts, not in—palaces**. --- We can have the vision of that truth and non-violence only in the simplicity of the villages. ---

You will not be able to understand me if you think that I am talking about the villages of today. **My ideal village still exists only in my imagination. -- In this village of my dreams the villager will not be dull—he will be all awareness. He will not live like an animal in filth and darkness. Men and women will live in freedom, prepared to face the whole world. There will be no plague, no cholera and no smallpox. Nobody will be allowed to be idle or to wallow in luxury. Everyone will have to do body labour. Granting all this, I can still envisage a number of things that will have to be organized on a large scale. --**
- If I can make sure of the essential thing,

other things will follow in due course.' [*Collected Works of Mahatma Gandhi*, vol. 81:p.319-20]

Nehru had replied: '- - - I do not understand why a village should necessarily embody Truth and Non-violence. A village, normally speaking, is backward intellectually and culturally and no progress can be made from a backward environment.

We have to put down certain objectives like a sufficiency of food, clothing, housing, education, sanitation etc. which should be the minimum requirements for - - everyone. - - we must find out specifically how to attain them speedily. Again, it seems to me inevitable that modern means of transport, as well as many other modern developments must continue and be developed. -- If that be so, inevitably a measure of heavy industry exists. How far that will fit in with a purely village society? Personally, I hope that heavy or light industries should all be decentralized as far as possible --. ---

I do not think it is possible for India to be really independent, unless she is a technically advanced country - -. In the present context of the world, we cannot even advance culturally without a strong background of scientific research in every department. There is in the world today a tremendous acquisitive tendency both in the individuals and groups and nations, which leads to conflicts and wars. - - That basis must go and be transformed into one of co-operation, not of isolation which is impossible. If this is admitted - - attempts must be made to realize it, not in terms of an economy which is cut off from the rest of the world, but rather one which co-operates. ---

There is no question of palaces for millions of people. **But - - no reason why millions should not have**

comfortable up-to-date homes, where they can lead a cultured existence. Many of the present overgrown cities have developed evils, which are deplorable. Perhaps, we have to discourage this overgrowth and, at the same time, encourage the village to approximate more to the culture of the town. - - -'. [9.10.1945, *A Bunch of Old letters*, London, 1958, JL Nehru: 507-10]

Gandhiji and Nehru had talks, and Gandhiji had then written to Pandit Nehru: 'The talks we had yesterday have given me the impression that **there is not much difference in our outlook or the way we understand things. I went to tell you how I have understood you.** If there is any difference you will let me know.

- (1) **The crucial question according to you, is how to ensure man's mental, economic, political and moral development. That is my position too.**
- (2) **And in doing so every individual should have equal right and opportunity.**
- (3) **From this point of view there should be equality between villages and cities. And therefore their food and drink, their way of life, their dress and their habits should be the same. If such a condition is to be brought about people should produce their own cloth and food and build their own houses. So also they should produce their own water and electricity.**
- (4) **Man is not born to live in the jungle; he is born to live in society. If we are to make sure that one person does not ride on another's**

back, the unit should be an ideal village or a social group which will be self-sufficient, but the members of which will be interdependent. This conception will bring about a change in human relationship all over the world.' [Letter to JL Nehru, 13.11.1945, *Collected Works of Mahatma Gandhi*, vol. 82: p.71-72]

1.3.2 The State of Relative Backwardness of Rural India since Independence

Economic and social indicators would clearly show that rural India has remained relatively impoverished and backward after Independence too and with the fast development of urban India, growing rural-urban divide is clearly visible. Here, a few commonly well-known features of the 'divide' are being given just to highlight the challenges involved in converting this divide into a rural-urban continuum:

- Large number of farmers committing suicides on account of financial insecurity.
- Economic activities associated with the supply chains of agricultural and other rural production, viz. collection, storages, processing including associated industries, and marketing, have been mostly concentrated in urban areas. These should, as far as possible, be relocated in rural areas at substantial reduction of cost and opening of gainful employment to rural population. A glaring example is the location of the FCI godowns in mega cities, resulting in denial of legitimate opportunities in rural areas and in avoidable costs.
- Due to lack of economic and social development in rural areas, there is

widespread un-/ under-employment and many people, especially landless labour and youth seek employment as migrants in urban and peri-urban centres, mostly as unskilled/ manual labour, including as rag-pickers. They constitute a major part of the slum population which lives in deep poverty and with little access to basic civic amenities.

As a part of the evolving global society, the needs of our times consist of prosperity with inclusion, development with equality, and industrialization with environmental concerns. Large-scale divides between the rural and the urban areas of the world -- manifested in the income levels and the quality of human amenities -- constitute a loss of opportunity, but are also a matter of concern as regards prosperity and peace.

Today, in the world over 3 billion people live in villages often in conditions of underutilization of talents and resources and of deprivation -- the opportunities that elude this half of the human population. [TARGET 3 Billion--PURA: Innovative Solutions Towards Sustainable Development, by A.P.J. Abdul Kalam & Srijan Pal Singh, New Delhi: Penguin Books, 2011; Preface, p.vii-viii]

While urban economy is being duly taken care of by the governments at Central and State levels, the rural economy did not get the attention it deserves from both the Planning Commission and the Administration so far. Due to this neglect, the rural economy did not pick up and it forced many young boys and girls for jobs to nearby cities based upon their qualification of education. Uneducated or less educated came for menial jobs

like house servants, cooks, drivers, unskilled jobs etc. These people are forced to stay nearby the cities/towns and these develop as slum areas. These slum areas also become shelters for anti-social, and even criminal, activities leading to wide-spread law and order problems, apart from serious social and civic management problems, which growing urban agglomerations, such as Delhi are now facing.

It is high time that the governments should allocate a much greater share of their time and resources towards planning for "Rural development". They should particularly see how to alleviate the factors leading to relative impoverishment of farmers and the backwardness of agriculture and other rural sectors in India. Today, all over India, the farmers are facing serious problems in the web of money lenders and uncertain returns, leading to even rising instances of suicides, such as in Maharashtra and other states. If rural development is taken up seriously, a lot of migration from the villages to the cities/ towns would also get reduced.

The Government should also consider the option of setting up commercial and industrial units and complexes in rural areas and away from the cities like metropolitan city complexes, such as Delhi, Mumbai, Chennai, Bengaluru, and Hyderabad, with the concomitant development of rural-urban 'continuums' over India.

'REVEALED: WHAT IS KILLING INDIA'S FARMERS?'

Extracts from an article titled, 'Revealed: What Is Killing India's Farmers?' [in 'INDIA TODAY', June 28, 2017 issue, by Nitin Jain & Dev

Ankur Wadhwan] are given here to illustrate the present state of farmers:----

'Dozens of distressed farmers plead for their crops at the gates of a sprawling *mandi* in Morena, Madhya Pradesh. A government surveyor has left them in a state of shock. He has allegedly rejected their *moong* produce, all at once.

- - - The crop inspector, Govind, discarded their yield as unfit for procurement without testing, the tillers alleged. - - - "There was no machine. He just put a palmful of it into a single pouch and announced his decision," [Sita-Ram [a farmer] protested. Govind, who initially claimed the produce had exceeded the threshold for broken dal, admitted he had carried no scientific examination of the samples. And when he did, in the presence of India Today's investigative team, senior officials approved the same *moong* crop for procurement with minor recommendations. - - -

Across Madhya Pradesh and Maharashtra, farmers came out in angry demonstrations earlier this month after they found no buyers for their bumper crop. Many of them had no government agencies or private traders around to pick up their surplus production, causing prices to nosedive and tensions to escalate.

Madhya Pradesh chief minister - - recent assurances about income support to the community aside, the Morena *mandi* threw a spotlight on a devastating truth -- procurement agents virtually forcing farmers to make a distress sale to private sharks. - - - -

That precisely illustrates why farmers end up peddling their crops out to private market at almost half of its minimum support price. Official *mandis* across India number 7,700, - - - said food-policy analyst Devinder Sharma. Most of them

are concentrated mainly in Punjab and Haryana, he said. Spurned by government-run markets on various grounds, many farmers in other states are compelled to undersell their produce to local traders, India Today's investigation found.

At Rajasthan's Pratapgarh *mandi*, procurement official Mangi Lal had nothing much to do when the investigative team visited him this month. Located in the middle of the garlic belt of the region, the market wore a deserted look. It was not accepting the yield because farmers had no crop certification to produce. - - - At the receiving end were farmers, who were not able to obtain complete paperwork because issuing authorities were out on a protest. Distressed, they were hawking piles of garlic at unimaginably low prices - down to Rs 1,200 from the MSP of Rs 3,200 rupees a quintal - to local traders. - - - -'

'HOW INDIA CAN TEND TO ITS FARMERS'

Extracts from another item posted by 'East Asia Forum', titled 'How India Can Tend to Its Farmers' [posted by Peter Drysdale, editor@eastasiaforum.org, 27.8.2017; authors: Simi Mehta and Arjun Kumar, New Delhi] given below too illustrate the problems concerning India's farmers and their possible solutions:-----

'Despite the pro-poor and pro-farmer policies of successive Indian governments since independence in 1947, India's farmers remain the "uncared for lot" — and the situation is becoming increasingly untenable for both the agricultural market and the farmers themselves.

This is more conspicuous of the

challenges faced by small and marginal farmers who own and operate 85 per cent of total landholdings, the average size of which is less than one hectare. Most of them depend on borrowing from informal sources of credit like local moneylenders and relatives. Even policies like that of Jan Dhan Yojana, which enables opening of a zero-balance bank account, have not discouraged farmers from borrowing money from informal sources.

When faced with an immediate requirement of cash for sowing seeds, plantation, irrigation, fertilizers and so on, farmers' access to formal credit is restricted due to their lack of collateral and operational inefficiencies. And for those farmers who do receive formal loans are generally underfinanced — so much so that one or two crop failures or sudden expenses on health or marriage compels them to turn to informal sources. This negative cycle has entrenched the strangleholds of private moneylenders who, - - charge exorbitant interest rates against the loans.

In June 2017, farmers took to the streets of India in protest, demanding complete loan waivers (due to crop failures over two consecutive drought years) and raising the Minimum Support Price (MSP) for grains and pulses to more than 50 per cent of the cost of production. Repeated price shocks, increasing input costs, and the lack of procurement of agricultural produce at MSP have negatively affected the agricultural activities and families engaged in it, so much that the country has become insensitive to the news of ever increasing suicide rates among farmers due to their indebtedness and destitution. Even **electronic national agriculture market (e-NAM)**, which aims to give farmers a choice of buyers across the

country and better prices, had a very limited impact on ground implementation.

Farmers' protests and movements have had ripple effects from one state to another, and several state governments have resorted to loan waivers to provide immediate relief. But loan waivers - - do not provide a long-term solution and impede the adequate allocation of commensurate resources for structural and systemic changes for agricultural development. Further, they obfuscate the need to develop the necessary infrastructure, technology and research for the application of real-time data for monitoring and evaluation and evidence based policy making.

While price support for horticulture produce is not feasible due to the perishable nature of produce, the way forward is to ensure vigorous increases in domestic and international investments in food processing industries, expansion of cold storage infrastructure and rural development to increase shelf life. ----

Moreover, the major causes of agrarian distress include incomplete land reforms, low quantity and quality of water, lack of technological breakthroughs, poor access to quality institutional credit and meagre opportunities for assured and remunerative marketing, as well as weather and market based risks. One immediate priority is the protection of crops through insurance. The Pradhan Mantri Fasal Bima Yojana, a government-initiated crop insurance policy, is a step in the right direction, yet it faces many unresolved challenges in its reach and execution, such as identifying the crops, sensitization of the

insurance companies to crop failures and so on. Timely disbursal of affordable formal credit and essential inputs like seeds, fertilizers, and water, along with an assurance of procurement at MSP on agricultural produce that is 50 per cent more than their cost of production would be an appreciable policy support that would boost farmer confidence (This has been accepted in a recent announcement made by Honorable Prime Minister) "Per Drop More Crop cannot remain a mere slogan if the objective is to revamp the robust agricultural heritage of India.

In addition to the above, policy measures should be implemented to improve irrigation practices, soil carbon sequestration and rainwater harvesting to ensure adequate and timely availability of water for crops. Infrastructure and technology for weather forecasting, agricultural market, plant protection, food processing, crop rotation and land fertility through public and private sector investment also needs urgent upgrading. Finally, it is extremely important to create a modern digital governance framework for hand-holding agriculture like e-NAM, biometric data and use of mobile phones for the propagation of relevant farming information, awareness, support and effective implementation that would invigorate the spirit of innovation among the farmers and substantially reduce the drudgery of the profession.

In short, economically viable and non-populist policies are needed to encourage farmers to farm. It is not in the nation's interest to have its farming community — who feed India — continue to live in distress. ----.'

MIGRATIONS FROM RURAL INDIA TO URBAN INDIA –

PRESENT SCENERIO

Following observations broadly outline the present scenario of large-scale migrations from rural to urban areas, also contributing in a way to the growth of varied types of Rural - Urban agglomerations:

1.1 68.8% of Indian Population, being rural and engaged primarily in agriculture may be classified in two categories:

- i) Families with economic land holding of more than 2.0 hectare and identified in APL (Above Poverty Line) Category ; not included in government subsidies for food, fuel, housing, MNREGA, etc.
- ii) Families of marginal farmers with land holding less than 2.0 ha, village artisans and service providers and landless labor. Majority of these will fall in BPL (Below Poverty Line) category; eligible for various Govt. subsidies.

1.2 Migration from rural areas led to rapid urban growth especially in the last two decadal periods 1991-2001 and 2001-2011. Such rural to urban migration can be classified broadly as following:

- i) With increased awareness for higher and professional education in rural areas almost 50% young boys and girls from APL families migrate for education and employment. Rural APL families are willing to spend large sums towards good education to their wards

leading to their gainful employment in urban areas. 10 to 15% young boys and girls from BPL families avail benefits of various government sponsored schemes for poor, backward and reserved categories for higher and professional education and migrate to urban areas for employment. Such permanent migrations are beneficial both for rural as well as urban communities; reducing pressure on land in rural areas and providing quality residents for urban areas.

- ii) Second category of voluntary migration is to meet the demand of skilled and unskilled labor for various infrastructure, housing and manufacturing sectors in fast growing urban areas. There is substantial demand for manpower for growing civic and domestic services in urban areas met by migration from rural areas. Such workers retain their families in rural areas, visiting them once or twice a year and providing them financial support.
- iii) Third category is the families of landless labor that cannot find gainful employment in rural areas and migrate in search of better economic opportunities.
- iv) Many APL families migrate from rural to urban areas to improve living comfort and enjoy many lifestyle facilities of urban areas. Many such families become absentee landlords as their children do not want to engage in agriculture due to harsh working conditions.

1.4 Requirements Essential for Sustainable Development of Rural India

1.4.1 Requirements for Sustainable Development

The Brundtland Commission (UN) in their Report (1998) define Sustainable Development as “development that meets the needs of the present, without compromising the ability of future generations to meet their own needs”. Sustainable Development will be possible only when it is recognized that economic growth, social welfare and environmental issues are linked and have to be addressed together. (See **Annexure 3**)

A glance at **Annexure 4** (Five E's of Sustainable Development) and **Annexure 5** (United Nations Sustainable Development Goals – SDGs) will highlight the multiplicity of factors / actions needed to ensure Sustainable Development.

Growth / Progress / Development : It becomes amply clear that economic growth cannot be the sole criteria for 'Growth / Progress / Development' and our growth / progress / development model has to necessarily take into account the following four areas :

- Sustainable Development
- Climate Change / Mitigation and Adaptation
- Poverty Reduction / Inclusive Growth
- Job Creation / Skill Development

1.4.2 Need for Appropriate Technological Choices, Project Planning and Execution

Need for *Engineered Technology / Directed Technology*

- Appropriate Technology can offer cost effective solutions to many of the problems / issues like Sustainable Development, Climate Change, Restoring the Earth's Ecosystems, Food and Energy Security, Safe and Sustainable Water Supply, Affordable Housing for All, Environment-friendly Transport, Medical Care, ICT Network for efficient / effective data transmission for financial, educational, social, and cultural needs.
- Advanced Technology per se is relevant only when the Technology selected suits the fast growing needs of “Society/ Nature” on the one hand and takes care of the “Resource” constraints (both the availability and the fast depletion) on the other.
- The technology selected must match and be in consonance with the “**Technology Foresight**” predictions. Since Technology Foresight Exercises take into account not only the long term future of Science & Technology but also of the Economy & Society, these are in consonance with the International / National / Area Specific issues and problems. These will, therefore, be consciously encompassing issues / problems like Sustainable Development, Climate Change, Poverty Reduction / Inclusive Growth, Job Creation, etc.
- For taking care of large and poor population it will be desirable to follow an approach termed **Gandhian Engineering** by R. A. Mashelkar [INAE: **Annals of the**

INAE - Vol. X - April 2013 ; **Lifetime Contribution Award Lecture titled 'Gandhian Engineering : More from Less for More', by R. A. Mashelkar**]. He mentions that Industrial Enterprises strive for getting more (performance) from less (resource) for more (profit) but the **Gandhian Engineering** means getting more (performance) from less (resource) **for more (people) not just for more (profit)** and is anchored in the solid foundation of affordability and sustainability.

- For inclusive growth and fast development under given financial and environmental constraints, the Developing and Underdeveloped nations **will need leap-frogging of some existing technologies and directly using latest and modern technologies.**
- For fast and effective technical progress to occur in reality and be sustained over the longer term, all countries and businesses will have to give higher priority to research and development. **The new scientific and technological know-how so created must be treated as a global common.**
- Concerned Project, its execution methodology, and the attendant technologies **should have least possible impact on the Environment** during execution stage and later during Project Life.

Project Planning and Execution

- The development process for rural-urban continuum will encompass not only infrastructure related projects

but also the projects from social, financial, health, education and other related areas.

- Creative solutions for efficient, effective and speedy completion of the Projects will be needed especially due to the interlinked complexities (due to Types, Large Volumes, Inter-connectivity & Intra-connectivity, Time etc.) of such projects.
- Needs for Villages, Village Clusters, Towns and Cities will vary but the 'Continuum' will have to be given inputs for their current stage of development viewing the System as a whole.
- Paradoxes like Centralization vs Decentralization, Certainty vs Uncertainty, Self Assertion vs Integration etc. in Problem solving, Project formulation, and Project execution will have to be suitably addressed.
- Modular matching at various Organizational levels and in various Systems / Activities will be a great advantage especially in this digital era.
- Some broad groupings of Villages, Village Clusters, Towns, Cities could be done according to their size, area, etc. For each such category some 'Minimum Facilities' could be prescribed and targeted for provision. This will ensure that limited resources are optimally used and 'Additional Facilities' are provided only when 'Minimum Facilities' have been taken care of.

1.4.3 Concept of 'Sustainable Rurbanization' as an Alternate

Paradigm

Indian researchers have looked at urbanization processes mostly through the prism of large cities. However, the critical process helping in sustaining overall urban growth is '**Rurbanization**', a process of rural settlements acquiring urban characteristics while retaining their rural socio-economic base. Hence, the need to build up an alternate macro-economic framework for the process of rurbanization. Some researchers describe such a large part of present urban growth in India as **Subaltern Urbanization**.

The diverse manifestations of the process of 'Rurbanization' show evidence of in-situ urbanization by expansion of cities into rural areas and transformation of villages into urban settlements ('Census' and 'Statutory' towns). A large part of the urban population in 'Census' towns continues to be governed by rural administrative set ups, leading to provision of low levels of infrastructure and basic amenities.

The inter-settlement linkages and socio-economic contexts seen in the rural hinterlands of large cities are different from those of small towns and the growth dynamics in small and medium towns vary enormously depending upon the local socio-economic histories and their linkages with large cities.

These diverse patterns of rurbanization indicate the need for their sustainable development according to their specific situations and requirements and in the context of the associated mega/ large/ medium / small cities or towns. Though their existence has been recognized by introduction of the category of 'Census'

town since the Census 2001, much more needs to be done for ensuring their due administration and management.

[The Contemporary Urban Conundrum, New Delhi: India Intl. Centre, Quarterly; Winter 2016 + Spring 2017 Issue, 'Rurbanization: An Alternate Development Paradigm, by Amitabh Kundu': p. 17-27]

1.5 Important Examples of Suggested Proposals for Overcoming the Prevalent Backwardness of Rural India

1.5.1 Introductory Remarks

Numerous studies have been conducted suggesting appropriate formats and approaches which should be pursued in order to overcome the relative backwardness of rural India in comparison with urban India, and thus converting the rural - urban 'divide' into a progressive 'continuum'. Here it is proposed to present important features of three such studies, covering a wide spectrum of the involved issues. The first presentation gives an outline of the comprehensive and widely appreciated study conducted under Dr. A.P.J. Abdul Kalam, proposing the 'PURA' system for sustainable development of rural India. The second presentation briefly gives an outline of the policy proposed by the Rural Technology Action Group (RuTAG), working under Government of India, for evolution and dissemination of suitable technologies for sustainable development of rural India. The third presentation summarizes an interesting set of directions proposed by Prof. Gangadhar Rao for development of villages in Andhra Pradesh as 'Smart Villages' via the 'Gandhian' mode. These three presentations cover a wide range of

ideas which should help in making rural India into a vibrant part of rural - urban 'continuum'.

1.5.2 Dr. A.P.J. Abdul Kalam's 'PURA' System for Sustainable Development of Rural India

Dr. A.P.J. Abdul Kalam, well-known space scientist and former President of India, had realized the need to overcome the persistent rural backwardness and the consequent sharp rural-urban 'divide' in India and had studied in detail how to achieve the required 'sustainable development' of rural India so as to convert the existing divide into a healthy and vibrant rural-urban continuum. His well-researched and documented proposal for this, widely known as '**PURA**' --**Provision of Urban Amenities in Rural Areas**--, as given in the book, '**Target 3 Billion, PURA: Innovative Solutions Towards Sustainable Development**' by Dr. A.P.J. Abdul Kalam & Srijan Pal Singh, New Delhi: Penguin Books, (2011), is being presented here in brief, as a primary source by which we may be guided in overcoming India's rural backwardness.

Selected references/ observations based on the book are given below indicating important parameters of the subject under study :

- “As global society, the needs of our times consist of prosperity with inclusion, development with equality and industrialization with environmental concerns. Large-scale divides between the rural and the urban areas manifested in the income levels and the quality of human amenities A loss of opportunity, but also a matter of

concern as regards prosperity and peace.” [Preface]

- The book integrates the challenges and opportunities and how to evolve a sustainable development system of 'PURA' by harnessing the potential of the rural masses. 'PURA' is an amalgamation of technology, people, traditions, skills and entrepreneurial spirit to achieve sustainable development that is financially viable, socially equitable and eco-friendly. [Preface]
- India's heart resides in its villages. Planning and execution of any policy for the nation must begin with lessons learnt from its 6,00,000 villages. [Introduction]
- In mid 1990s, TIFAC (Technical Information Forecasting and Assessment Council) decided to evolve a plan to transform India into an economically developed nation by 2020. The first of its ten pillars was: **'A nation where rural-urban divide has been reduced to a thin line.'** Since Independence, an asymmetry been persisting between rural and urban areas. While cities like Mumbai have the richest individual in the world, villages in Maharashtra had over 41,000 farmers' suicides due to indebtedness and bankruptcy from 1998 to 2009. Rural to urban migration is due to inequalities in opportunities and outcomes. The un-/under-employed population may move to the cities for better living conditions and higher incomes, or due to setbacks such as financial or medical, or for better amenities and higher education. [Ch.2]
- There are 638,588 villages in India,

with about 750 million rural Indians. 80% of 'Below Poverty Line' Indians live in rural areas. An average rural consumer expenditure is Rs. 625 v. Rs. 1,170 in urban areas. [Ch.2]

- The definition of Sustainable Development, especially for the integrated transformation of rural India has to take into account a set of parameters which determine the feasibility of the model for direct beneficiaries, non-beneficiaries, national values, environment and the system stability.

