Engineering Council of India

9th National Conference

Challenges of the 12th Five Year Plan - Role of Engineers and Technologists

November 28, 2011

Souvenir

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Background Discussion Note

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1 Introduction

The core theme of the 12th Five-Year Plan, reportedly, is faster and more sustainable inclusive growth with likely investment of more than I trillion dollars (Rs 45,00,000 Crore). Around twelve strategy challenges, which refer to some core areas that require new approaches to produce the desired results, have been identified by the Planning commission. These are: (1) enhancing the capacity for growth, (2) enhancing skills and faster generation of employment, (3) managing the environment, (4) decentralization, empowerment and information, (5) technology and innovation, (6) securing the energy future for India, (7) accelerated development of transport infrastructure, (8) rural transformation and sustained growth of agriculture, (9) managing urbanization, (10) improved access to quality education, (11) better preventive and curative health care, and (12) markets for efficiency and inclusion. It would be seen that engineers and technologists will have a major role to play in meeting these strategy challenges.

India needs to grow at 9-10% annually on a continuous basis at least for 15-20 years. This will need investment resources including public resources, its efficient allocation with emphasis on higher investment in infrastructure. Mere 8% growth, as of now, will not do. We know that economic growth realized so far has not generated enough employment. Many sectors of our economy have been facing workforce shortages, particularly of skilled technical workforce. We need multidisciplinary and multi skilled technical workforce, particularly diploma and degree engineers. We need more M.Tech engineers and PhDs. We need to improve our education and training systems; create efficient and accessible labour markets for all skill categories; and encourage the faster growth of small and micro enterprises.

We need to ensure that our future development has got to be sustainable. For this, inter alia, we need technological and organizational innovation. We need to encourage and incentivise innovation and its diffusion in academia and government as well as in enterprises of all sizes. Faster and more inclusive growth will need a rapid increase in energy consumption. We will have to meet this need equitably, affordably, and sustainably. Our transport infrastructure is inadequate which is the reason for our lower efficiency and productivity; higher transaction costs; and insufficient access to our large national market. We will have to create an efficient and widespread multi-modal transport network. We need to develop an efficient and sustainable rural infrastructure. Hitherto lower agricultural growth has perpetuated food and nutritional insecurities. Consequently, rural incomes have fallen resulting in more rural poverty. Our metros and cities are with inadequate social and physical infrastructure; and these metros and cities are also facing worsening pollution. We will have to make our cities more livable. Educational and training facilities have been increasing rapidly. However, access, affordability, and quality remain serious concerns. Employability is also an issue. Our health indicators have not improved as fast as other socio-economic indicators have. A good healthcare is unavailable (rural and semi rural areas) or is unaffordable (largely). Engineers and technologists have a major role to play in tackling all these issues for inclusive growth.

The bottom line and very important at that is that we need to consider also a greater and more involved participation of engineers and technologists, apart from others, in the institutional decision-making process for realizing faster, inclusive and sustainable growth of our economy in the 12th Five-year Plan and beyond.

Objective

The main objective of the 9th National Conference is to identify the role that engineers and technologist will have to play in tackling the above elaborated issues in the context of implementing the 12th Five-Year Plan, clearly define the role and action to be taken by the concerned agencies - the government, corporate sector, regulatory authorities, academic institutions, professional societies of engineers and others and bring up recommendations as objectively as possible.

Proposed Topics for Discussion

- Accelerated Development of Physical Infrastructure
- Development of Energy Projects for Ensuring Energy Security
- Working for Sustainable Development
- Environmental Protection and Upgradation
- Development and Upgradation of Technologies
- Sustained Growth of Agriculture
- Rural Infrastructure and Transformation
- Urban Infrastructure
- Improving Quality of Education for Engineers and Technologists
- Enhancing the Skills of Engineers and Technologists

2 Eleventh Plan Performance

2.0 A brief assessment of the Eleventh Plan Performance has been drawn from the Mid Term Appraisal (MTA) and the over view of the Twelfth Plan Approach Paper of the Planning Commission. Faster and more inclusive growth path has been a critical element. Inclusiveness was to be achieved by ensuring broad based growth supported by 13 Flagship programmes and infrastructure development. The overall performance of the Eleventh Plan is highlighted below:

Economic Growth

	Target	I	II	III	IV	V	Av. GDP
Average GDP Growth rate	9%	9%	6.7%	7.4%	8.5%	8.7%	8.2%

2.1 The decline in GDP is attributed to global recession, high inflation, and draught in certain parts of India. Industrialised nations GDP growth rate declined from 2% to 2.5% to (-) 2% to (-) 3%. India's decline was about 2 %. Similar gaps were experienced by China and Eastern Continent. India's economy remained fairly stable as it was not exposed to toxic assets. Robust FE reserve, timely introduction of Fiscal stimulus and Monitory accommodation helped Indian Economy achieve reasonable GDP growth.

2.2 The growth of Indian Economy in the Eleventh Plan had not been accompanied by rapid growth in manufacturing as happened in fast developing economies. This is an area which requires intellectual inputs from Engineers and Technologists. The MTA has identified a number of weaknesses where inputs are required such as:

(i) Improved power supply for competitiveness;

(ii) Special attention to MSME as these can not only provide large employment but also a seed bed for innovation and entrepreneurship;

(iii) Deepening of credit facilities;

(iv) Clustering of industries for better infrastructure support; and

(v) Find way out to land acquisition and related problems.

Infrastructure Performance

2.3 Inadequate infrastructure is one of the key areas of concern for Engineers and Technologists as it continues to pose serious constraints in the growth of Indian Economy.

2.3.1 Addition to Electric Power generation capacity in the Eleventh Plan is likely to be in the range of 50000MW against the target of 78000 MW.

2.3.2 Telecom sector lead by private sector has done fairly well in the mobile segment and achieved Plan target of 600 million connection including 200 million in rural areas in 3 years of the Plan. However, slow launch of 3G delayed broad band connectivity.

2.3.3 In the highway sector, NHDP implemented in phases did only 1800 Km in first two years on BOT. Financial crisis adversely

affected appetite of private investors and contributing to slow progress. In the Eleventh Plan NHDP I and NHDP are likely to be completed.

2.3.4 Implementation of PMGSY (PM's Gramin Sarak Yojna) meant to connect all villages with all weather roads having population of 1000 and 500 in hills and tribal areas, rephased under Bharat Nirman initiated in 2005-6 was satisfactory.

2.3.5 Although Railways 20 year Vision envisages high line capacity, rolling stock and technology modernisation, high speed train, increase in loco production but railways, a very important life line infrastructure, made as usual a steady progress to handle freight and passenger traffic in the Eleventh Plan.

2.3.6 Airport development and moderni-sation, a critical part of infrastructure development. Global economic recession did affect the resource availability due to poor turnover. In the Eleventh Plan with private sector participation Hyderabad, Banglore, Delhi, and Mumbai were modernised. AAI took modernisation of Chennai and Kolkota which were delayed. Out of 35 non-metro projects including NER 22 were completed.

2.3.7 Port Development remained far behind, against 858 MT handling capacity target only 55 % were completed. The conservative Government policy for privatisation remained a bottleneck. Some states have taken initiatives to develop ports with private sector participation.

2.3.8 Urban infrastructure development, a very Challenging opportunity for engineers and technologists to work on as the urban population will increase to 50 % of the total population in next 25 years. Development in the Eleventh Plan was relatively slow. It is a huge challenge to meet the deficiencies as the urban population is seriously under served in terms of water supply, sewerage, solid waste management, urban transport and other basic needs. Under JNNURM, Rs 100 ,000 Crore spent for preparation of comprehensive Development Programme, improve public accounting system and transparency, system improvement in Municipal Corporations, rent control laws, repeal of Urban Ceiling Act, Property Tile Certification System and encourage PPP participation has not made much dent.

2.3.9 Poor governance marred by corruption, law and order, lack of efficiency, lack of environment for investment and economic expansion, such as least transaction costs, simplified procedures and transparency continued to pose serious constraint in development. Slow pace of empowering PRIs and Urban Local bodies is also a major impediment in good Governance and accountability.

3 Twelfth Plan Approach

3.0. Twelfth Plan Approach Paper is based on the same objectives as in the in the Eleventh Plan. The focus is on Faster, Sustainable and More Inclusive Growth. On the basis of the analysis of the performance of Eleventh Plan and world economic Environment Twelfth Plan aims at 9% GDP growth. It also suggests alternative plan for achieving 9.5% GDP growth. Critical issues which have strong bearing for achieving 9% GDP growth have been highlighted here:

Energy Demand

3.1 The energy demand in terms of million tones of oil equivalent is projected to grow at 6.5%, i.e. from164.3 million tonnes in 2010-11 to 204.80 million tonnes in 2016-17 to achieve 9% GDP Growth. Oil imports is expected to grow from 76% in 2010-11 to 80% 2016-17; gas from 19% to 28.4% and coal from19.8% to 22%. Therefore, it has been suggested to moderate energy demand with focus on energy security through investment in other countries rich in such resources; energy pricing; energy efficiency; energy conservation through increased use public transport, transportation of freight by rail, expansion of gas supply network; use of high technology for ultra power generation units; and increase domestic production.