But we must raise economic and living standards of over 300 million in extreme poverty out of 1 billion+ population. One of the reasons for rural poverty is that a large part of the growth from manufacturing and service sectors and their benefits thin down significantly as they reach rural interior regions. Agriculture growth has been at just 1.2% since 1990s. To uplift the 300 million poor, its growth rate at least 4% is required, with fruitful employment to rural masses and the youth, with avenues for building capacity. It must alter the lifestyle of the rural population and give opportunity to every man and woman to build competencies and better standard of living. It means development initiatives to integrate competencies, skills, employment and market access plus quality education and healthcare for the rural people. The development process must extend to rural sector. [Ch.3]

- 'PURA' was proposed as a socio-economic system for sustainable development by a planned drive towards achieving an inclusive development starting at the village

household level. Its mission involves provision in rural areas of: a) **Physical Connectivity** — as an enabler of movement of people and goods, and wider access to goods, services and markets. b) **Electronic Connectivity** — to provide value adding services, e.g., for finance, healthcare, education and income creation. c) **Knowledge Connectivity** — e.g., to facilitate productivity, tackle under-employment, spread welfare services, develop market for products, and raise quality consciousness. and, d) **Economic Connectivity** — to create employment, entrepreneurship and income augmentation of rural areas through agro-based manufacturing and service industries; to be customized according to agro-climatic conditions, human resources, specialized skills and competencies, connectivity to the markets and cities and within villages, support industries, and the needed services.

Necessary conditions are: 1) Vertical integration of agro-manufacturing processes; 2) adequate entrepreneurship and planning in service sector; 3) raised incomes used to create capacity and efficiency; 4) adequate room for Physical, Electronic and Knowledge Connectivities to enable rise in Economic activities with a more capable workforce.

A 'PURA' unit means a loose grouping of villages as per their core competencies and needs often common to a particular type of terrain; hence, these may be classified as Plain, Coastal, Desert, Hill, Island,

or Delta 'PURAs'. [Ch. 3]

Agriculture sector is by far the largest employer in terms of human resources in India but its GDP share is only 17.5%, that of Manufacturing being 20% and that of Services 62.5%. Two-thirds of India's population lives in rural areas. India has 52% of its land cultivable (v. 11% average in the world) and its sunshine hours and days' length are ideal for year-round cultivation.

Since Independence, there has been a continuous thrust on improvements in the agriculture sector, but still, by world standards, its agricultural yields are low—low efficiency in water and land usage, labour employment and quality of goods, technology and market access.

In 2007, the relative ranking of nations in cereal production put USA at no.2, China at no.18 and India at no.85. India grows a wide range of perishables on a large-scale but its processing level is far lower than that in the West or even many Asian countries. Processing level of fruits and vegetables is 2% in India, 23% in China and 65% in USA; of marine 12% and of meat and poultry 1% in India as against 60-70% in developed countries; and of milk 37% in India as against 60-75% in developed countries.

The three segments of the value-chain, i.e. production, processing, and marketing, need to move about one pivot in rural India. The strategies for sustainable development in the agricultural sector include: access to input markets and quality input, improved yields and

reduced risks, confluence of technology and agriculture, incentives for better farming practices, security against weather anomalies, storage and transport chains, aggregation facilities, food processing with benefit to the farmer, and other similar measures within the rural complexes. [Ch. 4]

- **National Water Balance--The Challenge:** With over 70% of the developed water sources being used exclusively for agriculture, irrigation is the largest consumer of water resources in India. For sustainable development, expansion of irrigation facilities and water management must work in harmony. Focus is needed on reduction of water consumption per unit crop. Present water efficiency of crop generation is a matter of concern: 300g crop/cum water produced in India as against 1300g in developed countries such as USA. There is need for scientific cultivation using less land and water and using methods such as 'drip irrigation'. Water Usage Efficiency (including conveyance efficiency and field efficiency) is the parameter used to evaluate the proportion of irrigation water to the water reaching the crop root zone. [Ch. 4]
- National Milk Vision is another vital area for attention. India is world's largest milk producer. Indian dairy industry covers 13% in terms of employment but has only 5% share of GDP. The subjects needing attention include cattle breeding, their food and nutrition, cattle healthcare, dairy farm management, production of clean and good quality milk, milk procurement and transportation, and processing and marketing. [Ch.4]

India is the 3rd largest fish harvesting country. It has its own opportunities and challenges. [Ch.4]

- **India needs a Second Green Revolution**, which takes care of the growing demand for food and other agricultural production while its present 190 million hectare arable land is bound to shrink due to expanding construction activities and water shortages are likely to increase. Average productivity must increase from about 2 t/hectare to 4 t/hectare, with less use of water. [Ch. 4]
- A sustainable development system not only leads to economic growth but also translates monetary gains directly to human development, such as reflected in education and healthcare, and poverty reduction. Such a planned system integrates higher incomes with capacity building and leads towards a happy and prosperous society. A 'PURA' concept is achieved only with a dynamic linkage between economic development and social and cultural transformation. As capacity building occurs in terms of knowledge and skill, economic development evolves so as to provide employment or entrepreneurial opportunities for a workforce with higher skills and to expand existing skills. With economic empowerment and access to social assets and amenities, a cultural change will set in. The goal is: every rural household to be propelled into an empowered unit. Upto a point, external investment and support will be required and then the rural complex becomes sustainable with respect to its economy and capacity and services augmentation. At present rural India is suffering

from a 'low capacity, low income' trap. [Ch.5]

- As an example, parameters used to observe the progress of economic-social development in 'Chitrakoot PURA' which covered 500 villages by 2011, included Number of Unemployed, Poverty, Literacy, Health standards, how Clean and Green was the Environment of each family, Social Harmony, Family Self-reliance, Family Prosperity, Public Amenities, & Social Consciousness. [Ch. 5]
- A PURA's mission being socio-economic transformation of a rural complex, right benchmarks and standards for determination of the progress must be set up. There are many challenges here, such as: 1) How can economic and social goals be integrated for sustainable development? 2) How can private sector be incentivized in this task? 3) How to achieve convergence of private and public initiatives to undertake the mission? 4) How to empower people at local levels to articulate their needs? A fine balance is needed between centralized and decentralized approaches. [Ch. 5]
- Various factors instrumental in realizing a sustainable development in rural areas include: Reforestation, Energy Independence—preferable use of renewable sources, Renewable Sources for Power Generation—solar energy, wind energy, use of biofuels (including biodiesel), production of Biofuels (such as Jatropha plant in non-arable and fallow lands, Algae—for biodiesel—grown in shallow areas near the sea), reducing production of Waste and its conversion into wealth, and construction of 'green' buildings with eco-friendly designs.
- 'PURA' vision is based on a public-private model with a crucial role for the community. Community participation and a ready acceptance of transformation would lead to a bigger role for the Panchayat Raj institutions, enterprise creation, growth of co-operatives, and an outcome oriented sustainable approach. **Community participation must be four-fold: in planning, in execution, in sustenance, and in growth.** It will encourage local innovations and enterprises, activate markets, maintain quality standards, initiate social audits, and promote vertically integrated and value-addition enterprises. Proper incentives commensurate with the risks and efforts involved, and proper communication channels, are necessary for a community to participate. Procedures should be simplified and local leadership should be nurtured. Setting up of Co-operatives will help involve the community in economic development. [Ch. 7]
- Sustained development is realized only through empowerment and employment. 'PURA' system strives for a long-term solution to generate local enterprises in goods and services, which has a multiplier effect on rural economy and employment. These enterprise networks have to look at two kinds of markets for their products and services: high value urban/export markets, and local markets in nearby areas, i.e. domestic/horizontal markets. An

enterprise network is built through integration and a vertically balanced network. Every competency in the rural complex, as a natural product or skill, can be nurtured and have value added to it. The entire chain from procurement to the market for rural production can generate jobs for varied skills, managed jointly under co-operatives or under segments including small scale industries. The facilitation and investment chain needs a customized credit policy and integrated financial services. [Ch. 8]

- Models such as the 'Rural Business Hub', promoted as a public-private-panchayat partnership, too are useful for creating economic activity and linking rural products to markets and to industries. There are other Government-sponsored schemes also, which need to be made parts of a comprehensive rural development plan. [Ch. 8]
- Realization of a 'PURA', thus involves provision of the four forms of Connectivity to the rural complexes—Physical, Electronic, Knowledge, and Economic—through integrated action along the parameters of Agricultural and Non-agro Reforms (Ch. 4), Planned Enterprise Creation (Ch. 8), Societal Asset Creation (Ch. 5), Community Action (Ch.7), and Environmental Friendliness (Ch. 6) for sustainable development. [Ch. 9]

The proposed 'PURA' system as suggested in the book above indicates the **need for sustainable growth** and also **'A nation where the rural-urban divide has been reduced to a thin line'**, besides other features. Based on the observations made in the book, essential

aspects of the 'PURA' scheme for reducing the rural-urban disparities and evolving rural-urban 'continuum' may be formulated as given in **Annexure 6**.

1.5.3 Policy Recommendations by RuTAG (Rural Technology Action Group)

An important reference related to the development and dissemination of technologies for sustainable development of rural India may be seen in the note, '**Concept of RuTAG (Rural Technology Action Group) issued by the Co-ordinator, Central RuTAG, Office of the Principal Scientific Adviser to Govt. of India, New Delhi (04-05-2017)**'. It incorporates following main observations:

- Spread of rural technology has been diffuse, uneven, and slow and its full potential for generating a rapid multiplier effect in rural economy has remained unrealized.
- The main constraint has been lack of local technology action groups who can assist in assessment of the technical needs of the farmers, artisans, and the landless to enable them to add value to their products and services, and to realize the vast potential of the farm and non-farm sectors.
- All technology needed for rural development is available among Indian scientists and industry. The problem often is in its transfer and downsizing if necessary as the source of different raw materials in rural India is scattered.
- S&T (Science & Technology) NGOs, govt. agencies and a few industrial initiatives have been successful in disseminating rural technologies up

to a point. The primary challenge here is how to synergize such fragmented efforts and also to nucleate new initiatives. RuTAGs have, accordingly, been conceptualized as a mechanism to provide a higher level of S&T intervention and support for technology upgradation, hi-tech delivery, technology training or any other innovative method.

- The entities intended to be brought together by RuTAG are S&T institutions, S&T NGOs, Public Sector Undertakings and Corporate Industrial houses committed to rural development and State and Central Govt. organizations working in the area. A beginning has been made in Uttranchal and Tamil Nadu with Chandi Prasad Bhatt and M.S. Swaminathan respectively as advisers.
- RuTAG activity is helping towards:
 - Addressing defused rural economy through S&T Platform.
 - Dissemination of refined technologies reaching to rural areas.
 - Technology delivery for non-farm/ agriculture sectors.
 - Benefiting Rural groups through network of NGOs.
 - Adding value to the produce and Enhancing quality of rural life.

RuTAG Centres have been established in seven IITs (from 2004 to 2013) in Madras, Guwahati, Kharagpur, Roorkee, Delhi, Mumbai, and Ropar.

1.5.4 Prof. Gangadhar Rao's "'Smart Village' Trajectory of Andhra Pradesh via Gandhian Mode"

This presentation is based on a very informative **draft Paper, titled "'Smart Village' Trajectory of Andhra Pradesh via Gandhian Mode"**, received from its author, Prof. Gangadhar Rao (Andhra University, Visakhapatnam) in October, 2015. It gives a detailed analysis of the present socio-economic status of the villages in 13 rural districts of Andhra Pradesh and the directions contained in the policy paper, titled, **'Smart Village Towards Smart Andhra Pradesh'** issued by Government of Andhra Pradesh in 2015 for the development of rural areas.

The policy paper has defined the **'Smart Village'**. It includes having vision, the ability to foresee and to learn best practices from others - be it an individual, a community, a Gram Panchayat/ Ward, a city, a country. Being a continuous process, it also means acquiring better processes and equipment with latest knowhow, and not only acquiring the latest knowledge but also acting upon it. In this context, the author also refers to Mahatma Gandhi's village reconstruction programme and his concept of 'Gram swaraj': **"My idea of village swaraj is that it is a complete republic, independent of its neighbours for its own vital wants, and yet interdependent for many others in which dependence is a necessity. Thus, every village's first concern will be to grow its own food crops and cotton for its cloth. It should have a reserve for its cattle, recreation and playground for adults and children. Then if there is more land available, it will grow useful money crops, excluding ganja, tobacco, opium and the like. The village will maintain a village theatre, school and public hall. It will have its own waterworks, ensuring clean water supply. This can be done through**

controlled wells or tanks. Education will be compulsory up to the final basic course. As far as possible every activity will be conducted on the cooperative basis". [*Collected Works of Mahatma Gandhi*, vol. 76: p.308-9]

Based on a number of expert references, the author offers an estimation of extant village conditions and the feasibility of accomplishing Gandhian approach to 'Smart Village' as aimed at and projected by Government of Andhra Pradesh. To estimate the state of existing village amenities, the secondary data from general census 2011 has been analyzed. It is examined to obtain the level and composition of workers, population, and household amenities at the level of each panchayat. Socio-economic conditions of rural A.P. are examined through demography, workers participation and household amenities at panchayat level in order to know the current situation of the 13 thousand panchayats in A.P. and also, the health factors at district level are estimated.

In A.P., 70% of population is in rural areas. For each district, 'per panchayat workers' participation as cultivators, as agricultural labour, as household industry workers, and as other workers, has been worked out for rural A.P. It is found that workforce of 50% males and 72% females is still in agriculture labour group (71% males and 85% females in farm employment, i.e. including cultivators) and the major shift of workforce needs to be done from agriculture labour group to industry groups by mechanization of agriculture. Share of household industry stands at mere 2% for both male and female workforce. 'Other Workers' is the broader group, which encompasses trade and commerce, hotels and restaurants, finance, communications, personal services, government services, etc; it is

the chief source for employing surplus workforce from the agriculture sector. It is particularly necessary to transfer female workers to non-farm sector for better incomes and regular - instead of seasonal - employment.

Non-farm sector is limited as a source of generation of employment to rural workers and, hence, it should change so as to be able to accommodate the new entrants by extension and diversification. Diversification of rural economy with new opportunities, viz., small agricultural processing units, manufacturing and packaging of commodities of food and non-food material based on the local availability, could be the best sources for the generation of employment for rural workers, and this shows the way ahead which the government policies should pursue.

The Paper then analyzes the data showing district-wise average per panchayat household amenities in rural A.P., covering average population per panchayat and average number of households per panchayat without bank services, bathroom, drainage, thatched roof, thatched wall, electricity, LPG, latrine within premises, and more than one room. The analysis shows how deficient in basic amenities the rural households are still living.

This is followed by an analysis of district-wise provision of health factors, covering primarily the issues of Home Deliveries, Mother Mortality Rate, Infant Mortality Rate, and Crude Birth Rate.

The author then draws a critical comparison of the proposed concept of A.P. government for 'Smart Villages' under each item of the 18-point 'Constructive Programme', which was

pursued under Mahatma Gandhi. Guided by the 'Gandhian Approach', the Paper ends with recommendations covering the need for political will to change the present scenario of rural areas, to set up 'Village Shram Daan Treasury/ Bank' at village, *mandal* and district levels for providing opportunity to public to render varied voluntary services, to institute 'Village Development/ Service Trusts' to enable receipt of funds from government or non-government sources for development works in the villages, to create 'Facility Centres or Village Cluster Centres' for locating banking, medical, transport, marketing, education, information facilities and mini workers bureaus, and to enable action relating to 'Policy Implications' such as, those for shifting workers from farm to non-farm sectors. The author recommends people's participation and support, in the form of material and manual work, being construed for convergence of development of all the villages rather than betterment of a selected few villages. He ends thus: "Governments are to seek, plan and design in the way, as Father of Nation reiterated, to get grand success in their endeavours."

The draft Paper presents a detailed analysis of the current state of villages in rural Andhra Pradesh and suggests appropriate policy approaches for their sustainable development.

1.6 Current Government Proposals/ Plans/ Programmes for Sustainable Development of Rural India

1.6.1 Government Initiatives for Sustainable Development of Rural India

After Independence, the Planning Commission came into being for planned development in all sectors of

India, including agriculture (since 1.1.2015, substituted by the NITI Aayog). However, in due course it was realized that, even with development in productivity of agriculture, the rural - urban 'divide', instead being transformed into a vibrant 'continuum', was becoming accentuated. Therefore, the governments have gradually started giving a special thrust to the development of rural India by initiating various schemes related to vital sectors, such as providing increased employment opportunities, sanitation systems, and housing. The most effective scheme so far has been the Mahatma Gandhi National Employment Guarantee Scheme, under which in the whole of rural India now employment is ensured to one member of each family for at least 100 days in a year at a basic wage rate. In recent times, a special thrust is being given to this vital area by supplementing the existing schemes and taking up some new schemes. It is necessary that the schemes for rural areas are specifically devised to ensure sustainable development of rural India in all its vital aspects so as to transform India into a vibrant rural-urban continuum within foreseeable and targeted future.

At present, the main schemes in progress for rural development, as detailed in **Annexure 7**, are as listed below:

- (i) Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).
- (ii) National Rural Livelihoods Mission (NRLM), in which a new scheme Start-Up Village Entrepreneurship Programme (SVEP) was included during 2015-16.
- (iii) Rural Self-employment Training Institute (RSETI).

- (iv) Pradhan Mantri Gram Sadaak Yojana (PMGSY).
- (v) Indira Awas Yojana (IAY)/ From 2016-17 Pradhan Mantri Awas Yojna – Gramin (PMAGY-G).
- (vi) National Social Assistance Programme (NSAP).
- (vii) Deen Dayal Upadhyaya – Grameen Kaushal Yojna (DDU-GKY).
- (viii) Saansad Adarsh Gram Yojana (SAGY).
- (ix) National Rurban Mission (NRuM).
- (x) Swach Bharat Abhiyan (SBA), covering sanitation including making India 'Open Defecation Free' by October 2019..
- (xi) National Land Reforms Modernization Programme (NLMP).
- (xii) Rajiv Gandhi Panchayat Sashastikaran Abhiyan (RGPSA).
- (xiii) National Rural Drinking Water Programme (NRWDP).

1.6.2 Government's 'Seven-Point Strategy to Double Farmers' Income by 2022

Over years, agriculture sector of Indian economy has passed through a terrible agrarian crisis. With farm incomes stagnating and the public sector investments in agriculture declining, the brunt is borne by the farmers. The never-ending spate of farmers' suicides, estimated to exceed 3.18 lakhs in past 21 years, is only a symptom of a deeper malaise afflicting agriculture. According to the Economic Survey of 2016, average income of a farmer family in 17 states stood at just Rs. 20,000 per year. Farm debt over the years has soared. It has to be wiped off for agriculture to become economically viable. It is time to go beyond the Minimum Support Price policy (MSP) as only about 6% farmers

get the benefit, the rest remaining dependent on market volatility. The solution lies in setting up a mechanism with a mandate to ensure the necessary monthly income to every farmer family.

In view of the state of deprivation of the farmers, one of the worst agitations of farmers took place in Madhya Pradesh in June, 2017. It spread to half of the state's districts following the shooting at Mandasur. The state government somehow controlled the situation with promise to look after the farmers' financial problems. After the protest by farmers in Madhya Pradesh, Maharashtra, Uttar Pradesh and Punjab also have waived off, or have worked towards waiving off, the loans of small and marginal farmers'. Finally, thousands of farmers, from around 180 peasant organizations from over 20 states, had collected in Delhi (on 20.11.2017) under the All India Kisan Sangharsh Coordination Committee (AIKSCC) to protest and press for their two main demands -- better prices for their produce and complete freedom from debt. They demanded remunerative prices covering production cost plus 50%, as "recommended by the Swaminathan Commission and promised by Prime Minister", and one-time waiver of all agricultural loans. [*The Week*, Delhi, 25.07.2017, p.90-94; *The Pioneer*, Delhi, 21.11.2017]

The Government of India have already issued a press release (dated 18.09.2017) for '**Building a New India: Pledge to Double Farmers' Income by 2022 - Seven-Point Strategy'** (see Annexure 8).

The seven points are listed below:

1. Increase in Production.

2. Effective Use of Input Cost.
3. Reduction of Post-harvest Losses.
4. Value Addition (through Food Processing).
5. Reforms in Agricultural Marketing.
6. Risk, Security and Assistance.
7. Allied Activities:
 - I. Horticulture
 - II. Integrated Farming
 - III. White Revolution
 - IV. Blue Revolution
 - V. Sub-mission in Agro-Forestry
 - VI. Bee Keeping
 - VII. Rural Backyard Poultry Development.

As may be seen from the above list, the Seven-Point Strategy covers a comprehensive range of relevant issues involved in, and associated with, the agriculture sector, and being a targeted programme, it should bring about basic improvements in the financial status of farmers, hopefully ending the era of large-scale farmer suicides.