Oil and Gas

3.1.1 Oil and gas exploration policies under NELP were designed to achieve rapid expansion of domestic production with the involvement of private investors. So far 235 blocks have been awarded. However, the results achieved so far are disappointing. There has been some increase in crude oil production and a significant expansion of domestic gas output. However domestic production of both oil and gas needs to be significantly improved. ONGC's performance in increasing production, despite the allocation of a large number of blocks, has been disappointing. The international response to the recent NELP offers has been poor. It is necessary to re-examine whether the current policy provides a sufficiently attractive framework which can attract investors in this area. There is need for a stable long-term regime of fiscal incentives which is comparable to what exists elsewhere. The issue of pricing of natural gas and its linkage with international prices also need to be clarified if investors are to be attracted to this sector.

3.1.2 Non-conventional gas resources, particularly shale gas and also coal bed methane (CBM), have dramatically changed the supply scenario in the US. Similar developments are taking place elsewhere. A major thrust needs to be given to the identification of shale gas resources in India and the determination of the feasibility of exploiting them, which depends on several technical factors. Expansion of CBM should also receive priority attention. An effort to map available Shale gas resources is currently underway and is expected to be completed by the end of 2011.

3.1.3 As part of the focus on clean fuel approach, ethanol blending of 5 percent in petrol was initiated during Eleventh Plan and currently about 3–5 percent of ethanol is

blended in petrol. There is a need to expand the supply of bio-fuels, including bio-diesel, to reduce the dependence on imported oil. The share of bio-fuels, including bio-diesel and ethanol, needs to be increased during Twelfth Plan.

Grid Power

3.1.4 It is estimated that, in order to sustain GDP growth at 9 percent the demand for grid power will grow by 6 percent per annum to 1,200 billion units (Bu) by the end of the Twelfth Plan. If diesel/FO based captive generation is to be curtailed, as it should be for energy efficiency, we have to plan for grid supply of at least 1,350 Bu. The Twelfth Plan aims at capacity creation of about 100 GW, which will include 28 GW of capacity from projects which were supposed to be completed in the Eleventh Plan, but are now expected to be completed in the first two years of the Twelfth Plan. We must ensure that not only the spill-over projects from the Eleventh Plan are completed at the earliest, so that slippages in the capacity addition programme for the Twelfth Plan are minimised. In the Twelfth Plan this share is expected to increase further to about 50 percent. Since most of the new power capacity will consist of thermal plants, it is essential to ensure that coal availability does not become a constraint.

3.1.5 In addition, we should examine whether it is possible to back additional gas-based power capacity for initiation/completion during the Twelfth Plan, given the competing demand from the fertiliser sector.

3.1.5 Hydro power generation capacity potential, particularly, in the North East needs to be expedited. Increased share of nuclear power with proper safeguards would help in balancing power mix.

Transmission

3.1.6 In order to support the large expansion in production and consumption of electricity, transmission and distribution network will have to be significantly expanded and strengthened. It is important to build a policy framework within which more private sector investments which is lacking will be forthcoming in the Twelfth Plan. A special project on power evacuation from the North-East will have to be undertaken. The possibility of such lines passing through Bangladesh could be considered reflecting our mutually beneficial inter-dependence. Technological development for transmission lines of 765 KV and over 1,000/1,200 KV is of great relevance in order to reduce land requirement and also transmission losses.

Distribution

3.1.7 The distribution segment in the power sector is the weakest link in the power system due to non-implementation of the reforms and new policies by the SEBs. They have not made investments needed on the transmission side to reduce losses and have also not fully used the meters that have been installed under the meterization programme, to identify and rectify power leakage.

3.1.8 Since the financial viability of the power sector as a whole depends upon the revenues collected at the distribution end, it is absolutely vital that the distribution system is made financially viable during the Twelfth Plan. This can be done within the existing system of publicly owned distribution system by bringing in modern systems of management, use of IT, and enforcement of accountability. Another way is to go in for privatisation as some States have done. Delhi for example, has

privatised the distribution segment with good results in the term of reduction in T& D losses. Other states have resorted to "franchising" in which a private company takes over the management of the distribution system and collection of revenues on the basis of a predetermined revenue sharing model. Franchising has given good results in several areas, and the experiment is being replicated.

3.1.9 With new capacities being set up in different States, it is essential that we move to operationalise the Open Access policy. Although the introduction of Open Access has been mandated in the Electricity Act, 2003, there has been reluctance in the States to give freedom to customers having requirement of 1 MVA and above to choose their own sources of supply. This needs to be expedited so that power markets are widened and deepened.

Rural Electrification

3.1.10 Access to power has been particularly poor in rural habitations. It is desirable to try and universalize access of power during the Twelfth Plan and this requires dealing with the large backlog in the States of Uttar Pradesh, Bihar, Orissa and Assam and some of the other North East States. However for effective universal access, the RGGVY programme has to be restructured. Besides RGGVY focuses only on household supply and does not address the need for providing electricity for agriculture, which needs three phase supply. This in turn requires strengthening of the rural network. There are other schemes which provide electrical connectivity to people below poverty line. Solar lanterns have been distributed at subsidized rates. There is also an initiative for developing other resources of clean energy for both rural and urban consumption. These programmes need to be widened and strengthened.

Transport

3.2 Rapid growth needs to be supported by an efficient, reliable and safe transport system. This is especially important for an economy concerned about competitive-ness. On the basis of past experience in India, and the experience in other large economies, requirements of transport services are likely to grow significantly faster than overall GDP growth. Railway freight traffic elasticity is computed to be around 1.3. Civil aviation has grown by nearly 20 percent per annum in the Eleventh Plan. Road traffic volumes, as measured by the consumption of automotive fuel, have grown by about the same rate as overall GDP. The expansion of urban centres has triggered an enormous demand for dependable urban mass transit.

3.2.1 To meet these expanding demands large investments will be needed in roads, railways, ports and civil aviation sectors for augmentation of capacities and modernization. The public sector is expected to continue to play an important role in building transport infrastructure. Successful investment through Public-Private Partnership (PPP) mode will have to be expanded to support public sector resources. To improve management, the process of corporatization of ports, restructuring of NHAI and the setting up the National Expressway Authority, would have to be expedited. Organizational and institutional changes have to accompany large scale investments that are needed in the railways.

Roads

3.2.2 India has the second largest road network in the world totalling 4.2 million kms but most of it is of poor quality. Half the network is not paved and the National Highways account for only 2 percent of the total length. A start was made at giving a push to investment in roads in the Eleventh Plan. The NHDP-I (Golden Quadrilateral) and NHDP-II (North-South East West links) were started before the Eleventh Plan, but were effectively built in the Eleventh Plan. Small portions remain to be completed and these will be completed in the Twelfth Plan. In order to ensure the inter-connectivity of districts, work in various phases of NHDP-III, IV, V is to be progressively expanded. The more heavily trafficked part of this network has to be strengthened through conversion to six lane roads. In addition, a new programme for construction of roads in the North East was begun in the Eleventh Plan, including the proposed Trans-Arunachal Highway. Completion of this network in the North East, along with road connectivity to Myanmar and Bangladesh will help open up the North East to mutually beneficial economic cooperation with Southeast Asia.

3.2.3 A master plan for 18,637 kilometres of expressways, with new alignments for both passenger and freight movements in high traffic density corridors based on "access control toll" needs to be taken up. These roads will be either 4 or 6 lane. The proposed National Expressway Authority of India is expected to take the initiatives for both land acquisition and to get the work executed under BOT mode. A significant part of the existing NH consists of single-lane roads, which have suffered from a prolonged neglect. Their length is about 20,000 KM, which could increase further during the Twelfth Plan on account of expansion of the NH network. These single–lane national highways would have to be upgraded and augmented to two-lane standards. Due to economic viability considerations this has to be done by the Ministry of Road Transport and Highways on EPC basis for which resources would have to be mobilised through toll revenues, market borrowing and additional budgetary support.

Railways

3.3 Railways are very important part of any transport network especially for freight movement. They are much more energy efficient then road transport, with a much smaller carbon footprint. Indian Railways are one of the largest railways network in the world carrying 22 million passengers every day and carrying 923 million tonnes of freight a year. However, the quality of service provided leaves scope for substantial improvement in many areas. The average speed of trains is much lower than in other comparable countries. Railway safety is also an issue. The entire system is in urgent need of modernisation and this should have top priority in the Twelfth Plan. Railway modernisation will require a substantial increase in investments and in this context the financial performance of the system becomes crucial. The current revenue model of Railways is unsustainable. Private partnership will to be expanded. There is an urgent need for establishment of an independent Tariff Regulation Commission for the Railways to fix tariffs in order to depoliticise the Tariff setting process. This is essential if the Railway system is to be put on a financially viable basis.

4 Challenges of the Twelfth Plan

4.0 To achieve rapid growth, we have to overcome constraints and challenges experienced in the Eleventh Plan and those anticipated in the Twelfth Plan Approach Paper.