1.6.3 "Three Year Action Agenda" by NITI Aayog for Sustainable Development of Rural India - for a Vibrant Rural-Urban 'Continuum'

NITI (National Institution for Transforming India) Aayog came into existence on 1.1.2015. Vide letter dated 9.5.2016 from Prime Minister Office, it was advised to prepare a *Fifteen Years Vision*, a *Seven Years Strategy* and a *Three Years Action Agenda* for India. In this context, out of these, it has so far prepared and issued '**INDIA: Three Years Action Agenda (2017-18 to 2019-20)**', giving the current state and recommendations for policy changes and programmes for action over the three year period. This important document (issued in August 2017, 211 pages), has been accessed from NITI

Aayog's website (http://niti.gov.in/writereaddata/files/coop/India_ActionAgenda.pdf niti.gov.in). **It includes comprehensive observations and policy directives for sustainable development of India, including rural India as an integral part of a vibrant rural-urban continuum. It is proposed to give here selected extracts from this document in order to present an overall picture for sustainable development of rural India, and of the ways to meet the challenges for realizing a progressive rural-urban continuum in India, through a 'Three Year Action Agenda'.**

This document starts with 'An Overview' (Ch. 1), followed by Parts I to VII, which are titled respectively as Part I: Three Year Revenue and Expenditure (Chs. 2 to 4), Part II: Economic Transformation in Major Sectors (Chs. 5 to 6), Part III: Regional Development (Chs. 7 to 9), Part IV: Growth Enablers (Chs. 10 to 15), Part V: Government (Chs. 16 to 19), Part VI: Social Sectors (Chs. 20 to 22), and Part VII: Sustainability (Chs. 23 and 24). **The document has been studied and selected extracts are given below.** (emphasis added)

CHAPTER 1. An Overview

"1.1 **The objective of eliminating poverty in all its dimensions such that every citizen has access to a minimum standard of food, education, health, clothing, shelter, transportation and energy has been at the heart of India's development efforts since Independence.**"

"Agriculture : Doubling Farmers' Incomes :

- 1.10. **Farmers make up nearly half of India's workforce. Therefore, for India to flourish, its farmers and the farm economy must prosper. It is against this background that the Prime Minister has called for doubling farmers' incomes by 2022. To achieve this goal, the Action Agenda outlines a strong programme for agricultural transformation. It includes numerous measures to raise farm productivity, bring remunerative prices to farmers, put farmers' land to productive uses when they are not able to farm it themselves and improve the implementation of relief measures. Chapters in subsequent parts of the document offer an ambitious agenda for empowering the rural population through improved road and digital connectivity, access to clean energy, financial inclusion and "Housing for All."**
- 1.11. **Enhancing agricultural productivity requires of efficiently using inputs, introducing new technologies and shifting from low to high value commodities.** We need to expand the scope of irrigation to increase crop intensity, improve access to irrigation, enhance the seed replacement rate and encourage the balanced use of fertilizers. Precision farming and related new technologies, that allow highly efficient farming and conserve resources, must be spread through appropriate policy interventions.
- Conditions conducive to shift into high value commodities such as horticulture, dairying, poultry, piggery, small ruminant husbandry, fisheries and forestry need to be created.
- 1.12. **The reform of the Agricultural Produce Marketing Committees (APMC) Act needs a new lease of life.** Farmers should get genuine rights for direct sales to buyers of all commodities, potential buyers should get the rights to buy produce directly from farmers, entry of private agricultural markets should be free and an effective legal framework for contract farming should be established. Minimum Support Prices (MSPs) have distorted cropping patterns due to their use in certain commodities in selected regions. - - - - One measure that can help reduce distortions in the MSP system is the system of "Price Deficiency Payment." While MSP may still be used for need-based procurement, under the deficiency payments system, a subsidy may be provided to farmers on other targeted produce, contingent on prices falling below an MSP-linked threshold.
- 1.13. **Over the years, landholdings in India have become smaller and fragmented.** According to the 2010-11 Agricultural Census, 47% of landholdings had become less than half a hectare in size. These holdings are too small to support a family of five so that many farmers now seek alternative sources of

income. But stringent tenancy laws in most states have meant that these farmers hesitate to lease the land they leave behind. As a result, an increasing amount of farmland is being left fallow. The introduction of a modern land-leasing law that balances and protects the rights of the tenant and landowners would be a potential solution.

1.14. **Finally, to alleviate distress in case of natural calamities, the government has recently introduced the Fasal Bima Yojana.** This is an important positive step toward mitigating risk but requires improvement. Capping the subsidy amount per farm household to a fixed amount and charging the full premium for additional insurance would not only economize on financial resources but will also be more equitable."

"1.23. A large part of India's population resides in rural areas. The challenges in the rural areas include creating jobs such that some agricultural workers could shift to non-farm sectors, skill development, accessing education and health facilities, infrastructure, local governance, drinking water and sanitation and financial inclusion. The Action Agenda outlines possible avenues to achieve progress in these areas."

CHAPTER 5. AGRICULTURE: DOUBLING FARMERS' INCOMES

"5.1. **Agriculture (inclusive of animal husbandry, forestry and fishing) is central to the nutrition needs of India and also remains the largest sector of India's economy as a source of employment.** According to the Fifth Annual Employment-Unemployment Survey of the Ministry Labour and Employment, 45.7% of India's workforce in 2014-15 was employed in agriculture. - - - For the prosperity of a large section of India's workforce, it is essential that we sustain this turnaround. **Unsurprisingly, the Prime Minister has set the goal of doubling farmers' income by 2022-23 over that in 2015-16. Achieving this goal would require significantly faster growth in nearly all variables that positively impact farmers' incomes.**

5.2. The NITI Aayog Report of Task Force on Agricultural Development has looked into the issue of revitalization of agriculture in substantial detail. - - - The present chapter draws on these sources and many others including some originating at the NITI Aayog. - - -

5.3. - - - agriculture is a state subject. Therefore, it is critical that state governments actively participate in bringing about the requisite changes. The central government can help bring about change through a variety of central sector schemes and centrally sponsored schemes but these can only succeed if states are

willing and active partners.

- 5.4. **Immediate actions necessary to sustain and accelerate agricultural growth may be divided into four areas. First, we need to reform of agricultural produce marketing policies and market interventions to ensure that farmers receive remunerative prices.** The Minimum Support Price (MSP) as currently implemented has limited reach both in terms of commodities that the government procures and geographical area over which such procurement extends. At the same time, the existing agricultural marketing system through which the bulk of the farmers sell their produce places in their hands only a fraction of the price paid by the final consumer. Both issues require immediate attention. **Second, productivity of both land and water remains low for many crops when compared to other countries. There also exist large regional variations in productivity. Correcting this deficiency will require sustained action for many years to come. Third, enacted in the 1950s or 1960s, tenancy laws in most states of India no longer adequately serve the interests of either landowners or tenants. A beginning to correct the problem has been made recently but more work in this direction is required. Related, land ownership records are in need of modernization. - - - Finally, relief measures in the event of**

natural disasters need to improve."

Remunerative Prices For Farmers

"Marketing Reforms

- 5.5. Issues related to price fall under two categories. First, the prevailing marketing arrangements under the conventional Agricultural Produce Market Committees (APMC) acts in the states have meant that the farmer receives a small fraction of the price paid by the final consumer. - - - Second, the government procures some commodities in some regions at preannounced MSP. This leaves most commodities in most regions to be sold at market prices that can fluctuate substantially.
- 5.6. **Agricultural marketing suffers from policy distortions, fragmentation resulting from large number of intermediaries, poor infrastructure, lack of vertical integration and stranglehold of official mandis sanctioned by the Agricultural Produce Marketing Committees (APMC) acts of the states. ---**
 - Because mandis lack good storage and warehousing facilities especially when it comes to fruits and vegetables, substantial wastage occurs - - -. Mandis also charge multiple entry, exit and other fees. Therefore, it is essential that states genuinely reform their APMC acts. ----.
- 5.7. **Reformed APMC acts should**

fully empower farmers to sell their produce to whomsoever they wish. In parallel, actors other than APMC mandis should be conferred the right to buy produce directly from the farmer and to set up alternative marketplaces. ---

Conditions also need to be created for the emergence of aggregators who would collect produce from farmers for sale at competitive marketplaces. --
-.

5.8. While this wholesale reform may take time, following the recommendations of the committee on Encouraging Investments in Supply Chains, as an early harvest, states may exempt perishables from the APMC acts and replace licensees of APMC markets with open registration backed by bank guarantees.

5.9. **There is also urgent need for restructuring the Essential Commodities Act to provide exemptions to certain categories of players such as exporters, food processors, multiple outlet retailers and large departmental retailers from applicability of stock limits. ---.**

5.10. **We must encourage contract and group farming through separate contract farming acts under which the buyer can provide the farmer or Farmer Producer Organisation (FPO) access to modern technology, quality inputs, other support and a guaranteed price. - - - A necessary complementary**

reform is to encourage FPOs by reducing the ceiling on paid up capital and enhancing the role of Small Farmers Agri-Business Consortium (SFAC) and National Bank for Agriculture and Rural Development (NABARD).

5.11. **Agricultural market in India is highly fragmented.** With each farmer confined to a single mandi in many products in many states, we currently have thousands of markets across which no arbitrage takes place. - - - **Launched in April 2016, electronic-National Agricultural Market (e-NAM) is an important initiative in this direction. ---**
- Though it currently covers more than 400 markets and is to be extended to 585 mandis by the end of 2017-18 - - - cross-mandi purchases are few and far between. - - - Necessary measures include third party assaying and quality certification mechanisms, dispute settlement mechanisms, systems for forwarding goods to buyers, digital infrastructure to enable the national market and encouragement of FPOs. - - -
."

"MSP Reform

5.12. **MSP has distorted cropping patterns, with excessive focus on the cultivation of wheat, rice and sugarcane in the procurement states at the expense of other crops such as pulses, oilseed and coarse grains. It has also resulted in depletion of water resources,**

soil degradation and deterioration in water quality in some states, especially in the north-western region. At the same time it has discriminated against eastern states where procurement at the MSP is minimal or non-existent. One measure that can help remove distortion in the MSP system to some degree is the system of “Price Deficiency Payment”. While MSP may still be used for need-based procurement, under the deficiency payments system, a subsidy would be provided on other targeted produce in case the price falls below an MSP-linked threshold. - - - Each farmer would register her crop and acreage sown with the nearest APMC mandi. If the market price then falls below the floor price, the farmer would be entitled to the difference up to a maximum of, say, 10% of the MSP-linked price that could be paid via Direct Benefit Transfer (DBT) into an Aadhaar-linked bank account. - - - The system can initially be piloted in one or two crops in a few districts."

"Raising Productivity

- 5.13. **Boosting productivity in agriculture in a sustainable manner requires us to work on four fronts – Irrigation; seeds, fertiliser, technology and a shift to high-value farm products such as fruits and vegetables, milk, eggs, chicken and fisheries."**

"Irrigation

- 5.14. **Crop intensity and productivity --- are critically dependent on irrigation.** In India, a second crop is grown on less than 40 % of cultivated area. - - - The main reason for low crop intensity is access to water and moisture - - in Rabi season.

- 5.15. **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) provides a sound framework for the expansion as well as effective use of water in irrigation. It focuses on four broad areas – Accelerated Irrigation Benefits Programme (AIBP), Har Khet Ko Pani, Per Drop More Crop and Watershed Development.** Though we have announced ambitious PMKSY goals, progress on the ground needs improvement. - - - We need manifold increase in the allocation of funds for PMKSY. We need quick clearance for Inter Linking of River project. We must include shallow tube wells in - - water rich states in east India in PMKSY. Finally, we need a dedicated agency at national level to push PMKSY."

"Seeds and Fertilisers

- 5.16. - - - **Actions are required in both areas. Ideally, seeds must be replaced every year for hybrid and every three years for non-hybrid varieties.** In the former case, the optimum seed replacement rate (SRR) is 1 and in the latter case 33%. In India, seeds are replaced at rates below the optimum, especially in self-

pollinated crops such as rice, wheat, pulses and oilseeds. To bring the rate to the optimum, we need to enhance seed-research capacity as well as multiply stations. We also have to encourage private sector participation - - by removing the price control order of seed and other restrictions ---. At the same time, a robust third party quality certification system for seeds should be encouraged.

- 5.17. **Judicious and optimum use of fertilisers is also essential.** Fertilisers supply three critical elements: Nitrogen (N), Phosphorous (P) and Potassium (K). A common belief is that ideal mix of N, P and K is in ratio 4:2:1. While this may be an average, the actual optimum ratio and level of fertiliser use depends on soil and crop type and the amount of water used. This is why soil cards are important for customizing fertiliser use. ---- There is need to create awareness of the optimal nutrient mix and optimal level of fertiliser use among farmers. The soil health card can be a good vehicle for accomplishing this objective."

"New Technology

- 5.18. Technology in the form of high-yielding seeds and fertilisers were the driver of India's attainment of self-sufficiency through the green revolution, and new technology remains one of the most important determinants of growth in agriculture. ---.
- 5.19. Genetically modified (GM)

seeds have emerged as a powerful new technology promising high productivity, improved quality and lower use of fertilizers, weedicides and pesticides in the last one to two decades. - - - But this concern (regarding monopoly by multinationals) is readily addressed by limiting GM seeds to those varieties discovered by our own institutions and companies.

- 5.20. Precision farming and related new technologies like the system of rice intensification, raised bed planting, poly house cultivation of fruits and vegetables, laser land levellers, self-propelled sprayers, precision seeders and planters, transplanters for rice and vegetable seedlings and multi-crop threshers and harvesters allow highly efficient farming and resource conservation. However, these are highly skill and capital intensive methods of farming. **The emphasis should be on informing farmers of the opportunities new technologies offer, improving access to credit and creating an enabling policy environment for their adoption without major direct financial commitments. ---.**
- 5.21. **India needs a vibrant, responsive, market oriented and globally competitive agricultural research ecosystem. - - -** We may identify two agricultural universities and provide them necessary incentives to achieve global status. At the same time,

urgent action is needed to overhaul the public sector Research & Development (R&D) institutions while creating favourable environment for private sector participation - -. **An important step in this direction is to measure the performance of research institutions in terms of patents and publications.** We may --- facilitate public private partnerships in agriculture research. A genetic breakthrough in pulses and oilseeds is the need of the hour, and **a challenge led approach - - must be implemented immediately.**

- 5.22. Extension is another element needing urgent attention alongside research. **New methods and approaches need to be devised for agricultural extension using information technology and mobile technology. Skill India mission should be used for extension to impart agricultural skills. Local participation of progressive farmers, self-help groups and Primary Agricultural Cooperative societies (PACS) should be leveraged to help transfer technology --.-----."**

"Shift into High Value Commodities

- 5.23. **M a n y h i g h - v a l u e agricultural activities such as horticulture, dairying, poultry, piggery and small ruminant husbandry generate output streams that translate into generous income. Fisheries and**

forestry also constitute important alternative high-value products.

- 5.24. Shifts in the consumption pattern with rising incomes strongly suggest that the demand for these products will continue to rise - -. Besides, there exist vast export markets for many of these products. --- **But achieving this transition requires the creation of an ecosystem in which farmers find the shift into the high-value commodities cost-effective."**

"Horticulture

- 5.25. The necessary actions include marketing reforms that allow farmers to capture a greater share of the price paid by the final consumer, contract farming that better connects the farmer to food processing industry, easier access to term loan credit instead of just crop loan credit, greater encouragement for Farmer Producer Organisations and improved storage, transport, power and communications infrastructure in rural areas. This would enable and encourage private investment in agribusiness and, in particular, supply chains."

"Animal Husbandry

- 5.26. An important challenge - - concerns fodder. Rapidly growing numbers of unproductive male cattle and weak fodder base due to problems in pasture management and shrinking of

common properties make this problem doubly serious. We need innovation in institutional aspects of pasture protection and management. Also necessary is greater co-ordination between agencies responsible for livestock and those for crops that produce fodder.

- 5.27. **The dairy industry provides an important supplementary source of income in rural areas and encourages balanced growth for small farmers and farmers in hilly or drought prone areas.** - - - For this, increase in livestock productivity through breed improvement, better feed and nutrition, animal health, and better herd composition are important. Selective genetic breed improvement of indigenous cows and buffalos will need to be an important part of this process. The Rashtriya Gokul Mission for increasing productivity of indigenous cows was launched in 2015-16. Based on the results of the program, a similar exercise for buffalos may be considered."

"Blue Economy

- 5.28. **India has vast scope in both marine and inland fisheries.** - - - Inland fisheries, particularly of brackish water linked export oriented prawn cultivation, offer substantial opportunities for faster expansion. - - - There is considerable scope for the expansion of fish production in rain fed water bodies, irrigation reservoirs, natural wetlands

and ponds and tanks. We need to encourage the use of quality fish seed and feed while also investing in disease control, marketing infrastructure, modern fish processing plants and re-engineering of the value chain. Coastal states may also find it attractive to exploit deep-sea water for fishing, especially Tuna. - - -."

"Forestry

- 5.29. - - we need to revisit the policies with respect to felling of trees and their movement across state borders. **Wood-based products such as paper and pulp and furniture offer vast potential for enhanced income for farmers.** - - - It is essential and urgent that we liberalize our laws so that wood may be harvested from trees grown on private lands and transported to locations where it can be used most productively.
- 5.30. As the success of Gujarat and the original undivided Andhra Pradesh state illustrates, state governments can introduce most of the policy changes and interventions in this area on their own. Nevertheless, the central government can play a facilitating role through dissemination of best practices and financial assistance."

"Agricultural Land Policy: Leasing And Records

- 5.31. **Restrictions on formal and transparent land leasing in agriculture results in myriad issues, ranging from**

fragmentation of farms and low productivity of land to poor targeting of benefits and relief measures. A closely related issue is digitization and updating of land ownership records. Ideally, we should also begin working towards conclusive ownership titles - - -once ownership records have been updated and digitized.

- 5.32. Land being a purely state subject except as it relates to land acquisition, land leasing requires amending existing state-level tenancy laws or replacing them by a new law. **Recently, NITI Aayog has prepared a model Land Leasing Law.** Following it, Madhya Pradesh has introduced a new land leasing law - - -. Uttar Pradesh has taken the amendment route, introducing the key features of the NITI Aayog model law - -. Rajasthan has had a land leasing law that predates the NITI Aayog model law and goes beyond it. - - -**We must ensure that by end March 2020, at least two thirds of the states have liberal land-leasing laws that protect the rights of both the owner and the tenant - - -.**
- 5.33. Turning to updating ownership records and digitizing them, **a central sector scheme known as the National Land Records Modernization Programme was initiated in 2008.** The scheme aims to build a transparent and integrated system of real-time land records based on land surveys,

updating of survey and settlement records. High-resolution satellite imagery and ground truth data collection are to be used. It also envisages computerization of land records and registration, modernizing of record rooms and setting up of record management Centres. Unfortunately, however, this scheme has not worked well so far - - -. **It is urgent that the scheme is reformed and proper funding provided to speedily build updated digitized records in at least two-thirds of the states by end March 2020."**

"Relief Measures

- 5.34. Natural disasters such as droughts, floods, cyclones, storms, landslides and earthquakes can lead to extreme distress and hardship among many small farmers - -. In these situations, they need at least a minimal amount of relief at a rapid pace. **The Pradhan Mantri Fasal Bima Yojana, for which Rs. 9,000 Crore have been allotted in the 2017-18 Union Budget is an important positive step towards risk mitigation for farmers but it needs to be subjected to four important reforms. First,** at present, the insurance scheme limits the farmers' contribution towards premium to 1.5%-2% of the sum insured for non-commercial crops and 5% of the sum insured for commercial crops irrespective of the sum insured. The government pays the remainder of the premium

as subsidy. - - - **The scheme should instead be modified to have a capped subsidy amount per farm household - - - . Second, insurance scheme should provide coverage for three to five years so that coverage extends to both good and bad years. - - - Third, the subsidy on the premium should take the form of direct benefit transfer to ensure that farmers can shop for the best value for their money. Finally, there should be minimally two companies offering insurance in any given location.** This will - - lead to greater efficiency and lower premiums for farmers."

Chapter 6: TRADE, INDUSTRY and SERVICES: CREATING WELL-PAID JOBS

"Food Processing

- 6.35. **The food processing sector contributed 1.6 % of India's GDP in 2014-15. It made up 10.12% of GDP attributable to agriculture and 9 % of manufacturing GDP during the same year. - - - The sector is an important source of direct and indirect employment, accounting for 11.95 % of formal employment in 2012-13.** Food processing industries cover a wide array of activities ranging from traditional agro-based industries such as rice and flourmills to the processing of tea and coffee to the dairy industry. ---..
- 6.36. **The sector contributes directly to economic growth**

through reducing food wastage, creating jobs and export earnings. However, growth and productivity are plagued by several challenges. According to the World Bank Enterprise Survey, value added per worker in agribusiness in China was almost four times that in India in 2014. Food processing firms, particularly Small and Medium Enterprises (SMEs), have difficulties in accessing finance. The lack of quality infrastructure, including cold storage, storage for non-perishables, distribution networks and transportation, raise costs and inhibit competitiveness. Additionally, small farm sizes, restricted access to markets, uncertainty related to price, availability and quality of raw materials, and limited skilled manpower pose further challenges to the sector's growth. Below, we spell out specific actions that would help rejuvenate the sector.

- 6.37. ***Restructure the Essential Commodities Act such that processing firms receive exemptions.*** Restructuring the Essential Commodities Act to provide exemptions to exporters, food processors, multiple outlet retailers and large departmental retailers from applicability of stock limits will enhance output and marketability of these products.
- 6.38. ***Attract private investment in agribusiness through institutional reforms.*** Reforms in the APMC acts, a modern

contract farming act as announced in the Union Budget 2017-18, easier access to term loan credit instead of just crop loan credit, greater encouragement for Farmer Producer Organizations and improved transport, power and communications infrastructure in rural areas will make investment in food processing industries attractive.

6.39. ***Improve logistics and storage facilities.*** - - - - Of the total warehousing space of about 1,800 million sq. ft., the industrial and agricultural segments constitute about 86% and 14%, respectively. Two thirds of food storage is owned by the public sector. **India's current cold storage capacity at 25 MT is barely sufficient for 10% of fruit and vegetables produced in the country.** - - - an important reason for the high cost of food products and wastage. **The Ministry of Food Processing Industries (MoFPI) launched the Cold Chain Scheme to provide integrated cold storage and preservation infrastructure facilities without any interruptions in the supply chain. By 2020, we should complete 180 projects (managing about 60 Lakh MT of agro produce) under this scheme.**

6.40. ***Raise standards to converge with international standards.*** We must - - adopt food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO

22000, Hazard Analysis and Critical Control Points (H A C C P), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP). The quality and hygiene norms would lead to greater acceptance of Indian processed products by foreign buyers - -. In turn, this would help industry keep up with technological developments and best practices worldwide.

6.41. To maintain quality standards and food safety requirements, we should provide the requisite infrastructure such as certified testing facilities, training and information campaigns on standards. - - - -.

6.42. ***Set up 40 Food Testing Laboratories to Ensure Safety of Products.*** - - - Under the Scheme for Quality Assurance, 42 Food Testing Labs have been completed. The Scheme aims to implement an additional 40 Food Testing Labs. By 2020, we should create a network of 44 NABL-accredited food-testing labs to support the food safety regulatory activities.

6.43. ***Scale up initiatives that are integrated processing hubs such as Mega Food Parks.*** The Ministry of Food Processing Industries (MoFPI) has an existing scheme for the development of Mega Food Parks. These parks follow a cluster-based approach and bring together farmers, processors and retailers. Eight such parks are already functional as of 2016. The

MoFPI plans on creating 30 more of these. - - - should be made operational by 2030."

C h a p t e r 8 : R U R A L TRANSFORMATION

- 8.1. **As per the Socio-Economic Caste Census (SECC), 2011, there were 244.9 million households in the country out of which 179.7 million households (833 million people) were living in rural areas across 640,930 villages and 240,618 Gram Panchayats. While considerable progress has been made in lifting households out of poverty, 87.2 million (48.5%) rural households reported one or more deprivations according to the SECC, 2011. A majority of the rural households (92 million) are engaged in manual casual labour and agricultural activities.**
- 8.2. **The rural landscape has been transforming, with a clear distinction between rural and urban areas disappearing. This has resulted in a more integrated economy. Job creation, however, has not kept pace with the shift from agriculture towards non-farm sectors. Other challenges facing rural areas include low literacy levels, inadequate access to health, drinking water and sanitation as well as insufficient linkages with and use of formal financial services.**
- 8.3. **Over the next three years, the**

focus should be on - - - existing schemes for boosting skill development and employment generation as well as providing basic services to all villages. There should also be an emphasis on ensuring digital connectivity and literacy. Further, - - strengthening of Panchayats should be prioritized to enable them to respond to local needs effectively."

"Convergence Between Schemes and Transparency in Implementation

- 8.4. The SECC 2011 is becoming the basis for determining beneficiary level entitlements for several programs. - - a mechanism for updating the data on a regular basis needs to be institutionalised. There is also a need to correct for any significant discrepancies between Census 2011 and SECC 2011.
- 8.5. The availability of the SECC list coupled with the focus on Aadhaar-based payments to the bank accounts of beneficiaries could pave the way for greater convergence among various government schemes in rural areas. - - - - The State Institutes of Rural Development (SIRD) can play an important role in facilitating this convergence - - -. - - -.
- 8.6. The use of Geographical Information System (GIS) for tracking assets and houses created under MGNREGA and Pradhan Mantri Awaas Yojana - Gramin, respectively, - - - will

help in greater transparency and accountability with respect to the implementation of these schemes. --."

"Skill Development and Employment Generation

- 8.7. Beyond expanding the number of Self-Help Groups (SHGs) promoted under the Deen Dayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM), several measures are needed for strengthening the scheme. ----.
- 8.8. In order to address some of the human resource challenges, efforts should be made to ensure a longer term - - for the CEOs of the State Rural Livelihood Missions (SRLMs). - - - Additionally, emphasis needs to be placed on the retention of project staff - - as well as filling up of vacant posts.
- 8.9. The CRM team found that while the program has achieved success in accelerating SHG-Bank linkages and promoting economic activities at the individual level in several areas, more organized support is necessary for forming and strengthening Producers Groups and Producers Companies in areas like sustainable agriculture and non-timber forest products. ---
-.
- 8.10. A mechanism for measuring key indicators for SHGs including household savings, income, asset creation, debt reduction and productivity
- needs to be developed. For strengthening bank linkages, up to two Bank Correspondents should be appointed for a Panchayat and one Bank Mitra for a branch. Jan Dhan accounts should be opened for all SHG members and linked with their Aadhaar numbers. - - - With a three-year timeframe, - - - to provide banking services to at least 50% of the uncovered villages.
- 8.11. With respect to the Deen Dayal Upadhyaya Gramin Kaushalya Yojana (DDU-GKY), the focus should be on monitoring and improving the quality of placements. An integrated IT platform should be - - - linked with the IT platforms of the project implementing agencies at the state level. ---.
- 8.12. The Sub-Group of Chief Ministers on Skill Development has suggested some additional measures for strengthening DDU-GKY and NRLM. - - - - The recommendations also emphasize the need for leveraging Recognition to Prior Learning (RPL) under the National Skills Qualifications Framework (NSQF). All state departments should develop plans for assessment and certification of semi-skilled and skilled workers in agriculture and allied fields by the Agriculture Skill Council of India (ASCI).
- 8.13. With respect to MGNREGA, one of the areas that should be strengthened - - is monitoring. -

- - Additionally, social audits facilitated by an independent unit should be made compulsory. - - - Further, there should be an emphasis on establishing linkages between MGNREGA and skill training programs, as envisaged in the *Livelihoods in Full Employment* project launched in 2015.

8.14. In the absence of a dedicated fund for the maintenance of assets under MGNREGA, a number of assets - - become unusable over time. It might therefore be helpful to create a separate maintenance fund for community assets created under MGNREGA. A maximum of say 10% of the MGNREGA budget could be set aside for this fund with an equal contribution being mobilised from the community. - - - -.

8.15. Andhra Pradesh's experience provides a fine example of how asset creation under MGNREGA and infrastructure creation under other schemes can come together to produce durable assets. - - -.

8.16. Another step that needs to be taken on a priority basis is ensuring that all the technical staff vacancies in MGNREGA are filled and personnel have adequate capacity to supervise the quality of assets constructed under the scheme.

8.17. Data indicates that the benefits of MGNREGA have been reaped disproportionately by some of the more prosperous

states. Therefore, there is a need for developing a set of inclusion, exclusion and deprivation criteria for targeting the program in favour of the poorest households. - - - -."

"Housing

8.18. As per the PMAY-G scheme, houses will be provided to all by the year 2022. - - - 10 million houses will need to be constructed by March, 2019. - - - -.

8.19. To ensure that the goal is met, it is crucial that state specific plans are developed along with a work schedule and explicitly defined targets. - - - -.

8.20. Another priority is to ensure that funds are released in a timely manner - - - -.

8.21. A scheme for the provision of interest subsidy to every rural household that is not covered under PMAY-G has recently been approved by the Union Cabinet. - - to ensure convergence of this scheme with PMAY-G - - -."

"Drinking Water and Sanitation

8.22. Under the National Rural Drinking Water Programme (NRDWP), continuous uninterrupted water supply should be provided to a minimum of 179,000 partially covered habitations during the next three years. Additionally, at least 26,500 arsenic and fluoride affected habitations should be treated.

8.23. In order to achieve the target of becoming Open Defecation Free (ODF) by 2019, 55 million household toilets and 115,000 community toilets will need to be constructed under the Swachh Bharat Mission (Gramin). Special attention should be paid - - with respect to sanitation access for women, children, senior citizens and the differently-abled. Additionally, systems will need to be developed for comprehensive operationalization of safe management practices for solid and liquid waste.

8.24. Over the next three years, efforts should be made to promote the adoption of improved sanitation practices and hygiene behaviours, in addition to focusing on the hardware aspects. One of the recommendations made by the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan is to engage a professional agency for designing and monitoring an extensive media campaign - -. - - - - Communication campaigns are more likely to be effective if they are tailored to the prevailing local context in different states. - - - - Further, - - inculcating sanitation practices should be made an integral part of the school curriculum.

8.25. A comprehensive analysis should be undertaken to assess why the Community-Led Total Sanitation (CLTS) approach which has been very successful globally and in states like Himachal Pradesh in India, has not scaled-up across the

country. - - - CLTS - - - emphasizes on igniting behaviour change from within the communities themselves and recognizes that simply providing a household with a toilet does not guarantee its use or an improvement in sanitation related outcomes.

8.26. Another priority should be to train and incentivize a cadre of community-based sanitation workers or Swachhta Doots as envisaged in the Swachh Bharat Mission (Gramin) guidelines for overseeing the construction of sanitation facilities in villages as well as spreading messages about hygiene.

8.27. The validity of data pertaining to the numbers of toilets constructed should be confirmed through periodic checks and audits by government and non-government assessors. - - - An objective framework for assessing the ODF status of villages should be developed. Villages - - certified as ODF should be re-sampled periodically to assess whether the positive behavioural practices have persisted - -. - - - ."

"Energy

8.28. Over the next three years, the goal as part of the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is to bring electricity to every household in all villages across the country. In order to ensure this, there will need to be a focus on

the quality, reliability, affordability and legality of supply ---.

- 8.29. --- Continued efforts should be made to engage adequate numbers of Gram Vidyut Abhiyantas (GVAs) for monitoring the electrification process and resolving any discrepancies between official data and realities on the ground.
- 8.30. Further, 50 million BPL households, a large number of which are in rural areas, should have access to Liquefied Petroleum Gas (LPG) by 2019 under the Pradhan Mantri Ujjwala Yojana (PMUY). ---."

"Roads

- 8.31. Over the three-year timeframe, the goal should be to connect all villages in rural areas with all-weather roads under the Pradhan Mantri Gram Sadak Yojana (PMGSY). ----.
- 8.32. - - - Additionally, any discrepancies and deficiencies in the District Rural Road Plans should be addressed so that eligible unconnected habitations can be covered under PMGSY.
- 8.33. Further, quality control and monitoring under PMGSY should be strengthened - - . - - ."

"Digital Connectivity and Literacy

- 8.34. Tele-density in rural areas is one-third that of urban areas. An estimated 55,619 villages do not have mobile coverage.

Developing enabling infrastructure in rural areas is therefore a priority as discussed in the "Digital Connectivity" chapter.

- 8.35. Along with improving connectivity, ensuring digital literacy is also crucial. The recent approval of the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) by the Union Cabinet for making 6 Crore households in rural areas digitally literate is an important step - - - will help to enable the more widespread use of the Jan Dhan, Aadhaar, Mobile (JAM) trinity. This in turn could replace the current cumbersome and often leaky distribution of benefits under various schemes in rural areas with Direct Benefit Transfers. Eventually, this could pave the way for replacing multiple schemes with consolidated cash transfers - - -."

"Rurban Growth Clusters

- 8.36. The 300 clusters selected for development under the National Rurban Mission should be established by 2020. The institutional structures envisaged in the Mission's implementation framework should be operationalized at the state, district and cluster levels on a priority basis. - - - Dedicated teams are important for ensuring time-bound implementation and facilitating convergence between various government schemes. ----. ----.

8.37. Another area that should be strengthened is capacity building of officials and elected representatives of the Panchayats --- for fulfilling the Mission objectives. Active engagement of stakeholders at the local level will also enable modern technology to be combined with traditional knowledge and practices for effective and sustainable implementation of the Rurban model. Further, dashboards could be created at the national, state and district levels for monitoring the progress of all essential components of cluster development. - - - for undertaking the necessary course corrections."

"Panchayats as Institutions of Strong Local Governance

8.38. Several steps should be taken over the next three years to develop Panchayats as institutions that are capable of providing strong governance at the local level. - - - States should confer on the Panchayats full administrative and financial control over staff working with them. ---.

8.39. An annual study on the Panchayat Devolution Index (PDI) has been conducted by the Ministry of Panchayati Raj since the year 2006. Examining the underlying reasons for the superior performance of certain states - - reveals that while devolution has a number of dimensions, some elements are especially critical for its effectiveness. - - - - Efforts to strengthen Panchayats across

various states should focus on these elements.

8.40. -- the PDI is -- based primarily on the outputs of devolution. Efforts should therefore be made to include outcomes, wherever possible, to achieve a better understanding of whether greater devolution is making local economic development and social progress more effective. A percentage of the fund allocation to states under Centrally Sponsored Schemes could be linked to performance on this Index.

8.41. Panchayats should also be supported for acquiring the ISO certification. ----."

Chapter 10: TRANSPORT and CONNECTIVITY

"Roadways

10.4. India had --- over 4.24 million km of roads in 2013-14, consisting of National Highways, Expressways, State Highways, major district roads, other district roads and village roads. - - -. The National Highways Development Program (NHDP), the Bharatmala Project and Special Accelerated Road Development Programme-North East (SARDP-NE) focus on --- national highways. The Pradhan Mantri Gram Sadak Yojana (PMGSY) and Bharat Nirman focus on the construction and maintenance of rural roads. The development of secondary road networks falls under the

purview of state governments."

"Road Connectivity and Mobility

- 10.5. ***Increase connectivity, especially in Rural India and with Ports by expanding the road network.*** - - - - While the increase in road construction and freight corridors will help increase connectivity broadly, additional attention should be paid to enhancing connectivity to rural areas. By 2020, we should achieve universal connectivity in rural areas under the PMGSY, which should complete the remaining 35% of road core network. Additionally, the Union Budget 2017-18 identified 2,000 km of coastal connectivity roads to facilitate better connectivity with ports and remote villages. - - -."

Chapter 12 : DIGITAL CONNECTIVITY

"Access to Broadband Internet to Rural Households

- 11.4. - - - The government has already commenced a large-scale initiative, BharatNet, implemented by the Bharat Broadband Network Limited (BBNL), to create a high-speed digital highway for providing 100 Mbps connectivity to all 2.5 Lakh Gram Panchayats using optical fibre. In the first phase, ending on 31 March 2017, 2.2 Lakh km underground optical fibre was to be laid down to connect one Lakh Gram Panchayats. - - -.
- 11.5. In the second Phase of the

BharatNet, which is to be completed by December 2018, all 2.5 Lakh Gram Panchayats are to be provided fibre optic connectivity. - - - -.

- 11.6. The access to Internet to be made available under BharatNet is a prerequisite for enhancing other aspects of digital connectivity. For example, two of the pillars of the Digital India campaign – e-Kranti and Information for All – require Gram Panchayats to access the Internet. - - -.
- 11.7. To speed up bringing the fibre to the Gram Panchayats, the option to carry the cable on electric poles should be more aggressively pursued. - - - - In addition to increasing the pace of Internet expansion, carrying fibre cable on electric poles will help bring connectivity to areas that have difficult terrain. - - - In such terrains we may also explore the prospects for alternative technologies such as that based on satellite."

"Wireless Connectivity

- 11.8. Wi-Fi networks often offer a more affordable and flexible option than mobile Internet or broadband services for scaling up Internet access. - - - -.
- 11.9. If we are to fully exploit the benefit of digital technology, we must rapidly complete the BharatNet project. Following the Andhra Pradesh model, greater speed in implementation can be achieved by making use of the existing electric poles to carry

the fibre optic cable. It is also important to plan for last-mile connectivity. - - - - We should also explore commercial models to deploy Wi-Fi services. - - - - With the supporting policies and models in place, by 2018, we must ensure that wireless networks created under the Bharat Net project are used to provide last-mile connectivity to households in rural areas. Our goal should be to bring 15-kbps connections to at least 30% of the rural households by December 2019."

"Enabling Infrastructure for Connectivity in Rural and Remote Areas

11.10. While rural residents accounted for 68 % of India's population in 2011, they made up 73 % of the offline population. The high cost of Internet services deters many low-income households from accessing the Internet. - - - - To increase rural residents' connectivity, we must put in place enabling infrastructure such as - - access to electricity, increase mobile network penetration and improve access to mobile devices and data plans by lowering costs. Keeping regulatory barriers to the minimum necessary would lead to healthy competition in the mobile sector driving down the costs of devices and data plans."

**Chapter 24: SUSTAINABLE
MANAGEMENT OF
WATER RESOURCES**

"24.6. **Irrigation Sector.** The Ultimate Irrigation Potential (UIP) in India is assessed at 139.9 million ha. As per the National Perspective Plan, implementation of Inter Basin Water Transfer (IBWT) proposals may create additional irrigation potential of 35 million ha, By March 2012, Irrigation Potential Created (IPC) stood at 112.5 million ha. However, there was a gap of 23.2 million ha (21%) between IPC and Irrigation Potential Utilized (IPU). Moreover, the 'Net Irrigated Area' was only 65 million ha out of 141 million ha 'Net Area Sown.' Thus, the remaining 76 m ha needs to be provided with some means of irrigation. Moreover, the efficiency of irrigation sector for surface and ground water presently stands at 30% and 55% respectively. India can make significant gains in water availability through increased efficiency of water use across the board in irrigation. The irrigation sector is also grappling with the issues inter-alia of insufficient fund for implementation, non-completion of projects, poor maintenance, absence of effective Participatory Irrigation Management, non-alignment of cropping patterns to the agro-climatic zones, and absence of field channels for last mile connectivity.

24.7. **Drinking Water.** Providing adequate and safe drinking water to all households, through piped water supply, is a major challenge. As per 2011

Census, only 30.8% of the total rural households and 70.6% of the total urban households were reported getting piped water supply.

- 24.8. **Industrial Water.** Treatment of effluents discharged from industries needs to be accorded priority for controlling water pollution. Disposal of untreated sewage and industrial waste is a major cause of pollution in rivers and other water bodies."

"To provide irrigation to all farms (Har Khet Ko Pani) with improved on-farm water-use efficiency (Per Drop More crop)

- 24.11. Under Accelerated Irrigation Benefits Programme (AIBP) component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), the on-going projects have to be closely monitored to remove bottlenecks for faster completion. A total of 149 major and medium irrigation projects were approved earlier for Central assistance under AIBP. Out of these, 99 projects (with capacity to create additional irrigation coverage over 76 Lakh ha) have been prioritized for implementation under PMKSY as these can be completed within a period of 2 to 3 years, if financial resources are made available.
- 24.12. A scheme may be planned by the Ministry of Water Resources, River Development & Ganga Rejuvenation (MoWR, RD & GR), in

consultation with the states/UTs, for bridging the reported gap between the IPC and the IPU of 15.6 million ha in surface irrigation and 7.5 million ha in groundwater irrigation.

- 24.13. Repair, Renovation and Restoration (RRR) of existing water bodies, which are not in use, needs to be given high priority - - particularly in drought-prone areas. In such areas, inventory of water bodies in the villages and nearby areas may be prepared and geo-mapped. These bodies should be restored and put in use for water storage which would also facilitate recharging of ground water. This scheme should be implemented in convergence with other schemes such as --- (MGNREGA).
- 24.14. A nationwide Information, Education and Communication (IEC) campaign needs to be launched making farmers aware of the benefits of adopting Micro-Irrigation Systems with use of solar energy for better on-farm water use efficiency. This activity can be undertaken through the recently announced Micro Irrigation Fund in the Budget 2017-18.
- 24.15. The projects sanctioned under Integrated Watershed Management Programme (IWMP), numbering 8,214, require Rs. 22,610.14 Crore as central share and carry potential to provide irrigation to 27.3 Lakh ha. The

Department of Land Resources (DoLR) has proposed that an additional allocation of Rs. 9,020.14 Crore over and above Rs. 13,590 Crore allocated under PMKSY will result in bringing an area of 15.81 Lakh ha under irrigation in addition to the target of 11.50 Lakh ha set under 'Watershed Development' component of PMKSY. The proposal of the DoLR may be agreed as works taken up under 'Watershed Development' also contribute significantly to re-charging of groundwater.

- 24.16. There are 4,181 on-going surface minor irrigation schemes in 19 states which require Rs. 9,127 Crore as central assistance and carry potential to provide irrigation over 10.18 Lakh ha. These projects may be taken up on priority in states getting fewer benefits under AIBP and Command Area Development & Water Management (CAD&WM)."

"To create additional water storage capacity to enhance utilization of surface water resources potential of 690 BCM

- 24.20. By 2019, monitor and complete majority of the 313 large dams that are under construction. These dams will add 33 to 37 BCM to the existing storage capacity. By 2019, specific programmes may be launched to reduce siltation of existing dams and reduce seepage loss through

selective lining of canals."

'Ensure long-term sustainability of the limited ground water resources

- 24.21. The Government of India has launched a scheme 'Groundwater Development and Management' with an estimated cost of Rs. 3,319 Crore. - - - However, the pace of programme implementation needs to be accelerated. Aquifer mapping needs to be completed covering an area of 13.78 Lakh sq km on 1:50,000 scale from the present 2.28 Lakh sq km mapped area (up-to March 2016). This scheme should be prioritized in the blocks falling under over-exploited, critical, semi-critical and saline categories.
- 24.22. In areas, where groundwater is available in plenty, sustainable development of ground water should be promoted which would also facilitate creation of sinks to store excess water during the rainy season. In 4,530 blocks, especially in the Eastern and North-Eastern states - -, where groundwater development has been reported as safe, groundwater-based irrigation may be developed sustainably and used efficiently by adopting micro irrigation systems for better on-farm water-use efficiency.
- 24.23. A feasibility study should be conducted for assessing groundwater banking potential in India by 2018. - - - -."

"Water Governance

- 24.24. The following measures to facilitate effective water governance to manage the available water resources may be studied:
1. State-specific water policies including an independent regulator with powers to regulate water uses and pricing;
 2. Enactment of legislation for protection of water bodies and prevention of encroachment on water bodies;
 3. Enactment of River Basin Management Act and formation of River Basin Organizations (RBOs) for management of inter-State river basins by 2019;
 4. Enactment of National Water Framework Act in accordance with the National Water Policy, 2012 by September, 2017."

"Water footprint

- 24.25. By 2018, the benchmarks for water footprint in the irrigation sector needs to be developed initially for the major crops i.e. wheat and rice and then for other crops for adoption at farm-level.
- 24.26. Pilot projects for improving water use efficiency and testing their viability and scalability should be launched during the Action Agenda period. Depending upon the success,

the projects can be expanded to state/region/all-India level."

1.7 Summary & Conclusion

The Paper above (under paras 1.2 to 1.6) attempts to study the state of economic and social backwardness of rural India as compared with urban India, prevalent right from the days of the colonial rule but also continuing after Independence up to the present time, i.e., the existing rural – urban 'divide', and the challenges involved in converting the 'divide' into an integrated rural – urban 'continuum' by means of necessary 'sustainable development' of rural India.

Para 1.2 starts with a brief description of rural and urban components of India according to the Census of India 2011. It shows that 68.8% of Indian population still lives in its over 6 lac villages. With the continuing growth of India's population along with the process of progressive urbanization, in many areas a new trend of 'Rurbanization' is becoming apparent, whereby rural and urban areas and populations tend to overlap, even merge, in many locations, especially in areas covered by fast expanding metropolitan complexes.

Relative backwardness of rural India, including its impoverishment and exploitation, was a widespread phenomenon under the colonial rule, which led to the revival of villages being pursued as a major issue under the freedom struggle. However, as explained under para 1.3, rural India has continued to be relatively backward, poorer and deprived of opportunities and amenities even after Independence. To illustrate the present state of rural India, references have been given from three relevant studies highlighting the

symptoms of its relative backwardness and impoverishment and how the hard labour put in by farmers remains grossly undervalued, as indicated by the rising number of farmers' suicides driven by their economic deficit and uncertainties.

Para 1.4 then briefly presents the essential policy and action inputs required to bring about 'sustainable development' of rural India. It starts with a review of the well-known principles underlying what constitutes 'sustainable development', and particularly the need for appropriate 'engineered' / 'directed' technological inputs (including the application of 'Gandhian Engineering' approach, as advocated by R.A. Mashelkar) and for dedicated planning and execution of projects and drives being undertaken for the revival and modernization of rural India, particularly the agriculture sector. Considering the growing evolution and importance of 'rurbanization' process in India, the concept of subaltern 'rurbanization' and sustainable development of such areas are also discussed.

The subject of how to meet the challenges for realizing a progressive rural - urban 'continuum' constitutes a primary basis for India finding its rightful place in the world as a developed nation, and for meeting these challenges many scholarly studies have been undertaken, suggesting the directions which the pursuit of rural development may follow. Three such studies, covering varied aspects of the subject, have been referred under para 1.5. The most comprehensive study is that by the former President of India, Dr. A.P. J. Abdul Kalam, namely, his well-known proposal for the 'PURA' ('provision of urban amenities in rural areas') approach

(published in 2011). It has been summarized under para 1.5.2, including the elements of the 'Four Connectivities' (Physical, Electronic, Knowledge, and Economic Connectivities) recommended by it, which must be activated for the development of the necessary rural - urban 'continuum'. Then are presented in brief the directions for the development and dissemination of technologies for rural areas as worked out by the 'Rural Technology Action Group' (RuTAG), as issued from the Office of the Principal Scientific Adviser to Govt. of India (2017). Finally, is presented Prof. Gangadhar Rao's concept of 'Smart Villages' via 'Gandhian Mode' as being proposed for rural Andhra Pradesh (2015).

It is necessary to make a deep study of Dr. Abdul Kalam's 'PURA' concept and also other varied ideas proposed in numerous studies by experts on the subject of how to eliminate rural backwardness and develop rural - urban India as an integrated 'continuum', and thus, to evolve an array of appropriate policies and action plans.

The government bodies in India too are becoming increasingly conscious of the relative backwardness of rural India and the rising scale of consequent adverse effects, such as, the problems of growing migration of working population from rural to urban areas and the rising growth of large slums areas in large cities.

Under para 1.6, the Paper attempts to highlight the current government proposals, plans and programmes for the necessary 'sustainable development' of rural India. The presentation starts with a list of 13 major Government-of-India sponsored rural development schemes currently in progress, beginning with the

most extensive on-going MGNREGS, which ensures employment to one member from each family in whole rural India for at least 100 days in a year at a basic daily wage rate, concomitantly also leading to generation of rural assets. Next is presented the recent (September 2017) Government of India's announcement of a scheme covering 'Seven-Point Strategy to Double Farmers' Income by 2022'. Being a recently initiated programme, its progress will have to be watched.