Micro, Small, and Medium Enterprises (MSME)

4.1 The Eleventh Plan has targeted growth in manufacturing at 10-11 percent but actual performance will be only about 7.7 percent. It is a matter of concern that the manufacturing sector has not shared in the dynamism of the economy not just in the XIth Plan, but even in preceding Plan periods. As a result, the share of the manufacturing sector in GDP is only 15 percent in India, compared with 34 percent in China and 40 percent in Thailand. The slow pace of growth of the manufacturing sector at this stage of India's development is not an acceptable outcome. The challenge is remove constraints with proper policy support: The constraints are:

- Limited energy supplies(electric power, petroleum & natural gas, coal)
- Bring improvement in the quality of power supply to facilitate competitiveness
- Special attention to MSME to enable them to not only provide large employment but also use their potential for innovation and entrepreneurship
- Deepening of credit facilities for MSME;
- Clustering of industries for better infrastructure support;
- Easing from plethora of regulations; and
- Find ways out to land acquisition and related problems.

Infrastructure Development

4.2 The cumulative investment in infrastructure in the Twelfth five year Plan is targeted at around $1 trillion. Nearly half of this investment will be channelized into construction projects. The challenges in infrastructure development are:

- Improve project management in PSUs particularly in power, roads and highways, ports and railways sectors
- Handling of coal imports of 230 Million Tons
- Improving of efficiency of power distribution system and further improve T&D losses (Rs 70,000 Crore in 2010-11)
- State electricity Boards to implement the energy policy by separating management of Generation, Transmission and Distribution
- Find ways to financial crisis of private investors to increase the share of PPP projects infrastructure development.
- Speed up broad band connectivity
- Find ways to increase private participation in the airport sector, AAI role may be oriented towards construction, management and regulation of airports and ATC may be given separate management
- Railways may have to find ways to increase pace of investment with the help of PPP projects, Joint Ventures to meet the high demand for freight and passenger movement. Business as usual will not bring development envisaged in the 20 year Vision of railways

Urban Infrastructure Development

4.3 The urban population is likely to increase to 50% of the total population in the next 25 years would pose serious challenges for engineers and technologists, some of these are:

- Meet firstly the deficiencies in services and create optimum infrastructure to meet future demand of the urban population in terms water supply, sewerage, solid waste management, urban transport and other basic facilities
- Provision of low cost housing for lower income groups
- Focus on long term planning with phased implementation keeping in view the time and resources required to develop urban infrastructure

Challenge of Sustainable Management of Natural Resource

4.4 As the economy gains the capacity to grow rapidly, it will come up against the constraint of limitations of natural resources and the need to exploit these in a sustainable manner. Sustainability has traditionally been viewed in terms of limiting the damage that economic activity imposes on the environment and remedying this damage as much as possible.

Environment

4.4.1 Challenges thrown up as a consequence of use of land, water and forest resources are:

- Environment protection for sustainable economic development and growth (air, water, and land)
- Serious environmental issues in coal mining need to be tackled as most of the coal lies under the forest belt
- Dealing with pollution of water particularly the pollution of rivers and ground water
- Management of industrial waste and dangerous chemicals
- Dealing with water pollution in rural areas caused by fertilizer run offs (particularly urea and decomposition pollutes 13 % of water in rural areas)
- Protection of natural forests is another critical challenge as these are linked to soil protection and watershed management

Water

4.4.2 The challenge is posed by the need to manage our water resources in a manner which enables the finite water resources to meet the growing demands of rapid growth are:

- A very little gap is left between availability of total annual quantity of usable fresh water which is fixed and utilisation of water
- Meeting increasing demand for agriculture and other sectors
- Water resources in many parts of the country are under serious stress leading to excessive exploitation of ground water
- The challenge is to bring greater efficiency in water use (Agriculture accounts for 80% of water use, there is considerable scope for increasing efficiency in water use in this area)
- Better management of command areas of large and medium irrigation projects
- Need for a more aquifer management strategies
- Separation of electricity feeders for agriculture and domestic use as part of

the watershed programme to limit the availability of free electricity for pumping ground water

Measures suggested in the Twelfth Plan Approach Paper are highly economic-political sensitive such as: pricing for various purposes, separate waterline for lifeline water supply etc.

Land

4.4.3 Availability of land for infrastructure development of mineral resources, industrialisation, and urbanisation would remain a serious constraint unless land laws are streamlined and land record management system is modernised. The challenges which need to be addressed are:

- Present land acquisition process is complex, often unfair and non-transparent
- Modern law is needed to govern the acquisition of land for infrastructure, and industrial development and urbanisation. Government has taken up these issues which have been hanging for more than a decade.

Implementation

4.4.4 Delay in implementation of Projects and Programmes poses serious bottleneck in providing necessary infrastructure and services and impinges the growth of the economy. The challenges which need be tackled are:

- Better implementation and accountability is a important factor in timely completion of projects and with in the estimated/ approved costs
- Implementation of projects in industry, infrastructure and urban development are held up for variety of reasons and requires proper co-ordination mechanism.
- Improvement of project management capabilities to get faster and better returns from the public investment in infrastructure and also in social sector
- Project management, a learnable capability that can be institutionalised as demonstrated by development experiences of Japan, Korea, Singapore and China.
- A nationwide drive to improve PM is Proposed to be the part of Twelfth Plan

Governance

4.4.5 It is also true that the schemes continue to be implemented in a business-as usual mode, while what is demanded by these programmes is an innovative break with the past. The challenges need to be tackled are:

- The implementation of the Flagship Programmes which constitute nearly 90% of the expenditure on Centrally Sponsored Schemes (CSS). Expenditure on such schemes in the Eleventh Plan is of the order of 100, 000 crore.
- Improvement in implementation would require multifaceted approach relying on professionalisation of public service delivery, total quality management, innovative use of IT and other technologies with proper monitoring and supervision.
- It can also be improved through greater emphasis on social mobilisation and capacity building of local institutions like Panchayati Raj Institutions (PRIs), Municipal Corporations, deeper partnership with civil society organisations and the community
- Strengthen legal process to remove corruption and consequential delays in implementation

5 Role of Engineers and Technologists

5.0 National economic development is the outcome of the efforts of the whole society, including Central and State Governments, politicians, economists, engineers, scientists, technologists, financial institutions, local Governments and public bodies, societies, private and public sector corporate enterprises, MSMEs, service institutions and the communities. Historically the advanced countries have grown faster than others with strong industrial and technological base, infrastructure and urban development supported by innovations made by engineers and technologists in efficient use of natural resources, minerals and maintenance of environment impacts to a sustainable level.

5.1 India's economic development process is continuously challenged by the challenges in implementation of the plan but also its commitment to international bodies line UN, WHO, UN Environment Drive to fight impact of the climate change caused by the worldwide industrialisation, carbon emissions from transport, fossil fuel burning etc. Role of engineers and technologists in these areas assumes greater responsibility as servicing to these protocols require large amount of financial and other resources. Engineers and technologists have to design projects by using appropriate technology to reduce costs and also by applying Clean Development Mechanism (CDM) and use Carbon Credits (CC) particularly in rural projects to reduce carbon dioxide emissions/ green house emissions. These efforts will not only provide clean energy for cooking in rural areas but also help reduce poverty with low cost energy and carbon credit benefits.

Capacity Building

5.2 If we look at the challenges, experienced in the achievement of the Eleventh Plan and those perceived in the Twelfth Plan Approach Paper, it clearly brings out the inadequate capacity issues on several fronts which has given rise to variety of factors causing constraints and consequential delays. This is a vast subject to comprehend as capacity building has different dimensions in each sector, be it social, economic, or natural resources. Some of the important areas of capacity building emerging from the challenges in the Eleventh Plan and those perceived in the Twelfth Approach Paper are:

- R&D capacity for innovation, engineering and transfer of technology
- Project Management
- Environment and Climate Change Management
- Urban development planning and urban infrastructure development
- Capacity development to increase PPP investments
- Capacity development for the use of IT for Governance, accountability, and transparency
- Capacity development for tapping of non-conventional energy sources

- Capacity to produce electric power with proper mix of hydro, thermal, nuclear power and non- conventional energy to meet demand. This will cut environmental pollution and help in managing impact of climate change.
- Capacity to produce energy efficient equipment, machinery, home appliances, transport vehicles which must be governed by proper regulation.

Non- Conventional Energy

5.3 Technological development and engineering limitations has posed a serious constraint for exploiting non-conventional energy. This calls for a huge effort from the engineers and technologists for capacity building. The potential for such generation is clearly higher than current estimates of about 50 GW. Appropriate measures must be devised to strengthen a policy framework to use this. In order to make solar power a success in the coming decades, it is vital that we develop the necessary domestic S&T capacity such that we can collaborate as peers with the rest of the global community. A basic problem with most renewable energy sources is that they are significantly more expensive than conventional power. However, technological developments are reducing the cost of renewable generation and it is widely predicted that by 2019 the cost of solar electricity generation, which is currently six times higher than coal based electricity will come down to be approximately equal to the latter.

Nuclear Power

5.4 Nuclear Power is pollution free. Initial investment is comparatively high but in the long run generation cost is low. Recent Government initiative to ensure availability of nuclear fuel would lead to energy efficient generation of electric power. The capacity developments for nuclear power generation and at the same time provide safeguards against nuclear emission are challenges for engineers and technologists.