Finally, the Paper covers (para 1.6.3) the NITI Aayog's 'INDIA: Three Year Action Agenda (2017-18 to 2019-2020)', a comprehensive 3-year Plan including a detailed set of recommendations for India's socio-economic development. **The analysis and recommendations in the Plan, relating to the development of rural India, including the challenges involved in bringing about development of rural India in consonance with the evolution of rural - urban 'continuum', have been given in the form of relevant extracts selected from its 24 chapters. These constitute a set of most concrete directives for meeting the challenges of building up a progressive rural - urban 'continuum' in India.**

If India has to progress further and take its rightful position as a developed nation in the world, and get out of the present syndrome of being a 'poor' country with wide disparities, it must tread on the path of making special efforts to remove the relative backwardness of rural India through its necessary 'sustainable development' and to evolve India into a healthy and prosperous rural - urban 'continuum'.

ANNEXURE 1

Some Words / Terms Explained

- **Rural** : Connected with or like the countryside.
- **Urban** : Connected with a town or city.
- **Continuum** : A series of similar items in which each is almost the same as the ones next to it but the last is very different from the first.
- **Conundrum** : A confusing problem or question that is very difficult to solve.
- **Paradox** : A person, thing or situation that has two opposite features and therefore seems strange.
- **Countryside / Country area** : Land outside towns and cities, with fields, woods, farms, etc.
- **Town** : A place with many houses, shops / stores etc. where people live and work. It is larger than a village but smaller than a city.
- **City** :
 - A large and important town
 - A town that has been given special rights by State government.
- **Village** : A very small town in a country area.
- **Hamlet** : A very small village.
- **Rurbanisation** : May be described as a process of settlements acquiring urban characteristics while retaining their rural socio-economic base.
- **Subaltern Urbanisation** : Refers to the autonomous growth of settlement agglomerations – large clusters of people living in close proximity, which may or may not be classified as urban by the Census of India or the relevant State government.

- **Technology Forecasting** : Technology Forecasting attempts to predict the future characteristics of useful technological machines, procedures or techniques.
- **Technology Foresight** :
 - Technology foresight is a prediction methodology for determining the most likely technological developments in the mid-term future (About 10-30 years period).
 - **Definition** : “Systematic attempts to observe the long-term future of science, technology, the economy and society, with the aim to identify the emerging technologies that will probably produce the greatest economic and social benefits”.
 - For the purpose, it is important to bring together expertise in social affairs, business management, financial issues, and policy, together with expertise possessed by scientists and engineers.
 - It needs open minded people with “**T-Shaped Profiles**” i.e. people with indepth knowledge of their own domain as well as competence in a much broader spectrum of managerial, inter-personnel, and other skills.
- **Gandhian Engineering** : Industrial Enterprises strive for getting more (performance) from less (resource) for more (profit) but the Gandhian Engineering has a different message. It means getting more (performance) from less (resource) **for more (people), not just for more (profit)**. It is anchored on the solid foundation of affordability and sustainability (INAE – R. A. Mashelkar – April 2013).
- **Modular Matching** : Big Organisations and systems will have enhanced efficiency if “Modular Matching” is ensured at various Organisational levels and in various Systems / Activities. This assumes special significance in this **digital era**.
- **Some Paradoxes** :
 - **Centralisation vs Decentralisation** : Centralisation and Decentralisation are the opposite ends of an organisational continuum. In practice, there can be neither complete Centralisation nor complete Decentralisation, both being relative concepts. Further, any Decentralisation is possible only when a fair degree of Centralisation has been achieved. Managers have to ensure a dynamic balance between these two requirements for different issues, situations, problems, etc.
 - **Certainty vs Uncertainty** : Certainty provides order. Uncertainty provides growth. Both order and growth are needed for sustainable organisations.
- **Self Assertion vs Integration** : These two tendencies – the self assertive and the integrative – are essential aspects of all living systems. Neither of them is intrinsically good or bad. What is good, or healthy, is a dynamic balance; what is bad, or unhealthy, is imbalance – overemphasis on one tendency and neglect of the other. (Further details can be seen in Annexure 2).

ANNEXURE 2

Towns / Urban Agglomerations / Out Growths and Villages in India

(A) Towns

For the **Census of India 2011**, the definition of **urban area** was as follows:

1. All places with a municipality, corporation, cantonment board or notified town area committee, etc.
2. All other places which satisfied the following criteria:
 - i) A minimum population of 5,000;
 - ii) At least 75 per cent of the male main working population engaged in non-agricultural pursuits; and
 - iii) A density of population of at least 400 persons per sq. km.

The first category of urban units are known as **Statutory Towns**. These towns are notified under law by the concerned State/UT Government and have local bodies like municipal corporations, municipalities, municipal committees, etc., irrespective of their demographic characteristics.

The second category of Towns (as in item 2 above) are known as **Census Towns**. These were

(D) Number of Towns, UAs and OGs

No.	Type of Towns/ UAs/OGs	Number of Towns	
		2011 Census	2001 census
1.	Statutory Towns	4,041	3,799
2.	Census Towns	3,894	1,362
3.	Total Towns	7,935	5,161
4.	Urban Agglomerations	475	384
5.	Out Growths	981	962

At the Census 2011 there are 7,935 towns in the country. The number of towns has increased by 2,774 since last Census. Many of these towns are part of **UAs** and the rest are independent towns.

identified on the basis of Census 2001 data.

(B) Urban Agglomerations (UAs)

An **Urban Agglomeration** is a continuous urban spread constituting a town and its adjoining **Outgrowth** (OG), or two or more physically contiguous towns together with or without **Outgrowth** of such towns. An **Urban Agglomeration** must consist of at least a **Statutory Town** and its total population (i.e. all the constituents put together) should not be less than 20,000 as per the 2001 Census.

(C) Out Growths (OGs)

An **Out Growth (OG)** is a viable unit such as a village or a hamlet or an enumeration block made up of such village or hamlet and clearly identifiable in terms of its boundaries and location. Some of the examples are railway colony, university campus, port area, military camps, etc., which have come up near a **Statutory Town** outside its statutory limits but within the revenue limits of a village or villages contiguous to the town. While determining the **Outgrowth** of a town, it has been ensured that it possesses the urban features in terms of infrastructure and amenities such as pucca roads, electricity, taps, drainage system for disposal of waste water etc. educational institutions, post offices, medical facilities, banks etc. and physically contiguous with the core town of the **Urban Agglomeration**.

(E) Classification of Towns and the Population

Class of Town	Population	Total Population (Census 2011; In '000)
I	1,00,000 and above	2,27,899
II	50,000 – 99,999	41,328
III	20,000-49,999	58,174
IV	10,000-19,999	31,866
V	5,000-9,999	15,883
VI	Less than 5,000	1,956
	All Classes	3,77,106
	Urban Population as Percentage to Total Population	31.2

(F) Population of UAs/Towns

1. **The total urban population in the country as per Census 2011 is more than 377 million constituting 31.2% of the total population.**
2. **Class I UAs/Towns** : The UAs/Towns are grouped on the basis of their population in Census. The UAs/Towns which have at least 1,00,000 persons as population are categorised as **Class I UA/Towns**. **At the Census 2011, there are 468 such UAs/Towns**. The corresponding number in Census 2001 was 394. **264.9 million persons, constituting 70% of the total urban population, live in these Class I UAs/Towns**. The proportion has increased considerably over the last Census. In the remaining classes of towns the growth has been nominal.
3. **Million Plus UAs/Towns** : **Out of 468 UAs/Towns belonging to Class I category, 53 UAs/Towns each has a population of one million or above each. Known as Million Plus UAs/Cities, these are the major urban centres in the country.** 160.7 million persons (or 42.6% of the urban

population) live in these Million Plus UAs/Cities. 18 new UAs/Towns have been added to this list since the last Census.

4. **Mega Cities** : Among the Million Plus UAs/Cities, **there are three very large UAs in the country with more than 10 million persons, known as Mega Cities**. These are **Greater Mumbai UA** (18.4 million), **Delhi UA** (16.3 million) and **Kolkata UA** (14.1 million). The largest UA in the country is Greater Mumbai UA followed by Delhi UA. Kolkata UA which held the second rank in Census 2001 has been replaced by Delhi UA. The growth in population in the **Mega Cities** has slowed down considerably during the last decade. Greater Mumbai UA, which had witnessed 30.47% growth in population during 1991-2001 has recorded 12.05% during 2001-2011. Similarly Delhi UA (from 52.24% to 26.69% in 2001-2011) and Kolkata UA (from 19.60% to 6.87% in 2001-2011) have also slowed down considerably.

(G) Villages

India has a large number of Villages (more than six lac villages housing 68.8% of Total Population as

per 2011 Census) and these have been classified based on the number of inhabitants as given below :

- (i) 10,000 or more
- (ii) 5,000–9,999
- (iii) 2,000–4,999
- (iv) 1,000–1,999
- (v) 500–999

- (vi) 200–499
- (vii) Less than 200

- Ref.: (i) India 2017, A Reference Annual, Publication Division, Government of India.
- (ii) Census of India 2011. Website : www.censusindia.gov.in.

ANNEXURE 3

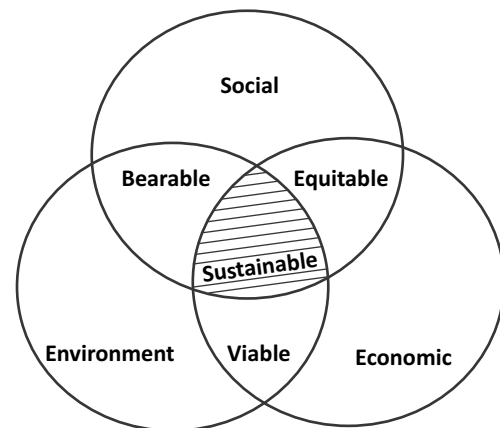
Sustainable Development

The Brundtland Commission (UN) in their Report (1987) defines **Sustainable Development** as “**development that meets the needs of the present, without compromising the ability of future generations to meet their own needs**”.

This broad definition however needs further elaboration as detailed below :

- A triple bottom line perspective, that considers **environmental, economic and social aspects**.
- A time dimension, which incorporates short term to long term, and considers impacts along the lifecycle, including impact on future generations.
- A resource context with respect to scarcity, over-abundance, or potential to disrupt resource availability in the future.

Sustainable development will be possible only when it is recognized that economic growth, social welfare and environmental issues are linked and have to be addressed together, rather than in a fragmented way as practiced currently. The figure below indicates the relationship among the three pillars of sustainability viz., **economic, environmental, and social aspects**.



Three Pillars of Sustainability

ANNEXURE 4

Five E's of Sustainable Development

If one is asked to choose parameters which can help an individual to perform all his actions/activities, on a sustainable basis, in the best possible manner, the following **Five E's** could be listed :

- i) **Efficiency**
- ii) **Effectiveness**
- iii) **Ethics** : Essential for sustainable performance.

- iv) **Environment** : Be in tune; Don't damage; Improve, if possible.
- v) **Evolution** : Create positive impact on the value structure.

Efficiency covers all activities, which make actions efficient and will, interalia, include efficient time management, good physical and mental health, possession of adequate knowledge and skills, will to do the job, positive attitude, doing things right the first time, low stress levels, etc.

Effectiveness will mean that the actions result in achieving useful goals for which it will be essential to have necessary vision, broad idea of goals to be achieved, systems to be followed to reach the goals, necessary co-ordination/co-operation with other individuals/organizations, conscious realization of one's capacity/capability levels etc.

Ethics is essential for sustainable development and performance. **It also helps in arriving at solutions, which are more equitable (concern for Equity).** It reduces stress levels, as ethical paths can be very clearly charted as against the paths which are followed for achieving the goals through unethical means.

Environment has to be seen in a broader context and may include physical environment, working environment, political environment, financial environment and the

like. Activities have to be performed keeping these in mind, lest they trigger reactions which may be difficult to control. Further, actions should not damage the Environment rather, improve it to the extent possible.

Actions must support the process of Evolution and Development in the positive direction for all those connected with the activities. Decline in human values can be detrimental to the society.

For better performance on a sustainable basis these parameters, i.e., the Five 'Es' are equally relevant to a Group of Individuals (Teams), Activities, Systems, Organizations and even the Nations. Efforts should be directed to continuously improve upon them.

Ref. : Agarwal, V. K. : “Globalised Interdependent World : Issues and Options” – RITES Journal, July 2009.

ANNEXURE 5

United Nations – Sustainable Development Goals (SDGs)

The **Sustainable Development Goals (SDGs)**, officially known as **Transforming our World: the 2030 Agenda for Sustainable Development**, are an intergovernmental set of seventeen aspiration Goals and are :

1. **No Poverty** - End poverty in all its forms everywhere.
2. **Zero Hunger** - End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. **Good Health and Well-being** - Ensure healthy lives and promote well-being for all at all ages.
4. **Quality Education** - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. **Gender Equality** - Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation** - Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy** - Ensure access to affordable, reliable, sustainable and clean energy for all.
8. **Decent Work and Economic Growth** - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. **Industry, Innovation and Infrastructure** - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10. **Reduced Inequalities** - Reduce inequality within and among countries.
11. **Sustainable Cities and Communities** - Make cities and human settlements inclusive, safe, resilient and sustainable.

- 12. Responsible Consumption and Production** - Ensure sustainable consumption and production patterns.
- 13. Climate Action** - Take urgent action to combat climate change and its impacts.
- 14. Life Below Water** - Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- 15. Life on Land** - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage

forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

- 16. Peace, Justice and Strong Institutions** - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
- 17. Partnerships for the Goals** - Strengthen the means of implementation and revitalize the global partnership for sustainable development.

ANNEXURE 6

Sustainable Development System for Providing Urban Amenities in Rural Areas (PURA)

A. Need for PURA

- In the world more than 3 billion people live in villages (**rural areas**), often in conditions of underutilization of talent and resources, and of deprivation. India has more than 6,00,000 villages which house about 70% of its population. There are large scale divides between the rural and urban areas which are manifested in the income levels and the quality of amenities. These are not only a loss of opportunity but are **also a matter of concern as regards sustained progress and peace. The empowerment of the rural regions is thus critically important from the perspective of inclusive development, sustained peace, and shared prosperity.**
- The world is changing much more dynamically than ever before in its history. This lightening-speed **leap in the pace of transformation has been**

enabled by four rapid forms of connectivity viz. Environment, People, Economy and Ideas.

Global warming and climate change are no longer the problems of individual nations, states or cities; they are world-wide problems that affect us all. Advances in modes of transportation have progressively made the movement of people across nations and regions more feasible. Global products are now a household brand across the world. Similarly, ideas and innovations are no longer geographically or politically confined. The seamless flow of information and people also means that local or regional issues will invariably get global prominence, **and unaddressed problems and unmitigated poverty can mutate rapidly into global terrorism which were are already witnessing.**

- There is large scale rural to urban migration. This migrations is due to inequality in opportunity and outcome between the rural and urban areas. The underemployed or unemployed population may move to the cities for better living conditions and higher

income levels. Setbacks – such as financial or medical – can force migration. It can also be due to the desire for better amenities and higher education.

It may also be mentioned that the asymmetry which has been created due to rural to urban migration has also taken its toll on cities around the world, **as about 37 per cent of their inhabitants live in slum areas. Many of these slum dwellers are the migrants from the rural areas.**

Per se, limited migration for better income and living standard is not bad. **However, a better alternative would be the creation of facility and income assets in rural areas. Then every village would have the productivity and the opportunity of an urban setting with the rural ambience and environment preserved.**

PURA stands for “Providing Urban Amenities in Rural Areas”. It is a socio-economic system for sustainable growth. The model of PURA begins at the individual village household level, which is the atomic level of PURA implementation. The next in the PURA hierarchy is the Village and the next higher grouping is the PURA Village Cluster. **India with more than 6,00,000 villages could be grouped into about 7,000 Village Clusters.**

B. Constituents of Sustainable Development

Broadly speaking, 'Sustainability' can be defined with the following constituents :

- Economic Sustainability
- Technological Sustainability
- Social Sustainability
- Environmental Sustainability
- Value Sustainability
- Learning and Adaptability

C. Theme of PURA

The theme of PURA – apart from concentrating on reinforcing agriculture – is to emphasize agro-processing, develop local crafts, diary farming, fishing and silk production, so that the non-farm revenue for agriculture sector is enhanced, based on core competency of the region. Moreover, its economy will be driven by sources of renewable energy, such as sun, wind, biofuels and the conversion of municipal waste into power. In this approach, the objective is sustainable development using the core potential of rural sectors.

D. Mission of a Typical PURA for a Village Cluster

- **Physical Connectivity**
 - Ring Road
 - Rail Connectivity
 - Public Infrastructure
 - Enables movement of People and Goods
 - Improves access to Schools and Health Care Centres
 - Reduces Investments in distribution of Power, Water and Communication Networks
- **Electronic Connectivity**
Establishing Electronic Connectivity through Broadband / Fibre / Satellite / Wireless / Leased Line.
 - Tele-Education*
 - Satellite Link
 - Wireless Connectivity
 - Fibre Connectivity
 - Public Call Offices (STD / ISD / ISDN)
 - Leased Line Connectivity
 - Tele-Medicine*
 - Village Internet Kiosks
 - e-Government Access
 - e-Market Access

- Tele-Training on Farming
- e-Banking
- ATM Centres for Villagers
- **Knowledge Connectivity**
 - Schools/Hospitals
 - Vocational Training
 - Knowledge Training
 - IRS Imagery for :
 - Land and Crop Management
 - Water Management
 - Forest Management
 - Environment
 - Proactive Health Care
 - Cooperatives Product Marketing
- **Economic Connectivity**
 - Small-Scale Industries
- Agro-Industries
- Warehouse
- Micro Power Plants
- Renewable Energies
- Village Markets
- Employment Opportunities
- Value System – Economic strength
- Women's Empowerment
- Urban Decongestion
- Improved Quality of Life
- Increased Purchasing Power

[Based on Source Ref.: Abdul Kalam, A. P. J. & Srijan Pal Singh : “Target 3 Billion – Innovative Solutions towards Sustainable Development”, New Delhi: Penguin Books, 2011]

ANNEXURE 7

Some Government Initiatives / Schemes for Rural Development

- **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) / Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)**

MGNREGA is a rights based wage employment programme and aims at enhancing livelihood security by providing upto one hundred days of guaranteed wage employment in a financial year to every rural household where adult members volunteer to do unskilled manual work.

During 2015-16, 3.63 crore households were provided employment and 134.96 crore person-days of employment generated increasing the outreach to the poor and the marginalised.

- **National Rural Livelihoods Mission (NRLM)**

The NRLM aims at mobilising all rural poor households into Self Help Groups (SHGs) in a phased manner. The Mission provides SHGs, long term support to attain appreciable increase in incomes over a period of time, to improve their quality of life and come out of abject poverty.

During 2015-16, a new Scheme named Start-up Village Entrepreneurship Programme (SVEP) was included in NRLM. The SVEP is to provide the supported enterprises with business skills, exposure, loan for starting, and business support during the first critical six months of the enterprises, by using the NRLM SHGs and their federations.

- **Rural Self Employment Training Institute (RSETI)**

The Government has decided to set up one RSETI in each district of the country. RSETIs are bank lead initiatives with the active support of state government. The Government of India provides one time infrastructure support of Rs. one crore

besides reimbursing the cost of training rural poor candidates. The state government provides land free of cost or at nominal charges, and the banks are responsible for day to day functioning of RSETI. The core strength of the RESTI lies in the short term training and long term handholding of the rural entrepreneurs for setting up micro enterprises.

· **Pradhan Mantri Gram Sadak Yojna (PMGSY)**

In a bid to give better rural connectivity PMGSY was launched in Dec, 2000. It is a centrally sponsored Scheme to assist the states, though 'rural roads' are in the 'state list' as per the Constitution. The primary objective of PMGSY is to provide connectivity by way of an all-weather road to the unconnected habitations with a population of 500 persons (as per 2001 Census) and above in plain areas and to habitations of 250 persons (Census 2001) and above in 'Special Category' areas.

· **Indira Awas Yojna (IAY) / From 2016-17 Pradhan Mantri Awas Yojna – Gramin (PMAY-G)**

Housing is universally recognised as a basic human need. Reducing rural housing shortage and improving the quality of housing especially for the poor is an important component of the poverty alleviation strategy of the Government. The rural housing scheme IAY implemented by the Ministry of Rural Development aimed at providing the houses to families below the poverty line (BPL) in rural areas. It has since inception provided assistance for construction of 3.6 crore houses incurring a total expenditure of Rs. 1,06,789 crore by March 2016.

In the context of Government's priority for “Housing for All” by 2022, the rural

housing scheme IAY has been restructured to Pradhan Mantri Awas Yojna – Gramin (PMAY-G) with effect from 2016-17. The PMAY-G envisages providing assistance to one crore houses in rural areas over the next three years (2016-17 to 2018-19). The unit assistance has been enhanced from Rs. 70,000 to Rs. 1.20 lakh in plain and from Rs. 75,000 to Rs. 1.30 lakh in hilly / difficult areas, besides several other initiatives.

· **National Social Assistance Programme (NSAP)**

NSAP is a social assistance programme for poor BPL households for the aged, widows, disabled and also includes provision for one time assistance in the case of death of the primary bread winner in a BPL family. The NSAP comprises of:

- Indira Gandhi Old Age Pension Scheme
- Indira Gandhi National Widow Pension Scheme
- Indira Gandhi National Disability Pension Scheme
- National Family Benefit Scheme
- Annapurna

· **Deen Dayal Upadhyaya – Grameen Kaushal Yojna (DDU – GKY)**

Announced in 2014, the DDU-GKY is a critical component of the National Skill Development Policy. Its aims are (i) to ensure that rural youths are skilled in market relevant trades and job-relevant competences; (ii) to ensure regular and sustainable employment to its beneficiaries and consistent career progression through up skilling and (iii) to ensure independent assessment and globally acceptable certification to its beneficiaries. Till December 2015, about 2 lakh candidates were trained and about 70 thousand placements made.

· **Saansad Adarsh Gram Yojna (SAGY)**

Salient features of SAGY are :

- **Three Adarsh Grams as chosen by Members of Parliament (MPs)** will be developed by March 2019, of which one will be achieved by March 2016.
- Thereafter, five such Adarsh Grams (one per year) will be selected and developed by 2024.
- Members of Parliament (MPs) will guide and lead the initiatives to ensure focus on community participation and holistic development of the village. It is not an infrastructure centred scheme.

· **National Rurban Mission (NRuM)**

About the Mission : As per Census of India (2011) statistics, the rural population in India, stands at 833 million, constituting about 68% of the total population. Further, the rural population has shown a growth of 12% during the 2001-2011 period and there has been an increase in the absolute number of villages by 2279 units, during the same period.

Large parts of rural areas in the country **are not stand-alone settlements but part of a cluster of settlements, which are relatively proximate to each other**. These clusters typically illustrate potential for growth, have economic drivers and derive locational and competitive advantages. Hence, making a case for concerted policy directives for such clusters. **These clusters once developed can then be classified as 'Rurban'**. Hence taking cognizance of this, the Government of India, has proposed the Shyama Prasad Mukherji Rurban Mission (SPMRM), aimed at developing such rural areas by provisioning of economic, social and physical infrastructure facilities.