Work Force

5.5 India's young age structure offers a potential demographic dividend for growth, but this potential will be realised only if the extent and quality of education and skill development among new entrants to the workforce is greatly enhanced. The total number of young working-age (15-24) people who continued in educational institutions doubled from about 30 million in 2004-05 to over 60 million in 2009-10 which is a healthy sign. The Twelfth Plan challenge is to create employment, as unemployment rate though reduced, was 6.60 percent in 2009-10.

Health

5.6 The Eleventh Plan had drawn attention to the fact that India's health outcome indicators continue to be weaker than they should be, at our level of development. The parameters relating to infant mortality (IMR), maternal mortality (MMR), institutionalised delivery, extent of full immunisation, show some improvement. The Infant mortality Rate (IMR) has fallen from 57 in 2006 to 50 in 2009. The percentage of deliveries in institutions has increased from 54 percent in 2006 to 73 percent in 2009, while the Maternal Mortality Rate (MMR) has come down by 32 points to 212 (2007-2009). These are marked improvements but their rate of decline is lower than what is needed for achieving the


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relevant targets. Regardless, a larger allocation of resources will definitely be needed in the Twelfth Plan to achieve the objective. We should aim to increase total health expenditure as percentage of GDP to 2.5 percent by the end of Twelfth Plan as against 1 percent in the Eleventh Plan.

5.6.1 Shortage of health professionals at all levels has become a serious impediment to achieving an expansion in the public provision of health services. There has been inadequate attention to improving our education and training capacities in this area. There are also problems of accountability of personnel even when these are recruited. These lacunae will take time to rectify, but the Twelfth Plan must give a special emphasis to solve this problem.

Education

5.7 The Eleventh Plan had articulated the need for expanding educational facilities and improving quality of education, as key instruments for achieving faster and inclusive growth.

There has been notable success in expanding capacity but the challenge of raising quality still persists. The Right to Education (RTE) Act, which became operational in 2009, has laid a solid foundation on which we need to build. It is not unreasonable to state that access is now more or less universalised. The challenge now is to improve the quality of education and expand capacity at all levels. The Eleventh Plan had outlined a three fold strategy of expansion, equity and excellence for higher education. The Central Government introduced a programme of creating new Central Universities and other institutions of higher learning in the Eleventh Plan. This effort has begun, but it will have to be continued into the Twelfth Plan period to reach its full potential. Revitalisation of the State Universities and Colleges is also critical. These universities suffer from under funding by State Governments with as many as 50 percent of faculty positions unfilled, forcing frequent resort to contract teachers and an adverse impact on the quality of teaching. The private sector participation is lacking quality. Minimum standards will have to be ensured. But free entry will, in the end, automatically weed out the poor quality institutions. Private initiatives in higher education, including viable and innovative PPP-models, will therefore be actively promoted. The current "not-for-profit" prescription in the education sector should be re-examined in a pragmatic manner so as to ensure quality, but without losing focus on equity.

6 Prospects of the Twelfth Plan

6.0 Global economic conditions are very uncertain and energy prices are likely to remain high. To achieve rapid growth, the economy will have to overcome constraints posed by limited energy supplies, increase in water scarcity, shortages in infrastructure, problems of land acquisition for industrial development and infrastructure, and the complex problem of managing the urban transition associated with rapid growth.

6.1 Greater efforts also need to be made in agriculture, health and education to ensure inclusion of the most excluded and sometimes invisible parts of our population. This cannot be done by following a business-as-usual approach. All sections of society – government, farmers, businesses, labour and concerned citizens – have to adopt newer, more effective ways of pursuing their activities, so that we can collectively achieve our lofty goals.

Annexure 1

Projection of Centre's Resources for the Twelfth Five Year Plan (2012-17)
(Figures in Rs Crore at Current Prices)

Sl No	Description	2011-12 (BE) Base Year	2012-13	2013-14	20014-15	2015-16	2016-17	12 th Plan
1	Tax revenue net to centre	664,457	837,216	1,004,659	1,175,451	1,363,523	1,574,869	5,955,718
2.	Non-Tax revenue	125,435	112,620	128,387	146,361	151,683	155,627	694,678
3.	Non- Debt capital Receipts	55,020	56,027	54,471	55,178	55,930	56,785	278,391
4.	Fiscal Deficit	412,817	421,606	412,095	404,441	463,085	530,233	2,231,461
5.	Aggregate Resources(1 +2+3+4)	1,257,729	1,427,469	1,599,612	1,781,431	2,034,222	2,034,222	9,160,248
6	Non-Plan expenditure	816,182	921,082	1,016,307	1,109,819	1,208,801	1,300,879	5,556,888
7.	Gross Budgetary support for Plan	441,547	506,387	583,305	671,612	825,421	1,016,635	3,603,360
7a	Central assistance to States/UTs	106,026	121,930	140,219	161,252	191,890	230,268	845,558
7b	Central Pan	335,521	384,458	443,086	510,361	633,531	786,367	2,757,802
8.	IEBR	256,936	293,641	335,589	383,531	438,321	500,938	1,952,020
9.	Plan Resources for the Centre	592,457	678,099	778,675	893,892	1,071,852	1,287,305	4,709,822
10.	Gross Domestic Product	8,980,860	10,383,085	11,774,132	13,481,381	15,436,181	17,674,428	68,649,207

Note : *These figures are tentative and subject to revision when the final report of the Working Group on Centre's Resources for the Twelfth Plan become available.*

Annexure 2

Projection of Centre's Resources for the Twelfth Five Year Plan (as percent of GDP)*

Sl No	Description	2011-12 (BE) Base Year	2012-13	2013-14	20014-15	2015-16	2016-17	12 th Plan average
1	Tax revenue net to centre	7.40	8.14	8.53	8.72	8.83	8.91	8.86
2.	Non-Tax revenue	1.40	1.10	1.09	1.09	0.98	0.88	1.01
3.	Non- Debt capital Receipts	0.60	0.54	0.46	0.41	0.36	0.32	0.41
4.	Fiscal Deficit	4.60	4.10	3.50	3.00	3.00	3.00	3.25
5.	Aggregate Resources(1+2+3+4)	14.00	13.88	13.59	13.21	13.18	13.11	13.34
6	Non-Plan expenditure	9.09	8.96	8.63	8.23	7.83	7.36	8.09
7.	Gross Budgetary support for Plan	4.92	4.92	4.95	4.98	5.35	5.75	5.25
7a	Central assistance to States/UTs	1.18	1.18	1.19	1.20	1.25	1.30	1.23
7b	Central Pan	3,74	3.74	3.76	3.78	4.10	4.45	4.02
8.	IEBR	2.86	2.86	2.85	2.84	2.84	2.83	2.84
9.	Plan Resources for the Centre	6.60	6.59	6.61	6.63	6.94	7.28	6.86

**The projections here assume 9 percent real GDP growth and 5 percent inflation in terms of GDP deflator.*

Conference Papers

An Ideal Model And Practical Approach To Holistic & Integrated Rural Development & Industrialisation

K. K. Agrawal*

The Most Important & Coveted Infrastructure to be Prioritised for Action

Theme Objectives of the Proposal :

"HOLISTIC APPROACH TO RURAL DEVELOPMENT"

"NO DOLES OR FREEBIES TO ANYONE EXCEPT LOAN ON RETURNABLE BASIS"

"NO EXTRA FINANCIAL LIABILITY TO GOVT., BARRING ITS PLAN RESPONSIBILITY & REGULATORY MECHANISM"

"REVERSING POPULATION MIGRATION FROM RURAL TO URBAN AREAS"

"AFFORDING MODEST LIVING TO ENTIRE RURAL POPULATION"

"ROLE & RESPONSIBILITY OF SOCIETY AS A WHOLE"

"POSITIVE & FAVOURABLE RURAL ENVIRONMENT FOR INDUSTRIALISATION"

"EXPONENTIAL GROWTH OF INDIA'S GDP AT LARGE"

Statement of Problem & Remedy Suggested – Task is Formidable yet Executable

Synopsis:

The overall conditions in India's rural areas are abysmally poor for a common villager in all aspects of habitation. Rural population accounts for about 60% of total India's population and 70% of that are in abject poverty. It appears to be belying the Creator's aim of human birth as the most exalted and most novel of the entire creation, calling for every human being to have opportunity to have minimum facilities to grow, develop and exist and to achieve the aims of this human birth.

Near total lack (barring sporadic provisions) of housing, basic infrastructure like water, electricity, public hygiene, roads, education, health care, telecommunication and entertainment facilities are part of lowest common multiple and highest common deprivation amongst villages in almost all regions.

Lack of organized industry development, inadequate agricultural infrastructure like irrigation, and non availability of application of Agricultural Development, Research and Technology at common man's level cause mass scale malady of unemployment, poor agro-output and resultant poverty.

Green cover is eroded on account of uncontrolled continuous deforestation with almost non-existent replacement plantation. Recovery or utilization and development of wastelands has practically not been attempted on an economic scale despite utilization potential for cash crops leading to bio-diesel type of products for which technology is duly available.