Taking also into view, the advantages of clusters, both from an economic view point as well as to optimize benefits of infrastructure provision, **the Mission aims at development of 300 Rurban**

clusters, in the next five years. These clusters would be strengthened with the required amenities, for which it is proposed that resources be mobilized through convergence of various schemes of the Government, over and above which a **Critical Gap Funding (CGF)** would be provided under this Mission, for focused development of these clusters.

Mission's Vision : The National Rurban Mission (NRuM) follows the vision of development of a cluster of villages that preserve and nurture the essence of rural community life with focus on equity and inclusiveness without compromising with the facilities perceived to be essentially urban in nature, thus creating a cluster of "Rurban Villages".

Mission's Objective : The objective of the National Rurban Mission (NRuM) is to stimulate local economic development, enhance basic services, and create well planned Rurban clusters.

Mission's Outcomes : The larger outcomes envisaged under this Mission are: (i.) Bridging the rural-urban divide viz: economic, technological and those related to facilities and services. (ii.) Stimulating local economic development with emphasis on reduction of poverty and unemployment in rural areas. (iii.) Spreading development in the region. (iv.) Attracting investment in rural areas.

· **Some other Schemes / Programmes**

- National Land Reforms Modernisation Programme
- Rajiv Gandhi Panchayat Sashaktikaran Abhiyan
- National Rural Drinking Water Programme
- **Swach Bharat Abhiyaan (SBA)**

[Ref.: India 2017 – A Reference Annual, Publication Division, Government of India]

ANNEXURE 8

**Press Information Bureau
Government of India, Ministry of
Agriculture (18 September, 2017)
Agriculture Ministry is working
sincerely and honestly to fulfil our
Prime Minister's dream to Double
Farmers Income by 2022:
Shri Radha Mohan Singh
Building a new India: Pledge to
Double Farmers Income by 2022
Seven-point Strategy**

[<http://pib.nic.in/newsite/PrintRelease.aspx?relid=170628>]

To improve the economic condition of the farmers, Prime Minister Shri Narendra Modi has set a target. The goal is to double the income of farmers by 2022. For the first time, a Prime Minister has put such a target in front of the nation for the welfare of farmers. Under the leadership of the Prime Minister, the Agriculture Ministry is working to achieve the target by 2022. The Ministry is working sincerely and honestly to fulfill our Prime Minister's dream. To double the farmer income, a large number of officials and farmers have been taking a pledge at events organized by the KVK since August 16, 2017.

Seven-point Strategy

1. Increase in production

It is important to improve irrigation efficiency to increase production. Therefore, our government has increased the irrigation budget. 'Per Drop More Crop' is our motto. Pradhan Mantri Krishi Sinchai Yojana has been launched to mitigate the drought effect and to ensure 'water to every farm'. Hence, pending medium and large projects have also been expedited. Watershed development and water harvesting & management projects have been put on the fast track.

2. Effective use of input cost

For the first time, our government has introduced Soil Health Card Scheme to inform farmers about nutrients status of the soils. This is reducing the

cultivation cost as farmers are following the recommendations and going for balanced use of fertilisers. In addition, the Government has curbed illegal use of urea and ensured adequate supply through Neem Coated Urea scheme. The government is also encouraging organic farming. The adoption of new technologies in agriculture such as space technology is helping in better planning through forecasting of crop production, agricultural land-use mapping, drought prediction, and utilisation of fallow paddy fields for Rabi crops. Apart from this, farmers are getting timely information and advisory services through online and telecom mediums such as Kisan Call Centre and Kisan Suvidha App.

3. Reduction of post-harvest losses

One of the biggest problems of the farmers is storage after harvesting as a result they are forced to sell their products at a lower cost. Therefore, the government is encouraging farmers to use warehouses and avoid distressed sales. Loans against negotiable warehouse receipts are being provided with interest subvention benefits. To protect farmers from losses, the government is focusing on storage facilities and integrated cold chains in rural areas.

4. Value Addition

The government is also promoting quality through food processing. Pradhan Mantri Kisan Sampada Yojana has been started and Rs.6, 000 crore has been allocated for this project. Under this scheme, food-processing capabilities will be developed by working on the forward and backward linkage of agro processing cluster, which will benefit 20 lakh farmers and create employment opportunities for about 5, 00,000.

5. Reforms in Agriculture Marketing

The Central Government is emphasizing on the need of reforms in agriculture marketing. e-NAM was launched with three reforms and so far, 455 mandis have been linked to this platform. Online trading has begun on various mandis. In addition, the government has circulated model Agricultural

Produce Market Committee (APMC) Act, which includes private market yards and direct marketing. In addition, the Government is also working on a Model Act to promote contract farming.

6. Risk, Security and Assistance

The Government has initiated Pradhan Mantri Fasal Bima Yojana (PMFBY) to reduce the possible risks. The scheme creates a security shield. The lowest rate has been fixed for Kharif and Rabi crops. Maximum rate is 2% and 1.5% respectively. The scheme covers standing crops as well as pre-sowing to post-harvesting losses. Not only that, 25% of the claim is settled immediately online. New technologies like Smartphones, satellite imagery and drones facilities are being utilised to carry out faster assessments of crop loss under PMFBY. From this Kharif season, the farmers can also avail customer service centre and online banking facilities to deposit their premium. The Government has revised the norms for assistance from SDRF and NDRF. Now, the government is providing compensation if at least 33% of the crop is damaged. Compensation amount has been increased to 1.5 times.

7. Allied Activities

I. Horticulture: The Mission for Integrated Development of Horticulture (MIDH) scheme is playing an important role in doubling the income of farmers. For this, we are providing better planting materials, improved seed and protected cultivation, 9/25/2017 Agriculture Ministry is working sincerely and honestly to fulfil our Prime Minister's dream to Double Farmers Income by 2022: Shri Radha M... <http://pib.nic.in/newsite/PrintRelease.aspx?relid=170628> 2/2 high-density plantation, rejuvenation, and precision farming.

II. Integrated Farming: Our government is also using Integrated Farming System (IFS). In addition to agriculture, the focus is also on horticulture, livestock, and bee keeping. This scheme will not only increase farmers'

income, it will also mitigate the effect of drought, flood, and other natural disasters.

III. White Revolution: Indigenous breeds of cows are being conserved under Rashtriya Gokul Mission. The genetic makeup is improving and increasing the production of milk. The government is set to establish Dairy Processing and Infrastructure Development Fund. In addition, Dairy Entrepreneurship Development Scheme is generating self-employment opportunities. White Revolution has been expedited to increase the income of the farmers.

IV. Blue Revolution: Blue Revolution: Integrated Development and Management of Fisheries is a new initiative and it includes activities such as inland fisheries, Aquaculture, Mariculture undertaken by National Fisheries Development Board (NFDB). Apart from this Deep Sea Fishing scheme has also been initiated.

V. Sub-Mission on Agroforestry: For the first time Sub-Mission on Agroforestry has been initiated with an aim to promote inter-cropping. Under this scheme, "Med Per Ped" campaign has also been included.

VI. Beekeeping: A large number of farmers/beekeepers are being trained for bee keeping. The bee keepers and honey societies/companies/firms are being registered. Integrated Bee Keeping Development Centres (IBDC) are being established in the states.

VII. Rural Backyard Poultry Development: Under this scheme, supplementary income and nutritional support are provided to poultry farmers. Awareness program sensitizing sheep, goat, pig and duck farmers about opportunities to enhance income through Rural Backyard Poultry Development mission is being carried out.

References / Selected Readings

1. Abdul Kalam, A. P. J. & Srijan Pal Singh : "Target 3 Billion – Innovative Solutions towards Sustainable Development", Penguin Books, 2011.
2. Agarwal, V. K. : 'Globalised Interdependent World : Issues and Options' – RITES Journal, July 2009.
3. 'Building a new India: Pledge to Double Farmers Income by 2022 Seven-point Strategy', issued by a Press release by Govt. of India, 18.09.2017, [<http://pib.nic.in/newsite/PrintRelease.aspx?relid=170628>].
4. Census of India, 2011. Website : www.censusindia.gov.in.
5. 'Concept of RuTAG (Rural Technology Action Group)', issued by Co-ordinator, Central RuTAG, Office of the Principle Scientific Adviser to Govt. of India, New Delhi, (04.05.2017).
6. EAST ASIA FORUM, 27 August, 2017 Issue, by Simi Mehta, Arjun Kumar.
7. Gandhi, M. K. : "*Collected Works of Mahatma Gandhi*", New Delhi: Publications Division, 1958 - 94, (100 volumes, referred as vol. no.:p. no.).
8. Gauri Singh : 'Smart Villages – Rural Growth Poles for the Next Decade', RITES Journal, January 2015.
9. Govindu, V. M., & Malghan, D. : "The Web of Freedom--J. C. Kumarappa and Gandhi's Struggle for Economic Justice", OUP Canada, 2016.
10. INAE : Annuals of the INAE – Volume X – April 2013 : Lifetime Contribution Award Lecture titled "Gandhian Engineering : More from Less for More" by R. A. Mashelkar).
11. *INDIA TODAY*, 28 June, 2017, Issue, "Revealed: What Is Killing India's Farmers?". by Nitish Jain, Dev Ankur Wadhwan.
12. *India 2017 – A Reference Annual*, Publication Division, Government of India.
13. IIC - Indian International Centre Quarterly Journal – Winter 2016 + Spring Issue – "**The Contemporary Urban Conundrum**": *Editorial and Foreword* -- p. ix-xii.
 - (i) Sujata Patel – Introduction : Revisiting Urban India, p.1-14.
 - (ii) Amitabh Kundu – Rurbanisation : An Alternate Development Paradigm, p.17-27.
 - (iii) Partha Mukhopadhyay, *Marie-Helene Zerah & Eric Denis* – Subaltern Urbanisation Revisited, p. 28-40.
14. Lindley, Mark : "J. C. Kumarappa---Mahatma Gandhi's Economist", Mumbai: PopularPrakashan, 2007.
15. Nehru, J. L. : "A Bunch of Old Letters", London, 1958.
16. NITI Aayog : '**INDIA: Three Years Action Agenda (2017-18 to 2019-20)**', (issued by NITI Aayog in August 2017, 211 pages); accessed from NITI Aayog's website (http://niti.gov.in/writereaddata/files/coop/India_ActionAgenda.pdfniti.gov.in).
17. Rao, Prof. Gangadhar : ' 'Smart Village' Trajectory of Andhra Pradesh via Gandhian Mode', Draft Paper (2015).
18. Schumacher, E. F. : "Small Is Beautiful---A Study of Economics as if People Mattered", New Delhi : Radha Krishna, (Indian edn., 1977); (original edn., 1973).
19. *The Week*, Delhi, 25.07.2017 Issue, p.90-94; *The Pioneer*, Delhi, dated 21.11.2017.

Chapter 2

High Speed Rail for Sustainable Development in India

2.1 Introduction

2.1.1 The ground-breaking ceremony at Ahmedabad to launch the Mumbai Ahmedabad High Speed Rail [HSR] project in India in September, 2017 by the Prime Ministers of Japan and India is likely to be a major step forward in the modernization of the Railways in India. India thus far has been taking incremental steps in bringing in new technology and building capacity in order to cater to the needs of its growing economy. The emphasis for many decades was on adopting 'appropriate technology' suitable at the time for bringing about a significant improvement in operational efficiency, throughput and safety. Examples of these were the relatively smooth transition from steam to diesel to electric traction, from conventional four-wheeler wagons to bogie BOX and later high capacity BOXN wagons with roller bearings and central buffer couplers, in signalling the transition from semaphore arm to colour light and Automatic signalling and the progressive introduction of track circuits. In Track technology, there have been similar improvements such as the shift from wooden, to steel to Concrete sleepers, from 90 lb to 60 Kg rails, the introduction of high speed turnouts etc. There have been similar improvements in Passenger Rolling Stock as the Railways changed over from the older ICF Coach design to the newer German

LHB coach design which had better safety features and higher capacity. This strategy of slow and steady induction of new technology had its benefits of standardisation and introduction of relatively simpler maintenance practices. The policies adopted have helped India become the fourth largest freight carrying rail system in the world and the largest passenger carrying system in terms of passenger kilometres. However, the strategies adopted were not 'transformational', which is the current buzzword and is perhaps the need of the hour. India was not able to introduce Heavy Haul (with axle loads over 25 tonnes) or High-Speed Passenger Rail services. The comparison is often made with China where Railway development has been truly 'transformational' in terms of network expansion, growth in freight traffic or the very rapid introduction of High Speed Lines.

2.1.2 The question being raised today is, does India really need High Speed Rail, particularly, as the present system is plagued with a number of problems such as severe capacity constraints restricting economic growth, poor quality of service and reliability, especially, a very poor record of punctuality of passenger trains, rising costs, a declining market share in passenger and freight traffic and a deep concern regarding safety in the light of recent accidents resulting in heavy loss of life. The answer to this

question is clearly that as a nation we need to both augment capacity of our existing rail system, rectify its deficiencies, modernize it and improve both productivity and safety as well introduce the so called 'transformational' rail technologies such as High-Speed Rail in Passenger transportation and Heavy Haul in Freight Transportation; the latter is being sought to be done through the Dedicated Freight Corridors.

2.2 Definition of High Speed

2.2.1 What is implied by High Speed? The International Union of Railways (UIC) has defined high speed as an operational speed of 250 km per hour or higher where a new High-Speed Line is built and a speed of 200 km per hour or more where an existing line is upgraded for High Speed services. There is also a definition of High Speed Rail attributed to Demridis & Pyrgidis (2012) which takes into account two characteristics viz. 'Maximum' Speed and 'Average' Speed. It also defines both 'High Speed' and 'Very High Speed' and takes into account both Maximum Achievable High Speed and the Average Running Speed across the corridor. This definition lays down two conditions:

2.2.1.1 Maximum achievable running speed in excess of 200 km/h (124 mph) is defined

as High Speed, and 250 km/h (155 mph) as Very High Speed.

2.2.1.2 An Average running speed across the corridor in excess of 150 km/h (93mph) for High speed, and 200 Km/h (124 mph) for Very High Speed.

2.2.2 However, as most Railway Administrations are members of the UIC, which is an internationally recognized body for Railways, it is better to adhere to their definition which is simple and easy to comprehend. The Demridis & Pyrgidis definition which takes into account Average Speed has merit, though, by defining 'High Speed' and 'Very High Speed' as separate categories, it only causes confusion. It is better to consider one category of High Speed trains.

2.2.3 For an appreciation of Maximum (Top) Speeds of Trains and Average Speeds in U.K., France, Japan, USA and as planned in India, the Table 1 gives the indicative Average and Maximum Speeds of a few High-Speed trains. It will be noted that the train in USA between Washington-New York- Boston does not meet the Average running speed criteria for High Speed Trains, whereas all other trains shown meet both the Maximum or Top Speed and Average Speed criteria for Very High Speed.

Table 1 : Maximum Speed and Average Speed for High Speed Rail in Japan, France and China (*No. of stops in brackets)

SECTION*	TRAIN	DISTANCE MILES	DISTANCE KM.	TIME MIN.	AV. SPEED MPH	AV. SPEED KmPH	TOP SPEED MPH	TOP SPEED KmPH
LONDON – PARIS (0)	EUROSTAR	306	490	135	136	218	186	298
PARIS – LYON (2)	TGV	264	422	113	140	224	186	298
WUHAN – GUANGZHOU (13)	CRH2/CRH3	573	917	175	196	314	217	347
BEIJING – TIANJIN (0)	CRH2/CRH3	73	117	30	146	234	205	328
HAKATA – OSAKA (5)	SHINKANSEN	344	551	141	146	234	186	298
OSAKA – TOKYO (4)	SHINKANSEN	320	512	145	132	212	168	269
WASHINGTON-NEW YORK (4)	ACELA	230	368	167	83	132	135	216
NEW YORK – BOSTON (5)	ACELA	225	360	215	63	100	150	240
MUMBAI – AHMEDABAD (4)	***	318	508	133	143	229	200	320

Source: 3G Mobility Presentation on Global HSR: High Speed Rail - Comparison of speeds in the U.S., Europe, Japan and China) Feb 2010

2.2.4 The actual maximum speed currently achieved by High Speed Rail lines is 350 kmph although speeds on trial runs have been in excess of 480 kmph. In India, Indian Railways has a two-pronged approach to speed; whereas they are planning a new corridor for High Speed Rail at over 300 kmph, they are also planning to introduce Semi-High-Speed Trains on existing corridors with speeds in the range of 160 to 200 kmph. Work is currently in progress for identifying steps to upgrade speeds on selected routes such as providing European Train Control System Level 2 signalling safeguards, upgrading turnouts etc., particularly, as some existing rolling stock is already fit for 160 km per hour. New Regional Lines such on the National Capital Region Transport Corporation's lines between Meerut and Delhi, Panipat and Delhi and Alwar and Delhi are being designed for speeds of 180 kmph.

2.2.5 India is, therefore, in the years ahead is expected to operate High Speeds Trains on newly constructed High Speed

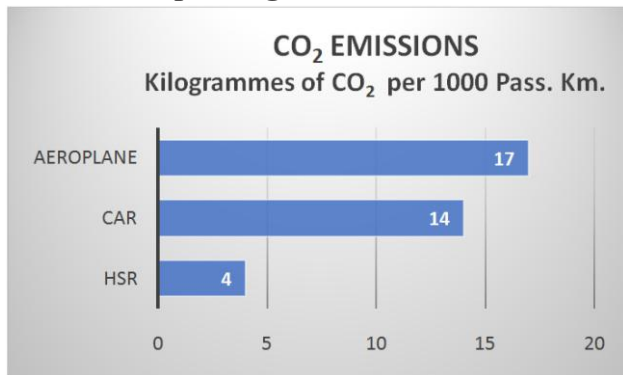
Corridors with speeds in excess of 300 kmph and on selected existing Broad Gauge Lines at speeds of upto 200 kmph.

2.3 Justification & Benefits of High Speed

2.3.1 The main justification for High Speed Railways is firstly, time savings which has been able to transform mobility by enabling a significant improvement in journey times and frequency of journeys between major cities. The High-Speed Railways have brought about this change in Japan, China, Korea and Taiwan in Asia as also in France, Germany, Spain, Italy and other countries of Europe. Europe also has Trans Europe Transport Network (TEN-T) project for developing 14 new High-Speed links in order to meet this objective. Secondly, HSR has been able to ensure reliability, safety, comfort and in increasing productive time to the individual. In case of safety it is worth noting that Japan has not had a HSR fatality in over fifty years since its inception in 1964. Thirdly, from an

environmental & sustainability perspective there is strong case for promoting shift from other modes to rail. Rail is acknowledged as the most efficient mode with regards fuel efficiency and its carbon emissions leave a very small carbon footprint. Whereas emissions per 1000 passenger kilometre are 4 kg of CO₂ in case of rail, it is 14 kg of CO₂ in case of the automobile and is 17 kg of CO₂ in case of airlines (in Europe – see Chart 1).

Chart 1 : CO₂ Emissions of different modes of transport in Kilogrammes per 1000 passenger kilometres



Source : High Speed Rail – Fast Track to Sustainable Development – UIC Publication.

2.3.2 A closer study of the subject in different countries viz. Japan, France and Spain also reveal that that CO₂ emissions of HSR are much lower than the other modes including conventional Rail. A brief summary is given below:

2.3.2.1 **JAPAN:** On JR East for the E5 Shinkansen Trainsets the Electricity consumed was 2.45 kWh per Coach Km in the year 2016 in case of a 10 car Trainset. The CO₂ Coefficient was 0.530 Kg per kWh according to figures published by Electric Power Companies of Japan. Assuming 73 persons per coach the Greenhouse Gases produced per passenger kilometre is given below.

$$2.45 \times 0.530 = 1.298 \text{ Kg per Coach Km}$$

$$1.298 / 73 = 0.0178 \text{ Kg per Pass Km or } 18 \text{ gm per Passenger Km.}$$

The Comparative greenhouse gases generated by other modes per passenger kilometre are Passenger Car 147gm, Aviation 103 gm, Bus 56 gm and Railways 22 gm as shown in the *Transport and Environment 2016 on the MLIT Website*. The target set for Shinkansen Trains is to reduce Energy Consumption for Shinkansen Trains by 5.1% between 2014 and 2021 and 8.3% for conventional trains during the same period.

2.3.2.2 **FRANCE:** The SNCF publishes CO₂ Emission Figures for various kinds of services on its website. These figures published in 2017 are given in the Table 2 below:

Table 2 : Comparison of CO₂ Emissions on various categories of Railway Lines in France

	Train Type	Emission
1	Inter City Services	8.6 g of CO ₂ per Pass.Km
2	TGV, Lyria, OUIGO (High Speed Rail Services)	3 g of CO ₂ per Pass.Km.
3	Transilien (Paris Regional) / RER (Paris Suburban Services)	5.2 g of CO ₂ per Pass.Km.
4	TER (Regional Services)	10.3 g of CO ₂ per Pass.Km.

It is interesting to note that for journeys within France the CO₂ Emission coefficient used is 48 g per kWh, whereas for journeys in Europe outside France the coefficient used is 420 g per kWh. The low emission levels in France is probably due to the very high percentage of Nuclear Power in the primary energy generation. The comparative figures for CO₂ emissions for other modes are motor Cars 166 g per passenger kilometre for the Paris region, intercity bus 141 g per pass. Km. and for domestic airlines 168 g per pass. Km.

2.3.2.3 **SPAIN:** Spain has a very large network of High Speed Rail Lines. It is, in fact the

largest High-Speed Network in Europe. In a paper 'Energy Consumption and Emissions for High Speed Trains' by Alberto Garcia Alvarez, the author has analysed the Energy Consumption of High Speed Trains on various routes in Spain and compared energy consumption and CO₂ Emissions with various other modes. A total of 10 High Speed Train Routes have been studied which include Madrid – Barcelona, Madrid – Seville, Madrid -Malaga, Madrid – Alicante, Madrid – Valencia among others. The Average Energy Consumption per Pass. Km. and Average CO₂ emissions per Pass. Km. for all the routes are given in the Table 3:

Table 3 : Average Energy Consumption and Average Emissions for HST routes in Spain and Comparison with other modes

	CAR	COACH	PLANE	CONV. TRAIN	HST
Av. Energy Consumption kWh per Pass. Km.	0.48	0.12	0.54	0.26	0.19
Primary Energy (Times that of HST)	2.53	0.63	2.84	1.37	1
Av. Emissions gm. of Co₂ per Pass. Km.	113	32.3	169.1	37.9	26.7
Av. Emissions (Times that of HST)	4.23	1.21	6.33	1.42	1

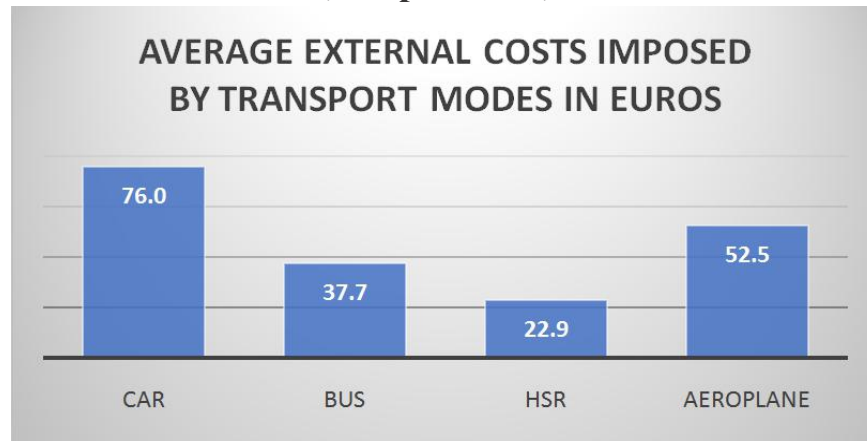
Source : 'Energy Consumption and Emissions for High Speed Trains' by Alberto Garcia Alvarez.

There are many technical reasons for lower energy consumption in High Speed Trains as compared with conventional trains. These relate to certain intrinsic features of the High-Speed Train System such as a more homogenous speed profile, fewer stops, fewer curves, higher power supply voltages and reduced requirement of auxiliary services.

2.3.3 HSR also imposes the least External Costs on Society such as noise and air pollution, visual intrusion, accidents and

impact on climate change which the UIC has also tried to quantify (Chart 2). In addition, in terms of Energy consumption it gives the maximum output in terms of Passenger kilometres per Kilowatt hour of energy consumed. **Therefore, HSR is part of the solution for fighting 'Climate Change'. Similarly, amongst surface modes Rail is the most efficient in land use. The case for High Speed Rail for improving sustainable mobility is, therefore, a strong one.**

Chart 2 : Average External Costs of various modes of Transport in Euros per 1000 passenger Kilometres. External Costs include climate change, noise, nature & visual intrusion, air pollution, accidents



Source : High Speed Rail: Fast Track to Sustainable Development - UIC Publication.

2.4 Case for High Speed Rail in India

2.4.1 In India for almost sixty years after Independence, Railways were the prime mode of travel in all intercity and long-distance passenger travel segments. However, in recent years it has lost ground to both airlines as well as road. With the rapid improvements in the Highway sector and growth in private budget airlines, the Railways has been unable to compete in the top market segment. This is partly on account of quality of service factors such as reliability & punctuality and quality of service of onboard services and at terminals, and partly on account of journey time considerations as there has been no improvement in speeds over

nearly half a century. Despite several attempts at improving services like the India's premier passenger trains such as the long distance Rajdhani Expresses, Inter-city Shatabdi trains and other more recent branded services, the charm of rail travel has gradually worn off. The IR market share of passenger travel has also progressively declined and in recent years actual number of passengers travelling on the system have plateaued which is cause for anxiety (Chart 3). This is possibly the strongest indicator that the Railways need to change and induct new technology to improve quality, reliability and safety in their passenger services. One element of this need for change, is High Speed Railway.

Chart 3 : Growth in Passenger traffic on Indian Railways 1950-51 to 2015-16 in originating numbers in Millions.

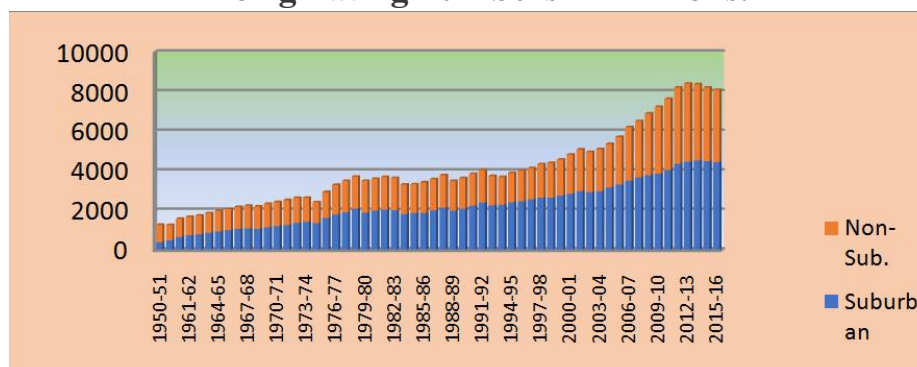
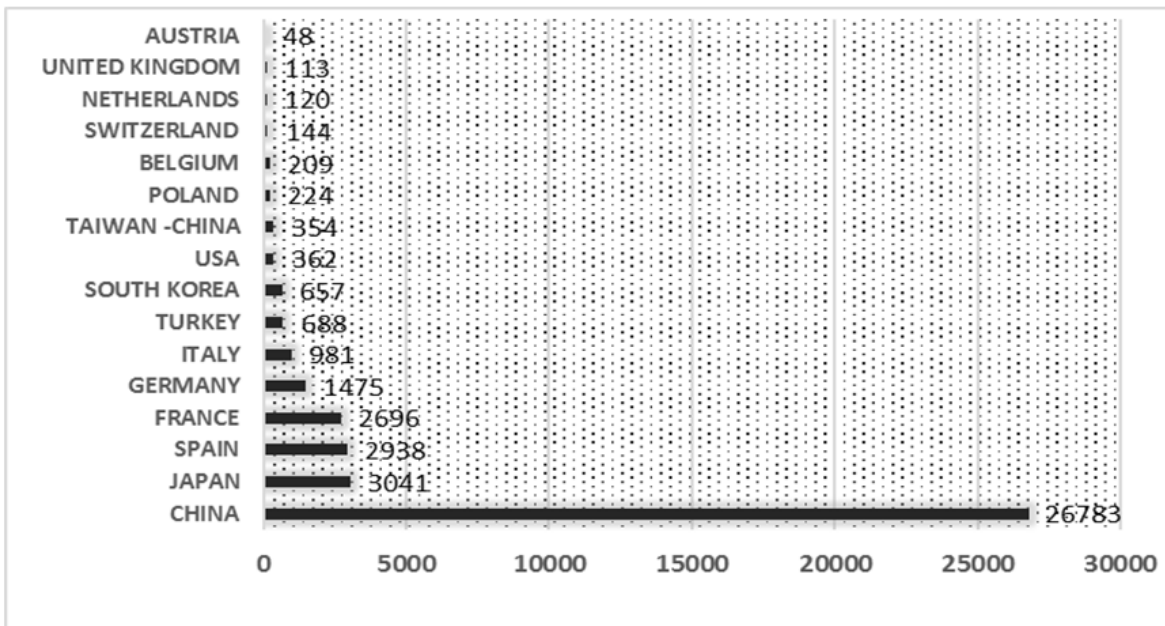


Chart 4 : High Speed Rail Lines in Kilometres in various countries as on 1st September 2017 (Source UIC Data)



2.5 Sustainable Development Goals & HSR in India

2.5.1 In September, 2015 the United Nations unanimously adopted the declaration on 2030 Agenda for Sustainable Development which comprise of 17 Sustainable Development Goals (SDGs) These goals focus on the five Ps viz. People, Planet, Prosperity, Peace and Partnership. India, amongst other countries is a signatory to declaration and strongly committed to achieve these goals by 2030. The 17 Sustainable Development Goals are (1) to end poverty in all forms and dimensions, (2) end all forms of hunger and malnutrition, (3) ensure good health and well-being and end epidemics of AIDs, tuberculosis, malaria and other communicable diseases, (4) achieve quality education for all including primary and secondary education for all boys and girl, (5) achieve gender equality and an end to discrimination against women and girls, (6) ensure universal access to clean drinking water and invest in infrastructure for sanitation facilities, (7) ensure universal access to

affordable and clean energy, (8) promote sustained economic growth, higher levels of productivity, technological innovation, entrepreneurship and job creation, (9) Promote sustainable industries, scientific research and investment in infrastructure and innovation, (10) adopt policies to reduce inequalities and promote inclusion of all regardless of sex, race or ethnicity, (11) develop sustainable cities, ensuring access to safe and affordable housing, investment in public transport and creating green spaces, (12) Responsible production and consumption including efficient management of shared natural resources, proper disposal of toxic waste, recycle and reduce waste and move towards sustainable patterns of consumption, (13) Climate Change – Check the growth in greenhouse gas emissions and take steps to mitigate the impact of climate related disasters, (14) manage and protect the marine and coastal ecosystems from pollution and address the impacts of ocean acidification, (15) conserve and restore the use of terrestrial ecosystems such as

forests, wetlands, dry lands and mountains. Initiate urgent action to reduce loss of natural habitats and biodiversity, (16) Strengthen the rule of law to ensure peace, stability and justice for all and reduce all forms of violence and (17) In order to achieve the SDGs built strong partnerships including North-South and South-South cooperation by supporting national plans to achieve targets.

2.5.2 Of the 17 SDGs, three are germane to transport and railway development, viz SDG (9) on Industry, Innovation and Infrastructure, SDG (11) on Sustainable Cities and Communities and SDG (13) on Climate Change. Under each of the SDGs more detailed targets have been specified.

2.5.3 In case of SDG (9) one of the targets 9.1 states “Develop, quality, reliable, sustainable and relevant infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access to all.” The Government of India has identified the Ministry of Railways as one of the concerned Ministries in achieving this target. In 2017 the Government presented a Voluntary National Review Report on implementation of Sustainability Goals to the United Nations, High Level Political Forum. In the Report under SDG 9 it mentioned “Moreover, the Indian Railways is setting up an INR 350 billion (USD 5.5 billion) Railways of India Development Fund to serve as an institutional mechanism for raising funds from the market. In 2016, India moved up 19 places in the World Bank's Logistics Performance Index, to finish 35 among 160 countries.” The Mumbai Ahmedabad High Speed Rail (MAHSR) Project fulfils SDG 9.1 Target objectives as it will prove to be a very high quality,

reliable and sustainable infrastructure which serves two different regions (states) of India and will significantly contribute to economic development through substantial time savings and contribute to economic growth in intermediate cities such as Anand-Nadiad, Vadodara, Bharuch, Surat, Vapi, Virar and Thane by improving accessibility. The existing Rail lines and the new MAHSR line shall be able to cater to all market segments on this route.

2.5.4 Under SDG (11) the Target 11.2 specifies, “By 2030 provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.” The Ministry of Railways is one the identified Ministries for fulfilling this target. Although, the target relates primarily to urban transport the MAHSR has an important role to play. It shall provide very high quality, fast public transport between Mumbai and Thane and Mumbai and Virar and similarly between Sabarmati, Ahmedabad and Anand-Nadiad or Vadodara. Moreover, all stations along the 500 Km route will be accessible with journey times of under two hours from both ends. The facilities on board and at stations will be world class and cater to all passengers with different needs. In view of its very small carbon foot print, efficient land use and efficient use of fuel it is the most sustainable mode of transport.

2.5.5 Under SDG (13) relating to Climate change target 13.2 specifies “Integrate climate change measures into national policies, strategies and planning”. Although, the Ministry of Railways is

not one of the identified Ministries to meet this objective it already has initiated a number of steps such as moving in a very significant way from diesel to electric traction and taking major initiatives with respect to use solar energy as a major renewable source for meeting energy requirements. The MAHSR project fits into the strategy of electrified traction and as has been brought out else where in this paper it is found to be the least polluting modes amongst other rail modes apart from being far superior to car, bus and airlines.

- 2.5.6 From a sustainability perspective there are positive environmental benefits in all HSRs in terms of efficiency of use of fuel, reduction of the carbon footprint and efficiency in land use. Moreover, as the scheme conforms to some of the the Sustainability Development Goals, the High Speed Rail Project, therefore is, an important component for achieving the National and Global Sustainability targets.

2.6 International Growth of High Speed Lines

- 2.6.1 It is over fifty years since the first High Speed Railway the 'Tokkaido Shinkansen' between Tokyo and Osaka came into operation in Japan in 1964.

The first European High-Speed Railway was the French 'TGV' between Paris and Lyon introduced in 1981/83. Since then High-Speed network has grown and new lines have been built in several countries, the largest network being in China. At present around the globe there are about 40,833 kilometres of Operational Lines, 14,210 kms of lines under construction, 3,843 kms of lines that have been planned and a further 31,765 kms in various stages of Long Term planning (country-wise details of operational lines are shown in Chart 4). The most remarkable High-Speed Rail Construction Plan has been in China where between 2004 and 2017 they have opened over 26,000 kilometres of lines which is well over 50% of the High-Speed Lines in the world. The next three countries in terms of kilometrage are Japan, Spain and France with between 2,600 and 3000 Kms of HSR lines. A summary of HSR Lines in Europe, Asia and other countries is given below in Table 4. What is interesting to note that countries such as Turkey and Taiwan have operational lines, Morocco is building one and several countries have ambitious plans. The issue, therefore, is whether India as one of the largest networks, and leading rail systems of the world can afford to be left behind in this phase of rail revival through High-Speed Rail.

Table 4 : HSR Lines in Operation, Under Construction and Planning in different Regions of the World

Country	In Operation	Under Construction	Planned	Long Term Planning	Total
EUROPE	8948	1708	1604	9690	21950
ASIA	31523	11836	2239	12906	58504
OTHER COUNTRIES	362	666	0	9169	10197
WORLD HSR LINES	40833	14210	3843	31765	90651

2.7 Genesis & Policy of High Speed Rail in India

2.7.1 The first scheme for High Speed Rail was conceptualized early in the millennium when RITES came out with a Report that highlighted the need for High Speed Rail Services between Mumbai and Ahmedabad, the route with the best potential. At that time the Railway Board was seriously considering increasing speeds as maximum permissible Passenger Train Speeds had remained unchanged for over three decades. However, after much deliberation the proposal was dropped and the priority shifted to building dedicated freight corridors. The decision, at the time, was logical in view of severe congestion on key freight routes, which was adversely affecting growth, and freight was the main breadwinner for the organisation. The Mumbai – Ahmedabad HSR proposal was revived when in 2009, Systra, Italferr & RITES were commissioned to carryout a fresh Pre-feasibility Study for Ahmedabad – Mumbai – Pune route which was completed in 2010. The French Railway also carried out a Business Development Report for this route in 2014. Based on dialogue between the Prime Ministers of India & Japan, a new Feasibility Study was initiated in 2013 for the Mumbai – Ahmedabad corridor which was completed in 2015 and is the basis of the present Project.

2.7.2 In the Railway Budgets between 2007-08 and 2013-14 pre-feasibility studies for building High Speed Corridors were announced for several corridors. These included Pune - Mumbai – Ahmedabad, Delhi – Kanpur – Lucknow - Varanasi – Patna, Delhi – Chandigarh – Amritsar, Howrah – Haldia, Hyderabad – Vijayawada – Chennai, Chennai – Bangalore – Coimbatore – Ernakulam,

Delhi – Jaipur – Jodhpur and Ahmedabad – Mumbai. On most of these routes Pre-feasibility Studies had been completed. The selection of the routes was not in all cases on the basis of any detailed analysis and factors considered were to cover all parts of the country and routes that appeared to have the best potential, however, political influence in some cases also seems to have crept in to this shortlisting. Along with building independent High-Speed Corridors of speeds of over 300 Km/h a proposal for upgrading certain existing lines for speeds of 160 – 200 Km/h was also proposed and the Japanese carried out a study for the Delhi – Mumbai Route. This two-pronged approach still appears to be the strategy of the Railway Board and steps to introduce Semi-high Speed on certain routes is under consideration.

2.7.3 There has been a shift in High Speed Rail Policy since 2014 when Government, as a long term goal, announced the “Diamond Quadrilateral Project – Bullet Train Network” which envisaged a High-Speed Rail Network along the Diagonals and Quadrilateral formed by linking Mumbai, Chennai, Kolkata and Chennai; a much more ambitious scheme than what was being considered earlier. As a result, a new set of Pre-Feasibility Studies were initiated for these routes and foreign help was sought in carrying them out for example the Chinese Government had agreed to undertake the Study for Delhi – Chennai High Speed Line. The Chinese it appears have since backed out. The first project that has been fast tracked is the Mumbai – Ahmedabad High Speed Corridor. As mentioned in previous paragraphs, this is a line where a number of studies had been done and the most recent Joint

Feasibility Study was undertaken by Japanese consultants on the basis of which the project was sanctioned. This line also has the best potential for success in the country and is expected to move into the construction phase in 2018.

2.7.4 The Government's initiative in the area of High Speed Rail is commendable. Increase in speeds on IR was long overdue. What India plans now is to follow a strategy similar to that pursued by Japan, France and Spain and others in revitalizing the Railway system, by introducing HSR, at a time when it is facing problems in several areas viz. financial, need for modernization, capacity constraints and safety. The High-Speed Rail initiative along with the freight corridors, it is hoped, will lead to modernization, induction of new technology and creation of capacity in other areas as well. The Ministry of Railways needs to carefully take note of the lessons based on experience of HSR in other countries. It must be noted that Planning a network of HSR along the Diagonals and the quadrilateral may not be the best choice as HSR may not be able to wean passengers from the airlines on such long routes. **It is important to understand that maximum benefits of HSR accrue in the 400 to 700 Km range where there is a good potential for attracting passengers from both air and private cars to HSR. It is crucial that HSR routes are selected on objective criteria. A two-pronged approach of building separate corridors for High Speed Rail above 300 Kmph and upgrading selected existing lines for 200 Kmph, is wise but needs to be vigorously pursued.** As the Dedicated Freight Corridors come up

capacity will be released on existing routes for High Speed (200 Kmph). This would be a cheaper and more affordable option. China, for example, has developed 200 Kmph lines some of which are passenger dedicated lines while others are for mixed traffic.

2.7.5 Therefore, in addition to High Speed Rail the Government is also planning to pursue a policy of Semi-High Speed Rail on selected existing routes with speeds of 160 to 200 kmph by upgrading existing infrastructure and rolling Stock. Some of the coaching stock on IR viz. LHB coaches are already fit for 160 Kmph and trials have been carried out with some other coaches such as Spanish TALGO stock. However, a number of other inputs shall be required in signalling, track, need for fencing, eliminating unmanned level crossings etc. However, once semi High Speed is achieved it can contribute significantly in reducing journey times.

2.8 Impact of HSR on Economic Development

2.8.1 The post construction impact on the local economy on towns and cities is difficult to assess at this stage. Therefore, the only means of assessing the impact on economic development is to look at the results achieved elsewhere in the world where high speed trains have been introduced. A few studies have been carried out on the subject and a brief description of different country experiences are given below.

2.8.2 **France:** With the introduction of the TGV between Paris & Lyon trips from Paris increased by 52% and there was a much higher growth in business travel

out of the Lyon region. The TGV by itself did not result in growth of business or economic activity but did help in facilitating decisions regarding locating new businesses when they were to be set up. On other routes like on the Paris – London and Paris – Brussels/ Amsterdam route, the city of Lille has witnessed the establishment of a large University and medical complex as well as establishment of banking and insurance offices, city of Le Mans saw growth of the insurance industry, Rheims saw the setting up of a new University and online IT based services. Similarly, Marseilles after introduction of the High-Speed line got a new Business Park and new entertainment centre. However, it must be mentioned that there are several towns along the HSR lines that have not seen any direct benefits. It has also been noted that there was a decline in overnight stays in hotels and no significant impact on setting up of industries. It was also observed that real estate prices in the vicinity of HSR stations increased by 20% or more in the first two years after the service began and thereafter began to stabilize. What the French experience emphasises that in addition to the High-Speed Rail, Local Government needs to initiate action to promote economic activity in order to maximise benefits.

2.8.3 **Germany:** A very comprehensive study on economic benefits was carried out on the High-Speed Line between Cologne and Frankfurt, particularly, with reference to two small towns, 20 km. apart, of Montabaur and Limburg located in the middle of this 177 km. corridor and the journey to these towns is 30 minutes from either end. The analysis revealed that the increase in market

access resulted in improvements in several economic parameters such as GDP and GDP per capita. Growth in local GDP improved by 2.7 % which has been sustained over time. The business of High Speed rail has progressively grown and has captured over 60% of the rail passenger market and over 67 million passengers use High Speed Rail annually.

2.8.4 **Spain:** Two major objectives of the HSR lines in Spain was firstly, to link all large coastal cities to the capital within a journey time of four hours and secondly, to reduce the regional disparities in the country. The OECD has acknowledged that there appears to have been some reduction regional disparities. Intermediate Large cities along the line appear to have benefitted. There has been growth in business and leisure travel although the high-speed services have resulted in reduction of overnight stays at hotels. The Spanish experience also highlights the need for selection of station locations close to existing businesses, releasing land for mixed use development, development of transport hubs in the vicinity of the station and need for attracting both public and private investment. On the longer journey by HSR between Barcelona and Seville / Malaga air still holds the advantage and over 70% of market share, because of shorter journey time and greater frequency of service. What European analysis brings out that in the competition with Airline, HSR holds advantage for distances up to about 750 Km.

2.8.5 **Japan:** Japan, in many ways, is the international benchmark for this technology in terms of both the system's

reliability and safety standards (no fatality in 50 years). In Japan the Shinkansen has become a national symbol in terms of its efficiency, it's very high standards of reliability and quality of service, and safety. It has also become a part of Japanese culture symbolising what Japanese Society has been able to achieve in terms of economic development, mobility, modernization and technology in the Post World War II period. The economic benefits are significant. The system transports over 315 million passengers annually generating revenue of more than US\$ 19 billion. With such large numbers using the rail system it ensures road congestion is kept under check. Moreover, it has enabled urban centres where stations are located to grow at an accelerated pace. Studies have shown growth in retail, industrial construction and wholesale was higher by 16% to 34% in cities served by the line in addition a 67% increase in land value. It has facilitated the growth of jobs in its own rail related construction industry and to an all round economic development. HSR has also helped in tourism growth, estimated at 15% to 25% between 1964 and 1985. In Japan there is much more efficient land use in case of the Shinkansen, significantly better than even European standards of HSR. With respect to impact on tourism, the extension of the Tohoku line from Morioka to Hachinohe (96 Km) and the Kyushu line from Shin Yatsushiro to Kagoshima (138 Km) saw a growth of tourist traffic by 50% and 140% respectively. The first line served a National Park and after the first year of opening visitor's numbers grew by 25% at the Park.

2.8.6 **China:** The most remarkable growth in

High Speed Lines has been in China. Although, construction of lines has been in recent years, initial studies of benefits, have been carried out by the World Bank. A study carried out for the Wuhan to Guangzhou and Beijing to Shanghai corridor attempted to estimate benefits in terms of agglomeration effects on productivity and GDP, Employment effects and effect on Tourism. What the study revealed is that agglomeration benefits for two-tier and three-tier cities can be very substantial and are estimated at 0.55% of total GDP in Jinan per year, 0.63% in Jilin and 1% in Dezhou. The Study was not able to quantify impact on creation of jobs and in case of tourism they concluded there has been rapid growth in this segment of travel, especially, to places of tourist interest. China is creating a national grid of high-speed lines thus integrating the nation politically, socially and economically. The benefits of the system linking the major metro cities and second and third tier cities in between will result in major reduction in journey times, providing linkages to distant rural areas in the west and releasing capacity on existing rail lines for rapidly growing freight traffic.

2.8.7 This review of impact of HSR in different countries reveals that in many cases there has been population growth at cities along the line, local GDP growth has shown a positive trend in many cases, there has been growth in tourism, land prices, development of new education centres etc. However, on some routes the results are mixed. In order to achieve positive results and take full benefit of expected growth in travel that HSR will generate it is essential that there is close collaboration in planning facilities between the HSR authorities

and local Government and municipalities to enable new economic activity in areas around the HSR stations. However, the extent of benefit varies from country to country. In India there is the potential for tremendous economic growth along the corridor in view of the size of cities along the route, developed infrastructure, industrial base, effective governance systems and educational facilities apart from places of tourist interest.