Solutions to meet the natural calamities like earthquakes, floods, cyclones Etc. are far from having been evolved for tackling, remedying and managing the natural disasters; any organized disaster management is almost missing.

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There is very large chunk of population in the rural areas, who do not get even their two (and large many even single) square meals; clothing and shelter being a far cry. Hunger and lack of even the most basic amenities cause total demoralization. Migration to cities takes place for greener pastures, causing slums in urban areas.

Government's very many help and aid programs from time to time have resulted into hardly any appreciable change in the situation, with acceptable wide belief that the financial help and assistance hardly reach the target poor. The schemes remain adjectives of political performance and later find place in archives of political glory.

Poverty remains the main portal of reality. This long deprivation / starvation has caused erosion of the value system in the society, globally in the entire country. The rural beneficiaries, abjectly poor as they are, have got used to eat / drink away whatever little of aid reaches them, having lost the meaning / importance of the aid money, not hard earned by them.

Spirituality and morality are virtually missing in the society at large, causing apparently a total social chaos. What value system can be expected, in people in rural scenario, with hungry stomachs and unending deprivations. False side of political democracy has predominantly taken over in terms of spreading large scale corruption and individual values on very fast decline amongst all rungs of population, irrespective of class/cast/creed/rung of the society – educated or otherwise – rich or poor – in service or in business – in politics or in bureaucracy.

Resurrection calls for many a formidable "Samudra Manthan" for reversion to what may be called normalcy. Very large scale efforts are called for right type of education and a minimum standard of living to one and all, specially to the larger percentage of population living in rural part of the country in such impoverished conditions.

An evolved solution is proposed to bring about an integrated and holistic approach addressing majority of the problems simultaneously. Underlying concept is that nothing has to be given free or as a dole to any one except aid on repayment basis. What is required is proper direction, guidance, support and leadership, in addition to moral and administrative support from the local administration, and may be an objective "regulatory mechanism".

Any such schemes and suggestions for a serious planning and implementation have essentially to involve the rural population at large in the planning, implementation and management. Subjectivities, if and any, need to be addressed, initially once and repated continuously alongside the implementation of the suggested solution until the whole mechanism is detailed and firmed up.

The proposed system, when detailed and implemented, will cause boosting of morale and morals and automatic empowerment to the people in rural sector and will yield a situation of reversal of migration of rural population to urban areas, thereby reducing undue pressures on cities.

Hence, there is a huge role, responsibility and challenge to the Society at large and to Intelligencia in particular; and this transformation will be adding a huge value to the society at large and rural social sector in particular finally becoming a harbinger of an exponential prosperity in the country.

While the topic is wide open for discussions on developing the detailed mechanics, financial and management system and control and regulatory mechanism to arrive at a fast track concrete manual of working with a program of implementation, suggestion outlines are made by the Author as contributory.

The task is formidable, challenges are far too many and complex due to near total demoralization, mass scale depression/ frustration and corruption, lowest level of political exploitation. The scale of perversion, having caused phenomena of 'Naxal movement' and local uprising in various areas like north-east giving rise to apparently law and order chaos, will be a big challenge.

The contribution of bodies like ASSOCHAM, FICCI, various Business people, Etc. And Industry organizations along with those of major planning bodies, social engineering and agriculture extension,

have to come forth on crusadic initiative and speed and absolutely uninhibited. Planning has to be thoroughly detailed. The implementation may appear to be an uphill task, yet once put on rail, there will be no looking back.

The loan financing will have to be huge, though it will all be, essentially, in form of returnable loans on very soft terms. The "Micro-financing loan schemes", "Capital Fund for Soft Loans" and the schemes likewise need to be encouraged with regulatory controls. For common infrastructure, viz., Roads / Public Health system / Educational infrastructure / Health infrastructure/Agriculture extension infrastructure, Etc. will have to be funded through state and central Governments scheme capital assistance, donated funds by Business and Industry, and the like institutions.

These have to be worked out in detail and a well thought out system with regulatory mechanism and overseeing control systems in place with strict Audit monitoring.

It has to be acknowledged that rural sector's comprehensive growth and development, as proposed and planned above, will be the answer to India's real development in order to achieve developed nation's status by 2020.

Prelude : Broad Description of the Existing Rural Scenario :

Large part of the rural segment in our country continues to be under-developed, deprived and afflicted with extreme poverty, suffering from near non availability of very basic amenities and minimum requirements for a normal human life and habitation.

The afflictions in rural areas, at large, are enumerated as follows.

- Lack of organized, comfortable and affordable "Housing and clean Habitation and ambient Environment" ;
- Lack of basic Amenities like "Water, Electricity, Sewerage/Drainage/Public Hygiene";
- Lack of "village Roads" and "roads and communication network with other Villages and Cities";
- Lack of "organized and objective Education"; absence of "Vocational Orientation in the Education system"; and near absence of "Adult Education", the latter despite a long existing Government scheme / program of adult education ;
- Lack of "basic Health and Maternity Facilities" and "Health Extension infrastructure";
- Lack of systematic guidance on use of "advanced Agriculture Methods", almost non-existent "Agriculture Extension" and in most areas lack of "Application of new Techniques through transfer of Technology";
- Lack of Awareness and Education of and Extension on "development of local Arts and Handicrafts"; and lack of encouragement and motivation to the 'Artisans to keep alive the now old traditional dying Arts' as viable means of 'earnings and sustenance' as well as 'to keep the dying arts alive' ;
- Absence of 'Employment Opportunities' and lack of 'Generation of Employment' ;
- Virtual Absence of 'short term and long term steps and infrastructure for mitigation of Natural Disasters; and Lack of disaster management education / know-how and awareness';
- Lack of 'Industrial Growth and localized production' of even for those materials and Items which are required for day to day use in the development process like the consumer items, building industry Items, agriculture machinery, Etc. ;

- Lack of 'Water Shed development programs, Rain Water Harvesting, Conservation of Water, Recharging of Under ground water', Etc. ;
- Lack of organized 'Entertainment' leading to Healthy growth of the Rural Population, specially the children and the youth ;
- Lack of 'Community Development and Harmony and Brotherhood' by too much of perversion caused by ill effects of the vote bank and caste/communal oriented politics, exploiting communal passions and affecting the Harmony of living together ;
- Continued 'Deforestation and total Lack of new Plantation' and 'lack of any systematic remedial program of forestation and creating a green cover' ;
- Total Lack of 'Technology Transfer and Extension Programs' in use of 'Horticulture, Floriculture and other Agro based Employment and Resource generation potential, Gobar Gas Applications, Exploitation of Non-Conventional Energy Applications, like Solar energy, Geo-thermal heat pumps, Wind Energy applications, Generation of Manures and Composts from waste products like house-hold waste, fallen leaves, agriculture waste otherwise not useable, Etc. All of these can auger growth and Development of the Villages and its Population ;
- Lack of marketing facilities for the local produce through cooperative efforts of the village people for creating a suitable infrastructure for direct marketing and sale of produce and handicrafts Etc. ;
- Lack of application of certain good Govt. sponsored programs in the field of population growth, health care programs, developmental programs Etc.;
- Lack of empowerment of any type; and affliction with highly dogmatic social beliefs and practices ;
- Lack of spiritual development causing highly deteriorating personal character, badly bruised personal value system of a large population in cities, towns and villages and lack of moral education to children and to others.

All this is leading to: a) more and more poverty, b) very bad look of the rural side of India despite any amount of statistics to project it otherwise, and c) mass scale migration of the huge hungry and misdirected population to cities and urban areas where their living conditions are hellish and undescribably bad, usually termed as slums.

The highly polarized political system in India, wide spread and rampant corruption in almost all segments of Indian society (be it urban or rural), and character perversion are some of the reasons of this state of affairs. It has once been admitted, as long back as in mid-eighties by as high as a Prime Minister that out of a rupee going into development, even 16 paise (16% of development investment) was hardly going to the advantage of the end user, and that too with a highly uneven distribution. Perhaps the situation has further deteriorated by now.

The rural side of the country is going from bad to worse due to resulting and growing criminalization, negative politicization, increasing disparity, showing a negative growth rate rather than it should have been otherwise. The villages, largely, are not even worth visiting by any one from within the country. The so called welfare schemes are not able to make any dent since hardly anything of the aid meant for rural people reaches them.

Solution Model Suggested for Integrated & Holistic Development Tackling all Issues Simultaneously without Government Funding – Outline of :

It is the ultimate aim and objective that, every one in rural and semi-urban areas of the country, without exception, must possess and own the very basic and essential requirements that human beings need for individual/family sustenance in their respective habitats, detailed as follows.

It is also tacitly assumed, as also elaborated later, that no one gets any resources for free so that an ownership and value is duly felt and sense of personal pride and self respect / esteem is retained. This, enhanced by education and financial and social security, will go a long way in developing a value system and character in people at large.

- Housing for each family – safe, durable, cost effective, comfortable and disaster resistant – on a minimum size of land plot;
- Adequate water supply, power supply, sewerage and drainage systems including subsoil water recharging through rain water harvesting;
- Approach Roads and Storm water drainage;
- Adequate compulsory and free Education for boys, girls and illiterate adults with essential and compulsory vocationalisation from primary to secondary level – and covering essential education on moral values and spirituality ;
- Extension programs for agriculture extension, organized afforestation and waste land recovery and utilization; environmental and ecological orientation; agro-based and handicrafts based employment oriented trades & skills development programs for self employment;
- Adequacy in Health, Health care and (personal & public) Hygiene ;
- Inducing local Industrial development and infusing co-operative based programs like Dairy development, Bio-diesel oriented plantations, local product marketing through co-operative system .

The goal is very ambitious with large number of problems to be tackled along with, yet it is achievable, detailed planning and implementation, efficient management plan, optimism and faith, and above all honesty and cooperation, with strong will and undaunted optimism.

As aforesaid and reiterated, the basic and essential premise in making/proposing these solutions is that no non-returnable financial aid or dole is to be given to any one in the process of improvement of their lot. The financial aid should be in the form of a loan repayable in soft terms and low rates of interest. This recovery of loans will cause re-circulation of input funding on a continuing basis. This will help in creating a self respect and pride amongst the beneficiary people at large. Thus, approach will be to achieve communistic upliftment using capitalistic principles and methodologies creating ownership amongst and sharing of benefits and profits by the people themselves leading finally to empowerment to the people.

It will be seen that the process may call for a great deal of will, planning, preparatory work, organizing, coordinating, bringing the people around to the idea and benefits arising, time, initial resources as capital funds (which will rotate by themselves in the process and will generate profits), manpower and organization, search and transfer of available technologies and consultancy expertise for field application, and above all an overall leadership in total implementation. However, a lot of optimism will have to be stored and restored from time to time,

as it will really be a process of successes, failures and successes.

Fortunately, the various reigning Governments have, and from time to time, come out with a lot of schemes with provision of funding for upliftment of rural sector but hardly tangible success can be attributed to these. However, these could well be integrated, at best, with the present proposals and, if possible, can be used as seed funding in the suggested model of development with an advantage that this funding will regenerate for making this as a continuing process.

Brief Outline Details of the Proposed Solution Model :

The above are further elaborated and detailed, seriatim, in later below, along with the associated issues and operational mechanics, at large.

1. Housing on suitable minimum sized plots:

1.1 The Houses should be safe, durable, comfortable in local climatic conditions and stable against locally anticipated natural disasters, and with reasonable life span. The house plot area should be minimum yet adequate. A large variation in designs are possible based on locally available materials, local climate and cost effectiveness. Proper town planning inputs by expert consultants is called for. The following types are few design/ construction types amongst many – just for brain storming.

- Bamboo based houses in one or two storeys with sloping roofs in clay tiles or thatch or sheeting designed for 25 years or more life expectancy;
- Load bearing brick /stone masonry walls in one or two storeys with sloping roofs in clay tiles or thatch or sheeting designed for about 40 years or more life expectancy; The seismic measures must be adopted in all the load bearing constructions.
- RCC framed system with panel walls in one or two storeys with sloping roofs in clay tiles or thatch or sheeting designed for about 50 years or more life expectancy;

1.2 The planning shall be based on the principles of habitat planning based on the local culture, climate and ambience.

1.3 The designs will be resistant to local anticipated disasters like earthquakes, winds and cyclones, heavy rains and floods, even tsunamis in coastal zones and will cater to adequate sheltering in case of unforeseen levels of natural disasters;

1.4 The house construction activity will call for mobilization of design and construction consultancy services of experts, which has to be made available to achieve functionality, safety, economy and cost effectiveness using the latest technology in buildings design and construction;

1.5 This building activity will give rise to considerable employment to local labour and artisans as well as will develop the production/transportation and trade activity for building materials. Efforts must be made to localize the production/ manufacturing activity based on economic feasibility. This will bring about localized industrial activity in various rural regions of the country adding employment opportunities and prosperity.

1.6 Suitable space for the live-stock / domestic animals like cows/buffalows/bullocks, will have to be part of the housing plot area.

1.7 Adequate water supply and electricity supply; the latter using renewable / non-conventional energy applications.

1.8 Suitable drainage / sanitation, rain-water harvesting and hygiene planning.

1.9 Suitable space for kitchen garden and small size fruit trees, essentially to be planted and reared to be used by the house owner.

1.10 Space for Gobar gas plant, for each house if the cattle-stock is enough or for more than one house.

1.11 The cost of land, if not already owned by a person, is to be borne by him. The land needs to be provided and the price has to be minimal on non profit basis. Land plots for housing can be subject to consolidation based on habitation planning by professionals Planners / Consultants for each habitation, irrespective of size. The local Administration has to step in to ensure this aspect by (enactments, if required) and enforcement.

1.12 The nominal reasonable fees, for providing consultancy advice on planning, designing and construction, may also be charged. The local people will be trained, for providing such services, by hiring professionals and by transfer of available building and construction technologies; and these trained professionals will be put to help these beneficiaries.

1.13 The people, who need funding, will be provided with the funds on loan basis on soft interest rates and repayment schemes with the proviso that repayment would start within 6 months of funding. Let the people decide the design to be adopted, its mechanics of construction and extent of their own inputs, based on the extent of loan availed based on their capability of repayment.

1.14 Such an effort will call for development of local industry in building materials and will generate employment and development. This will also call for use of local artisans and technical inputs which will generate huge potential for employment and training.

1.15 The house hold furniture and utility articles will add to the business activity in the local markets. The general standards of living will get revolutionize, over a period of time. The local people must be encouraged to start these industrial / business / trade ventures.

1.16 A lot of training activity has to be planned and provided to the local people by specialists and Consultants from the cities. The NGO's could also be developed and involved, using, as far as possible, the local manpower.

1.17 This will, in effect, lead towards process of empowerment directly or indirectly.

2. Services Infrastructure like Electricity, Water supply, Sewage disposal/ treatment, Drainage, Roads

2.1 Adequate electric power generation / distribution; with optimum use and application of non conventional energy sources like Solar energy, Geo-thermal energy, Wind energy, Bio-mass, Domestic solid waste & Animal organic waste conversion Etc.

2.2 Adequate and potable water supply with necessary and suitable distribution system;

2.3 Using the methods of water shed management where required;

2.4 Sewage disposal and treatment with effective utilisation of the treated effluent for irrigation, development of fisheries, Etc.;

2.5 Storm water drainage and drainage of non-sanitary fluid waste from bath, kitchen and

the like areas (called sullage) and treatment with effective utilisation of the treated effluent for irrigation, re-charge of subsoil on principles of rain water harvesting, Etc.;

2.6 Roads and paths within the village and approaches to the village connecting the main public road;

2.7 External sanitation and public hygiene;

2.8 Road side tree plantation using useful trees, fruit bearing trees, evergreen shading trees, Etc;

2.9 Grassing and greening of the habitat neighbourhoods as well as spaces around common utilities;

2.10 Road lighting using the solar powered light fittings

3. Education, General Development / Agro-Extension Programs & Vocational Training:

3.1 Provision of Primary schools and secondary schools depending upon the population of the village, making education compulsory for all children upto the age of 16/18 years.

3.2 Adult education programs, on part time basis in the evenings / nights, can be run in the same school buildings.

3.3 The school education will have a major element of vocationalisation imparting education / courses / training / practice on local common Crafts, handicrafts, Cottage Industry trades, Sewing and Knitting, and many other skills useful for skill development of children with the objective of making them suitable for self employment along with studies but essentially in case of unavoidable drop-outs. Till they remain in schools, children can produce on amateur basis and earn by an organized marketing efforts by a team of local villagers under expert consultant's guidance and advice.

3.4 The same will also be used up for vocational training to the adult education participants, specially the women, to make them self-earning; using a similar mechanism of marketing as in aforesaid para.

3.5 There should be schools for Agricultural Extension programs to impart knowledge on new and modern agriculture methods, either in separate center or in community centers, location depending upon clustering of villages based on population.

3.6 There can be training facilities (the centers may as well be part of agriculture extension programs) for Agro based employment trades like fisheries, Sericulture, Honey-bee keeping, Poultry, Etc. and other Local existing and other handicrafts, which are slowly getting extinct, like Handlooms and weaving, small scale weaving, Potteries, metal crafts, bamboo crafts, wood crafts, Etc.

3.7 Engineering Institutions including Polytechnics and ITI's, Medical Institutions including Nursing and other non-clinical course programs, Rural Management Institutes including non traditional teaching course programs like Dairy and Animal Husbandry, Cottage/Artifacts and Handloom Development/Production, Environmental/Ecological systems, Etc., and Agricultural Universities/Colleges with special associated subjects like Water Shed Management Etc., must be located in rural areas based on population, to cater to the rural population and their requirements.

3.8 Extensive and systematic (suitable variety and type) Tree Plantation program can be undertaken in the land areas lying vacant,

land areas which are alkaline or saline or otherwise not fit for normal agriculture, road side plantation by allotting certain numbers (say 500 to 1000 per unemployed family) with guidance for plantation, nurturing and maintenance for certain period, to the unemployed rural population on compensation basis with the responsibility and condition on assuring mortality of plants and their healthy growth.