2.9 The Mumbai Ahmedabad High Speed Rail Project (MAHSR)

2.9.1 The Project was conceptualised in May 2013 when the Prime Ministers of Japan and India met. After the initial agreement, a Joint Feasibility Study was undertaken from December 2013 which was submitted in the second half of 2015. Based on this Study, the Project was sanctioned and in March 2016 second stage 'Follow Up Studies' were taken up by Japanese consultants. These included deciding on the Schedule of Dimensions and drawing Standards and Specifications for various project aspects such as Viaducts and Bridges, Station Buildings, Signalling and Telecommunication, Track, Earth structures, Tunnels etc. which shall be the basis for detailed design. In addition, capacity building was an important component and a large number of Indian Railway Officers have and are undergoing training in Japan. The Follow-up Studies phase was completed by early 2018. Simultaneously, consultants were appointed for Detailed Design on which work is ongoing. For many aspects such as Rolling Stock, Signalling and Telecommunication and Over Head Electrical Equipment the

detailed design shall be done by the equipment suppliers and therefore in these cases, bidding documents are being drafted and are expected to be finalised by 2019. The project is due for completion by the end of 2023, however, the Indian side has made a request for advancing the date by over a year so that the line is opened as a part of the 75th Year of Independence celebrations. This is a challenge and therefore hectic activity has begun and meticulous planning and implementation will be necessary over the next few years.

2.9.2 Mumbai Ahmedabad High Speed Rail Project – Some Salient Features

2.9.2.1 **Gauge & Interoperability:** All previous studies for the High-Speed Rail on the Mumbai – Ahmedabad route had envisaged Broad-Gauge track. In fact, use of the existing alignment by upgrading it, as an inter-operable system had also been considered. However, it was felt that that use of the existing alignment would involve duplicating various systems of conventional line which would not only be complicated but could also affect safety. Moreover, the existing system was already congested and being operated to full capacity. Secondly all systems in the world where speeds were above 300 kmph, the Standard Gauge line was used and this gauge was tried and tested in terms of track technology and rolling stock. The only High-Speed Rail lines on other than the Standard Gauge were the odd line in Russia and Spain. Moreover, speeds over 300 Kmph on a Broad-Gauge alignment would require considerable amount of design and developmental work which would require time. It was therefore decided to

build a Standard Gauge Line totally dedicated to HSR..

2.9.2.2 The Basic Structural Standards: Such standards for India were recommended and were finalised after examining standards followed in various HSR systems in different countries. These included parameters such as minimum radius of curvature, maximum gradient, maximum design axle load, distance between centre of track, cross section of double line tunnels and track structure. After a comparative study of different HS Railways, particularly Japanese standards, structural standards were agreed upon many of which have been incorporated in the Schedule of Dimensions, for example the minimum radius of curvature adopted was 6000 metres, minimum distance between track centres of 4.5 metres and cross-section of a double line tunnel of 80 sq. mts. etc. In most cases these are more liberal than what is followed in Japan and somewhat lesser than European Standards.

2.9.2.3 Rolling Stock, Power Supply and Signalling: A similar comparative analysis was done of Rolling Stock characteristics, Over Head Electrical Power Supply Systems and Signalling and Telecom technology used in various HSR systems. Although, practices, systems and equipments used in various High Speed Rail lines around the world were examined regarding their characteristics, it was decided to adopt Japanese Standards and equipment and where necessary modify equipment to Indian conditions. For example, in case of Rolling Stock, Japanese E5 Type EMU stock used on JR East is proposed to be used. Japanese coach design has

one very significant advantage that the Car body width of 3.4 metres is significantly wider than stock used elsewhere. In case of Over Head Equipment (OHE) it is proposed to adopt the AC 2 X 25 kV system as the feeder system and Compound catenary which will be necessary as volumes and train frequency increases. On the Signalling front, Cab Signalling (continuous) with Digital ATC as the Train Protection System shall be installed, whereas European High-Speed works with the ETCS Level II system. The detection of Track occupancy shall be done through Audio Frequency Track Circuits. Communication shall be through the Japanese LCX Leaky Cable system. The European alternative systems are GSM-R and TETRA Space Radio systems. Train Operation, route setting and advanced Time Tabling shall be managed in the Operation Control Centre with the help of the Japanese COSMOS Software especially developed for this purpose.

2.9.2.4 Train Operations: In the initial years, it is projected/planned that, Train Operations shall be based on 10 Car Train sets with 1 Business Class Coach (55 seats) and 9 Standard Class Coaches (2+3 Seating – 695 Seats). As traffic volume grows, additional coaches will be added eventually growing to 16 Car Trainsets with a seating capacity of 1250. The number of trains in each direction shall be 35 in each direction when the line opens, growing to 105 in each direction by 2053 at the end of the Project life. Peak hour services shall grow from 3 per hour to 8 per hour during the same period. The line has 12 stations namely Mumbai, Thane, Virar,

Boisar, Vapi, Bilimora, Surat, Bharuch, Vadodara, Anand/Nadiad, Ahmedabad and Sabarmati. Rapid trains shall stop at Ahmedabad, Vadodara and Surat only with a running time from end to end of about 2 hrs 07 minutes whereas trains stopping at all station will cover the distance in about 2hrs 46 minutes. Rolling Stock shall be maintained at Sabarmati and Thane Rolling Stock Depots which will have state of the art machinery and equipment.

2.9.2.5 **Disaster Prevention:** Japan being prone to Natural Disasters, particularly earthquakes and cyclones the country has a very sophisticated early warning system for possible natural calamities. They, therefore, in order to monitor seismic activity, have a series of seismometers along the line which are linked in real time to the Operational Control Centre where the severity of the seismic activity is monitored and accordingly decisions regarding train regulation are made. In case of very severe signals the power to the Over Head Equipment is automatically cut off. Similarly, monitoring of wind velocity is carried out through anemometers placed along the line and the system automatically alerts the controllers and standard norms for action are laid down. Rain gauges are also provided at intervals on the Japanese system. As high temperatures can result in rail buckling rail temperatures are measured in real time at nominated locations and appropriate action initiated when necessary. Similarly, a system exists for monitoring water levels in rivers and sensitive locations. It is proposed to incorporate some of these disaster prevention safeguards on the Mumbai Ahmedabad High Speed Line.

2.9.2.6 **Alignment Features:** The alignment of the route was decided after taking into account topographical aspects, geological information, hydrological conditions., meteorological data etc. It was decided that the entry into Mumbai City would be made by diverting the direct route via Thane, tunnelling under Thane Creek and developing the Mumbai terminal in the Bandra Kurla Complex. Similarly, it was decided to take the route via the existing Vadodara and Ahmedabad Western Railway Stations by building elevated stations at these locations to facilitate easy transfer from existing Western Railway Lines to the High-Speed system despite very difficult and complex construction issues. While the consultants had initially recommended about 65% of the alignment on embankment, 25% on Viaduct about 6% in tunnel and the balance on bridges and cuttings, the Government of India, perhaps wisely, decided to build 92% of the route on viaduct. **An elevated route has tremendous benefits in terms of security and reduction in requirement of land to be acquired.** There will be about 27 Km of tunnels including a 21 Km undersea tunnel below Thane creek, the longest rail tunnel in India. There are also environmental challenges as the line traverse's mangrove swamps, a flamingo sanctuary and a wildlife Park.

2.9.2.7 **Impact on the Environment:** During the construction phase of the project there is expected to be a negative impact with respect to pollution on account of air, water, soil pollution, generation of waste, noise & vibration. With respect to the natural environment there is expected to be a significant impact on the Biota and ecosystem which could result in partial loss of flora and fauna as the alignment shall pass through protected

areas such as the Sanjay Gandhi National Park, Tungreshwar Wild Life Sanctuary and some Reserved Forests as also a mangrove swamp near Mumbai. In the construction phase there shall also an adverse impact on the Social Environment in terms of disrupting local economies and Project Affected Persons losing jobs or having to change means of livelihood as well as some change in the land use pattern. During the operational phase appropriate mitigation measures shall be necessary to be taken with respect to effluent and waste generated at Depots and workshop and noise, vibration and sonic boom in tunnels. The natural environment will remain impacted during the operation phase particularly in case of biota & ecosystem and the protected areas. Mitigation measures in terms of resettlement of displaced persons and appropriate compensation to the poor are being worked out. Precautions to prevent the spread of diseases such as HIV/AIDS in view of shifting populations will be necessary. There will be a few other impact also such as visual intrusion on the landscape.

2.9.2.8 Project Structuring & Viability: In order to structure the project a range of options were considered with different levels of Public and Private Sector Participation ranging from all components viz Land Acquisition, Civil Works, E&M, Rolling Stock, Operations & Maintenance being managed by the Public Sector to the other extreme where only land was acquired by the public sector and the remaining segment with the private sector. However, in view of the very large scale of the project, the risks involved and limited experience in india of successful PPP projects it was

felt that full public sector control was the only workable option. The capital cost was assessed at just under Rs 100,000 Crores with approximately, 40% accounted for by Civil Works and track, 18% by Rolling Stock, 23% by OHE, Power Supply, Signalling & Telecommunication and 7% on dedicated systems for operating the Shinkansen system. The revenue stream consisted of fare box receipts and only a miniscule percentage from other sources. The revenue assessment was based on charging 1.5 times the then First Airconditioned Class fare of Indian Railways, however, the actual fare that will be fixed shall depend upon various factors such air fares, quality of service and how willingly passengers take to the HSR when the line is opened. The project in the initial evaluation was expected to give a positive Financial Return, though marginal and less than the hurdle rate for rail projects. However, there is always the possibility of cost escalation and the marginal positive financial rate of return becoming negative. As long as the project covers its operating & maintenance costs the project is worthwhile in view of its societal benefits. In terms of Economic Benefits, the returns are much more significant. The economic returns accrue in terms of savings in, fuel, vehicle operating costs, travel time, reduction in pollution, reduction in accidents and through job creation. The major economic benefits are through reduction in travel time, Vehicle operating costs and Reduction in Pollution. It must also be noted that High Speed Rail Projects in practically all countries where they have been introduced do not give a return on Capital investment and are primarily

justified on Economic considerations only. Spain is a good example where despite the fact that patronage on several lines is below the EC set norms they have continued to invest in HSR. In Europe, such projects receive support from the European Community and in Japan projects are funded by the Central Government and Local Government, executed by a Government Agency and the operating company are required to service debt at a rate that they can afford.

2.9.2.9 **Funding:** Investment in such a mega infrastructure Project and its attendant risks is a major concern for both policy makers and citizens. The question arises could this money be better spent elsewhere – opportunity cost. To a great extent this question is hypothetical as about 81% of the amount is coming from Japan in the form of a soft loan at 0.1% rate of interest and a tenor of 50 years and a 15 year moratorium. The Government of India only has to finance land acquisition. There could not have been more favourable terms. It must be realised that except for this specific project the Japanese Government would not have extended a loan on such soft terms and on this scale. In the realm of diplomacy & realpolitik there is also a certain degree of give and take,

therefore, apart from this soft loan, India has gained major benefits from Japan in terms of relaxation by Japan for India of its policy regarding the export of Civil Nuclear Technology for Indian Nuclear plants. A new global economic and strategic partnership is emerging which provides a win – win situation for both nations.

2.9.2.10 **Developing Alternative Sources of Revenue:** One lesson that is important to learn from Japan is the diversification that has taken place on rail systems to develop non-fare box sources of revenue. The Railways there have consciously developed significant revenue streams by leveraging real estate, promoting retail and developing entertainment and sports centres, hotels and leisure activities to generate tourism revenue. What is very noticeable even to the casual visitor is the element of Retail with the very large shopping complexes that have come up at stations. JR East for example has also promoted its own brands in malls run by itself. Japanese Railway Companies have promoted in-station, above station, station-front and around-station development on an enormous scale in order to augment revenues. Table 5 below indicates the percentage of revenue generated from different Streams in some major Rail systems formally part of the old JNR and a few Private Railways.

Table 5 : Indicative Percentage of Total Revenue from different sources of Japanese Railway Companies

Company	Transportation Revenue	Real Estate Revenue	Retail Revenue	Tourism Revenue
JR HOKKAIDO	50%	13%	25%	12%
JR CENTRAL	78%	2%	13%	7%
JR WEST	65%	7%	18%	9%
TOBU	37%	6%	37%	11%
SEIBU	34%	24%	9%	33%
KEIO	31%	6%	42%	15%
TOKYU	17%	17%	45%	12%

In India it would also be necessary to consider various options for raising money from non-fare box sources. Some pilot studies have been carried out. The possibility exists that in collaboration with Local Urban Bodies, schemes for land value capture by promoting real estate development in the vicinity of stations to promote business activity and residential development by offering a higher FAR and the returns could be shared by the City authorities and the Railways. Although, normally associated with urban transport, the potential exists for Transit Oriented Development with intensive mixed land use development including business, residential, educational and leisure activities all within 400 to 800 metres of the Station to promote sustainable communities around which development takes place.

2.9.2.11 Project Monitoring: The Mumbai Ahmedabad High Speed Rail Project, to facilitate timely execution, has been divided into a number of Packages relating to Civil Works, Special Bridges, Track Works, Electrical Works, etc. Some of these Packages relate to works on a logical physical stretch of the alignment, others relate to the entire alignment and a few to specific items such as identified major bridges. The Project is targeted for completion by end of 2023 with a 50 km stretch being operational by 15th August 2022 when India celebrates 75 years of Independence. This stretch can initially be used for extensive testing of the fixed infrastructure and rolling stock prior to commercial services. A mammoth project of this size will require very close monitoring to ensure timely completion without any hassles and timely resolution of interface issues. The time frame is tight, particularly when one

considers that even in Japan in some cases projects have taken a decade to complete. A Master Implementation Plan therefore, needs to be developed. In addition, for ensuring meticulous monitoring of the several activities, an advanced Computer based Project Monitoring system will need to be introduced. Effective Project Management is going to be the key factor in ensuring there are no time and cost overruns.

2.9.2.12 Impact of Imported Technologies on Indigenous Capabilities: For the MAHSR it is proposed to import a very major portion of the HSR systems. These include Track and Track fittings, Signalling and Telecommunication equipment, Over Head Electric Traction and Power Supply Equipment, Rolling Stock, Training Simulators etc. There has been a tremendous effort by the Government of India to persuade the Government of Japan to 'Make in India'. As this is at present a *one-off* project with no future line planned on Japanese technology it does not appear likely that any major manufacturing shall take place in India. Although, it is possible that some components like track fittings, coach furnishings, communication equipment components may be manufactured in India through Joint Venture companies with Japanese Companies collaborating with Indian Companies or Japanese corporations manufacturing through their subsidiaries in India. A number of Indian Corporations are eager to enter Joint Venture Agreement with Japanese Corporations.

2.9.2.13 A major concern is that of quality and reliability. This is one aspect that Indian

companies need to focus on. An important issue that is of concern to Indian Railways is the very high number of *asset failures* of various assets such as signal equipment, locomotive failures, track etc. which cause loss in punctuality of trains and in some cases can be a safety hazard. Although, there has been some improvement in recent years, IR has not been able to overcome the problem. This issue not only relates to quality of manufacturing but also to maintenance practices. It is expected that on such a major project there will be positive learning for Indian Contractors and Companies with respect to quality and reliability in all spheres be it civil construction, fabrication of steel truss bridge girders, power supply infrastructure, rolling stock components etc. Another area of interest is the inspection and maintenance system followed in Japan where maintenance is carried out by 'Group Companies' which are subsidiaries of the main operating companies.

2.10 Lessons Based on Global Experience

- 2.10.1 Based on experience gained in other countries there are a number of simple lessons to be learnt. The main points in this regard are summarised in paras below
- 2.10.2 The route and terminals between which it is planned to introduce HSR services need to be carefully selected. An HSR line gives the best benefits when the line is between two metro cities which are commercial or industrial hubs with significant demand for travel. Wherever lines have been built between a metropolitan centre and a provincial capital or rural centres the traffic generated does not justify the HSR.
- 2.10.3 In most cases where lines have been

successful, the HSR has contributed to decongesting a route, achieved significant reduction in journey time compared with road and conventional rail, creating additional capacity for passenger mobility and also releasing capacity on conventional rail / road for freight.

- 2.10.4 As maximum environmental benefits accrue from the shift of airline passenger to HSR, the HSR advantage exists only up to about 700 kilometres beyond which air travel is superior in terms of journey time and fares. A journey time of between one and half hours to three hours by HSR is perhaps the best.
- 2.10.5 The traffic demand risk is extremely high and there are several lines on which traffic volumes have not come up to the levels initially projected in Study Reports. This has happened amongst others, in Spain, Korea and Taiwan. The Traffic studies initially need to be carried out carefully and Government should be willing to cover the risk, and support lines where there is a traffic shortfall.
- 2.10.6 As the Investment cost in HSR is extremely high and returns at best are low, in almost all countries, Government has played a key role in financing projects and absorb losses when lines have run into trouble. In Japan, the central and local governments provide for capital expenditure. In Europe, apart from Government there is significant European Commission funding. In Korea, 35% of Capital cost came from Government and in Taiwan, the Government had to step in when PPP went wrong. It is also important that costs are kept low and cost overruns kept under check.

2.10.7 Some studies have been carried out regarding the impact of High Speed Rail on Regional development by looking at population growth, unemployment, local GDP, economy, tourism, land price, education etc. The results are mixed. There are locations where population has grown; elsewhere there has been higher GDP and economic growth, at some stations land prices have gone up. However, there appears to be no clear definitive trend. These benefits will perhaps require very close collaboration in planning facilities between the HSR authorities and local Government and municipalities. From a sustainability perspective, there are positive environmental benefits in all HSRs, in terms of efficiency of use of fuel and reduction of the carbon footprint and efficiency in land use. However, the extent of benefit varies from country to country.

2.10.8 The Public Private Participation models have not been successful in HSR development and if at all it has to be applied than it should be to a very limited extent.

2.11 Conclusion

India has taken a bold step in planning the first High Speed Rail Corridor from Mumbai to Ahmedabad. It is hoped that the HSR will help revive the Rail Passenger Transport and provide customers with a new experience in quality of service, reliability, punctuality and safety. It should also give Railways a competitive edge over other modes and enable a shift from other modes to rail which is important from a sustainability point of view. The HSR, it is expected, will establish new standards and systems in rail transportation and some of the new learning will get transferred to IR's conventional lines with a view to improve quality of performance. In such a mega project, managing the project is

important to ensure timely delivery and ensuring that there are no cost and time overruns. It is also important that this does not remain an isolated High-Speed line and a network is progressively built around it so that eventually the benefits of economies of scale accrue and expertise gained can be used on future projects, particularly, as demand exists on several routes and with the economic growth envisaged there will be justification on more routes in the country. The success of the Mumbai Ahmedabad High Speed Rail Project is essential for future expansion. The new Mumbai Ahmedabad High Speed Rail Line and the Semi High Speed upgradation of certain existing routes has the potential of transforming rail passenger travel in the country.

References / Selected Readings

1. A Track Record of Success – High Speed Rail Around the World and its Promise for America, Tony Dutzik, Jordan Schneider, Phineas Baxandall & Erin Steva, PIRG Education Fund, 2010
2. Achieving the Sustainable Development Goals in India – A Study of Financial Requirements & Gaps, Report by Technology and Action for Rural Advancement, New Delhi, 2015
3. Dedicated High Speed Rail Network in India: Issues in Development, G. Raghuram & Prashanth D. Uday Kumar, Indian institute of Management, Ahmedabad, 2016
4. Energy Consumption and Emissions for High Speed Trains' by Alberto Garcia Alvarez, 2018.
5. Europe's High Speed Trains: A Study in Geo-Economics, Mitchell P. Strohl, Praeger Publishers, Westport, 1993

6. High Speed Europe – A Sustainable Link between Citizens, Director General for Mobility & Transport, European Commission, 2010
7. High Speed Rail as a Tool for Regional Development, DB International GmbH / UIC, 2011
8. High Speed Rail, Regional Economics and Urban Development in China, Andrew Salzberg, Richard Bullock, Ying Jin and Wanli Fang, World Bank Office Beijing, 2013
9. High Speed Rail: Fast Track to Sustainable Development - UIC Publication, 2012.
10. High Speed Railways in China: A Look at Construction Costs, Gerald Ollivier, Jitendra Sondhi & Nayan Zhou, World Bank Office, Beijing, July 2014
11. India and Sustainable Development Goals: the Way Forward, United Nations – Research and Information System for Developing Countries, New Delhi, 2016
12. Potential Impacts on Accessibility and Consumer Surplus of Improvements of the European Railway System, Rotoli F., Christidis P., Vannacci L. Lopex-Ruis H.G., Navaajas C.E., & Ibanez R.N., EURO Working Group on Transportation, Seville, 2014
13. Regional Economic Impact Analysis of High Speed Rail in China – Step by Step Guide, World Bank, 2014]
14. Regional Economic Impact Analysis of High Speed Rail in China, Main Report, The World Bank, Washington, 2014
15. Shinkansen from Bullet Train to Symbol of Modern Japan, Christopher P. Hood, Routledge, New York, 2006
16. Sustainable Development Goals, Targets, CSS, Interventions, Nodal and other Ministries, NitiAayog, New Delhi 2017
17. Territorial Implications of High Speed Rail – A Spanish Perspective, Editor Jose M. De Urena, Ashgate Publishing Ltd., Farnham, 2012
18. The Economic Effects of High Speed Rail Investment by Gines de Rus, Discussion Paper No. 2016 – 16, OECD - International Transport Forum, University of Las Palmas, 2008
19. The Economics and Politics of High Speed Rail - Lessons from Experiences Abroad, Daniel Albalade and Germa Bel, Lexington Books, United Kingdom, 2012
20. The History and Future of High Speed Railways in Japan, Toshiji Takatsu, Japan Railway & Transport Review, August 2007
21. UIC High Speed Data (Web site)
22. Voluntary National Review Report (India) on the Implementation of Sustainable Development Goals, United Nations High level Political Forum on Sustainability, New York, 2017.

INAE Forum on Technology Foresight and Management for Addressing National Challenges

The Indian National Academy of Engineering (INAE) founded in 1987 comprises India's most distinguished engineers, engineer-scientists and technologists covering the entire spectrum of engineering disciplines, and functions as an apex body to promote and advance the practice of engineering and technology and the related sciences and disciplines in India and their application to problems of national importance. The Academy provides a forum for futuristic planning for country's development requiring engineering and technological inputs and brings together specialists from such fields as may be necessary for comprehensive solutions to the needs of the country. The Academy is an autonomous institution supported partly through grant-in-aid by Department of Science & Technology, Government of India. As the only engineering Academy of the country, INAE represents India at the International Council of Academics of Engineering and Technological Sciences (CAETS).

Among other activities, one of the important objectives of the Academy is to assist the Government from time to time in formulating policies on critical technical issues. Five Forums have been setup by the Academy to bring out the comprehensive report related to the issue of National Importance. The objective of these forums is to bring out comprehensive/exhaustive document covering review of existing aspects, analysis of options, future trends and specific implementable policy/recommendations and methodology of execution. One of such forum is INAE forum on Technology Foresight and Management Forum for addressing National Challenges.



Indian National Academy of Engineering

Unit No. 604-609, SPAZE, I-Tech Park, 6th Floor, Tower A, Sector 49,
Sohna Road, Gurgaon 122002

Phone : 0124 4239480, Fax : 0124-4239481
email : inaehq@inae.in, website : www.inae.in