3.9 Center for art and culture like music, dance and drama Etc. as essential feature of extra-curricular activity of education.

3.10 Centre for games, sports, gymnastics, yogic exercise training Etc. as essential feature of extra-curricular activity of education.

3.11 The mechanics of funding the operation, management and ownership of the buildings and infrastructure for various purposes needs to be planned. As part of Govt. scheme of free education to all, funds can flow from the Govt. The practice of self earning through compulsory earning through vocational activity should be encouraged so that these children can participate in funding their education partly.

3.12 Subsidy culture will not be encouraged or promoted. However, development of infrastructure for education and extension programmes on education or part of any of the above mentioned activity can be out of donations from the private organizational sponsors, as only one time investment, or partially by the state or alternative funding mechanism.

3.13 The problem of teachers / trainers / special skilled vocational craftmen Etc. can be tackled by picking up local people and providing them special training programs by special Consultancy groups and / or NGO's. The training in Agro-extension programs and Agro-based trades, help and assistance can be sought from nearest Agricultural universities, colleges and research institutes. This will provide huge opportunity and potential of employment.

3.14 The management team for all the above should have, predominantly local panchayat and residents of participating villages, along with specialists, Consultants and essentially local Administration. It should be ensured that red-tapism has to be done away with, objectivity brought in and honesty of approach and positive attitude are the key words.

These are enumerated for guideline since each and every facility may not be provided in all the villages; selection of various items can be made, as area specific, depending upon local populace, easily available facilities and potential of the place, for locating various facilities at various places. Certain facilities will cater to a cluster of villages for its viability.

4. Agriculture and Agro based Industry

4.1 With the help of the state Agriculture teaching and research centers, an interaction of research by way of transfer of technology, can be brought about and extension programmes. This may lead to educated persons of the village to undergo courses in the centers meant for the purpose, as mentioned at 3.4 above, who in turn can train the villagers to improve their agriculture practices, including introduction of mechanisation in agriculture.

4.2 Similarly, training can be got imparted in Agro based commercial trades at centers as mentioned at 3.5 above, and these trained people can in turn and will initiate these practices amongst the villagers.

4.3 A center for storage and sale of cultivated seeds, fertilisers and agriculture machinery can be started by few trained persons of the village and can sell at optimal profit to the villagers.

4.4 Extensive and systematic (suitable variety and type) Tree Plantation program can be undertaken in the land areas lying vacant, land areas which are alkaline or saline or otherwise not fit for normal agriculture, road side plantation by allotting certain numbers (say 500 to 1000 per unemployed family) with guidance for plantation, nurturing and maintenance for certain period, to the unemployed rural population on compensation basis with the responsibility and condition on assuring mortality of plants and their healthy growth. The tree plantation can also be for the useful and cash earning trees yielding rich returns.

4.5 The agricultural plot boundary area can be used for specialized plantations like fruits, medicinal plants, and other cash crops. This will also improve the ecology and environment, and will become a source of additional fiscal benefits to the rural society and will yield huge employment to the villagers simultaneously increasing the a) green cover, b) protection against natural calamities in many areas, c) yield in terms of cash crops of fruits, timber, medicinal plants and other bye-products.

4.6 Certain parts of land area can also be used up for oil seeds which are used for variety of purpose including synthetic conversion into high value products like bio-diesel, use into soap industry, edible oils like Palm oil, Etc.

5. Development of Local Industry & Trade, Cooperative Programmes:

5.1 There is a great potential of the local industry to develop and flourish. For example, the various items of construction of housing and infra-structure, like bricks, doors/windows, pre-cast concrete elements, roofing tiles of clay, steel items like window grills, gates Etc, fabrication items relating to various provisions in infrastructure construction, can all be locally promoted and set up by local people and in absence of sufficient entrepreneurship, outsiders can be inducted. The sale/supply can be made on optimal profits making thus the materials and various items cheaper in price.

5.2 Dairy and dairy products industry can be promoted by a group of entrepreneurs and mechanism can be evolved for purchase of local milk supply from villagers on cooperative basis or otherwise so that they can be assured of fair and optimum proceeds.

5.3 Similarly, direct marketing and sale of the local products, be it Agro based or handicrafts Etc, should be encouraged to be set up locally so as to ensure best pricing to the local artisans and manufacturers.

5.4 Bio-diesel oriented plantations can be undertaken on even waste lands, alkaline lands, rain strapped lands Etc. and the seeds collected for oil (with by-product of oil cakes) impelling used for distilling bio-diesel through special industrial efforts. This requires a lot of unskilled manpower and entire operation can be undertaken in cooperative system of working to produce agro-based diesel of even better quality than petro-diesel, and by-products like glycerine Etc. The input oil of seeds of other trees like mahuwa Etc. can also be used for the purpose.

5.5 Concept of free market economy has to be brought about and accordingly, the social business is to be regulated.

5.6 The business and industry can be zonalised to cater to a group of villages sufficient to justify and cross the break even point.

6. Extensive Green Cover by Forestation & Landscaping, by Mass scale Tree Plantation, and Horticulture Activity:

6.1 The activity of extensive tree plantation should be undertaken with 3 objectives : (Refer items at # 3.7 and # 4.4 above)

- to create greenery and environmental proliferation,
- to grow local/country variety of fruits in abundance in large size trees,
- to encourage growth and development of fruit orchards,
- to grow commercially advantageous trees on continuous and progressive basis.

6.2 The village area itself should have extensive tree plantation on road sides, in houses if space permits, school compounds, Chopal/club compound Etc.. The trees must be of useful and general purpose variety like Neem, Aonla, Mangos, Tamarind, Evergreen types, Flowering type, Etc.The responsibility for growth of sapplings for a period of upto about 3 years can be entrusted to various house owners on compensation / payment basis with responsibility fixed up if a plant dies.

6.3 An extensive green cover should be developed/created around the village, on common or Govt. Land by planting very large number and variety of trees of commercial type like Teak and other timbers and of green foliage, so as to improve the environment and to control partially the disasters. Again, each willing person can be entrusted responsibility of nursing 10 or more trees for a suitable period, say 3 to 4 years with responsibility in case it dies. This will generate income to the unemployed, simultaneously solving the problem of nursing and tending the plantation.

6.4 The extensive landscaping with growing of flowers, which can be exported, green lawns and Fruit trees will be for a benefit of local population at large.

6.5 Encouragement by offering incentives can be given to commercial growth of Orchids, Flowers and Fruits which will improve the income of the entrepreneurs as well as export in a large scale can be planned.

6.6 Fruit orchards should be encouraged on a large scale which will lead to increase in local fruit consumption for better health, development of fruit canning and processing agro-industries, and even export of good variety of exportable fruits.

6.7 The suggested system will yield opportunities of employment and business for individuals as well as families, simultaneously adding a huge green cover, safety against climatic hazards and adding fruits to the local people earning business profits to the growers.

7. Health, Health Care & Hygiene (Personal Health & Community Health)

7.1 The health care in rural areas is quite poor in as much as that health centers are either non- existent and even if these are available, non availability of Doctors and qualified staff and the medicines are in great shortage. More often than not, there is hardly any building and proper services infrastructure and even this facility is rather rare. Maternity facilities are also quite poor.

7.2 The facilities and infrastructure for public health system, social and preventive

management, infectious disease management Etc. are rare not one in even cluster of villages. For serious cases, the poor villagers have to travel to district health centers, which often is rather far from distant villages.

7.3 It is proposed that part of the system proposed here, an adequate medical facility planning can be done, infrastructure built under the operational and management with aids, donations, partially Govt. funding or corporate sponsorship, which in due course would be managed by Govt.

7.4 The conditions of the rural areas can be so improved that it attracts the Doctors and medical staff to come to these rural health centers.

7.5 With the help of specialized consultancy groups, adequate medical health and maternity centers can now be planned meticulously and extensively and set up. The management, again, should be in the hands of local group of the village or cluster that is catered to by it with specialists and civil Administration as part of it.

7.6 The medicare facilities have to be planned in private sector and are to be developed and set up with the help of specialized Consultant groups. The initial funding has to be through one time aids and donations to be managed by assigned managing group.

8. **Development of Employment Potential :**

8.1 There will be automatic generation of employment in all the above detailed activities. It will be the local personnel, who will be preferred, subject to their suitability, before one can go out for recruiting people.

8.2 It will be a part of the system in which the training will be in-built in every establishment for training the local people. For the purpose of training, the experts/trainers will be called from outside the area for the purpose, who in turn will earn by training.

8.3 For entrepreneurial development too, the training would be ensured from the respective expert organisations.

9. How to get Started and to get Going

9.1 This is just nucleus of the idea. First of all considerable detailed working is called for to bring up the entire proposals in workable form, laying down the mechanics of operations and imple-mentation, problems anticipated from beneficiaries and local village Panchayats and local politics and their solutions, legal hurdles anticipated and their solutions, local Administration problems and their solutions, in general as well as for various specific areas depending on respective regional conditions, geography Etc..

9.2 There has to be a nucleus group to carry out further development of the proposal in more details, including setting up the systems detailed planning and implementation programs, sub-systems for field implementation of individual activity areas. The social scientist groups have to coordinate with the local administration, local village population and Panchayat bodies Etc. to bring home the scheme followed by rural survey and social programming for execution and implementation by sub-systems groups.

9.3 The broad estimates of funding for one time investments, loans and its mechanism of operation including mechanics and legalities, by involving banks and corporate financial groups and operational mechanics, all have to be worked out and

areas of responsibilities assigned to respective groups.

9.4 All details so far worked out, it is at this stage that detailed financial logistics, arrangements, agreements and operation thereto have all to be worked out in detail and financial arrangements are all chalked out so that at no stage implementation gets stuck up.

9.5 The Consultants for macro and micro level planning have to be assigned as part of certain assigned groups or may be some NGO groups for working out detailed implementation programs and mechanics of operations. A detailed network of Consultants, their coordination and Master control group has to be set of for the purpose.

9.6 The social group of Consultants have to coordinate with the local Revenue Administration at District level for operation logistical support and on the matter of land allotment and consolidation, for housing and buildings for common social infrastructure like schools, hospitals, community buildings Etc. as well as the matters of water and power generation / supply systems – conventional or non-conventional energy areas.

9.7 The local land surveys and habitation planning has to be initiated after inputs, agreements/consent of all concerned is firmed up.

9.8 The sub-consultants have to take over for detailed Engineering of all the schemes in their respective activities and areas. For example, Engineers have to come forth for house designing and construction programming for various beneficiaries based on their respective requirements, limitations of funding/loans/repayments Etc. Similarly the respective broad Consultants in the fields of Educational planning, Agricultural planning, Health systems planning have to get going and work out detailed designs, estimates, implementation programs proceeding with execution.

9.9 The job is formidable and needs a huge inputs to bring it to stage of take off.

9.10 However, part by part and sporadic implementation can be carried out in limited areas by groups, who feel involved and can form a resource groups for such a venture. Small part of such schemes have been implemented in a limited manner in various parts of the country and lessons can be drawn from there; areas being education, adult education, vocationalisation of local population, specially women, agricultural growth and promotion, cooperative programs in dairy sector, Bio-diesel generation sector (just started).

9.11 It is tacitly assumed the planners and Implementation managers will take care of the level of motivation to be created and generated amongst all concerned to adopt an approach of high class honesty and integrity in addition to sincerity. They will have to take care of the differences amongst classes of political diversity and polarization. The personal and self interest of various influential individuals as well as musclemen will have also to be taken due care of. A high class leadership and exemplary conduct is to be shown at all levels by all concerned, assuming that a new world is being created.

9.12 Similarly, the beneficiary public will have to educated and made aware of the program, their benefits and long term advantages in success of the scheme, their honesty and ethical conduct in implementation of the

scheme and their cooperation will go a long way to their own advantage and in their own interest.

10. Role of NGO's, Voluntary Organisations, Consultants, Engineers/Technologists, and Assigned Specific Groups in the process to achieve the proposed Goals :

10.1 The task is huge and formidable, to execute and manage and calls for specialized, completely devoted and dedicated bodies requiring to deploy and associate with a large number of specialized Consultants of various disciplines. These organizations can be NGO's, Voluntary bodies like trusts Etc. who have to develop a lot of expertise, exclusivity, huge manpower and systems, training and instructional mechanism Etc.

10.2 Since the proposals require a huge planning efforts – macro as well as micro level – at all stages, relating and pertaining to various disciplines , here-in-after detailed, the role of Consultants is virtually total in the planning process and later in the process of implementation and execution.

10.3 The Consultancy and Engineering Planning/ Construction Management expertise will be required in the following disciplines. This has to come through systems to be deployed in the process, willingness to help and an attitude of sacrifice. Nothing will, however, be given free; all has to call for making services available against a fair compensation, yet a sense of sacrifice and an inner urge to do something for the genuine backward class of the society at large irrespective of traditional caste system prevalent in the society – rampant in rural regions.

- Economic Planning
- Financial Planning
- Social Planning & Coordination
- Social Psychologists
- Habitation & Urban Planning
- Architectural Engineering Planning
- Engineering Consultancy
  - Civil Engineering
  - Structural Engineering
  - Electrical Engineering
  - Public Health Engineering
  - Roads and Highway Engineering
  - Construction Projects management
- Educational & Adult Education
- Agricultural/Agronomy/Extension
- Hospital, Health & Public Hygiene
- Horticulture and Para-Agro activities, Forestry and Agro-trade
- Vocational Training & Local Crafts & Culture
- Cooperative Development & Marketing
- Legal & Financial areas
- Liaison and Coordination
- The General Management

10.4 Thus, the success of this mega venture will depend on the role of the Organisations, Management Systems and Techniques, Consultants of various categories and their quality and capabilities. Honesty, ethics and integrity of very high order has to be exhibited by all those who are associated in the venture for which role of and motivation by various Associations and Professionals has to brought out.

11. Financing of the Project :

11.1 A huge corpus of funds needs to be arranged initially for making the micro

financing available to the rural population as well as for the infrastructure components to be shared by all concerned.

11.2 The funds recovery from the borrowers / beneficiaries of loans will start not earlier than two to three years of start of implementation of the scheme.

11.3 The scheme planning stage will consume funds, initially, which will be distributed amongst the village beneficiaries, at a later date.

11.4 The fund corpus will have to be generated from generous contributions/soft loans from the business houses of all scales as well as from strata of the society. Part of it may as well come from the various respective State/Central Govts., as loans and/or budgeted stipulations.

11.5 Certain special taxation mechanism could be evolved for generating and mobilizing the start-up funds.

11.6 This issue needs, however, to be addressed in much more detail as part of public deliberations and suggestions.

12. **Role of Central Government, State Govt. and its Administrative Machinery, Local Village Governing Bodies like Panchayats Etc. in the process to achieve the proposed Goals :**

12.1 The role of Govt. – State as well as Central and local bodies like Panchayats or Village level Governing bodies – assumes the utmost importance and absolutely unavoidable yet, their role has to be directive, policy related, monitoring, regulatory, cooperation and complementary assistance while it should be avoided in actual execution of the proposed scheme and system.

12.2 The role of central Govt. will essentially be of making available the technology and expertise through various central Govt. Research laboratories, Scientific Research Institutions, Agricultural Universities, Etc. and of making policy guidelines, if and where required, as supplementary to scheme implementation and support to the state Govts. and local rural governing bodies on one hand and execution systems and bodies on the other.

12.3 The state Govts. Have to play a positive and proactive role, free of any political overtones/colours. The District Administration has be made responsible for actual success of the implementation of the proposed scheme in terms of cooperating in all matters and taking care of the bad and negative social elements working in any type of counter-productive manner in the implementation of the scheme.

13. **Summary** :

13.1 The rural side of the country has to be brought up from the present miserable conditions to normal and productive conditions so that the potential formidable resources in rural India add to the national income; and objective of the country to be amongst developed nations by 2020 is realized.

13.2 Rural areas require a total change from deprivation and abject poverty of majority of villagers, in terms of standards of housing and living infrastructure, education, health-care, employment and income generation, independence and empowerment and improvement in general values and moral standards.

13.3 The villages should add to the national income with improved agriculture by

employing technological research in modern agriculture thereby adding to the farmer's income.

13.4 Adult education, vocational training from early school classes to adult education, specially to the women and making them independent from the early part of life, will add to the personality of the children and their contribution to the nation at large.

13.5 No free aids or dole needs to be given to any one in the process. This development is proposed all in private sector approach with Govt.'s help in Administrative support to make it a success.

13.6 The villages of the country, after implementation of the proposed scheme in entire rural areas, and its operation for a few years, will totally reverse the presently existing migration from villages to cities in search of jobs and creating conditions of slums in the cities.

13.7 The suggested scheme is self supporting in all aspects of human needs and development as it generates huge employment opportunities, it brings of industrialization in rural sector, there is very high improvement of rural areas in terms of quality of living, infrastructure, comfort level and improvement in self-esteem and self-respect of people in general, bringing up, thereby, highly improved character and value system.

13.8 The natural talent of human resource in villages, which, thus far, remains untapped, will blossom and be available to the country at large in the field of education, scientific research, engineering talent, sports and games, art forms of various types and agricultural production.

13.9 This model of development, with suitable modification, can also be taken for development of semi-urban areas, too, which are also in bad shape.

13.10 The local village level administration has to be trained and made active or rather pro-active in the total success of this implementation and to play a very important and coveted role in making the proposal to work through with the help of the external groups, like NGO's or other assigned groups, Consultancy groups in various areas and the Govt. through basically district administration.

13.11 An important and major task will be to bring the local populace around and to make them to participate in all the activities. There will have to be important role to be played by the Social Consultants and Psychologists with the help and positive assistance of the village administrative persons like Panchayat Members.

13.12 Considerable training efforts are required to first educate the local administration, like Panchayat Members, district administration officials Etc. in all its aspects of planning, implementation and ultimate advantages flowing out of it.

13.13 Funding and finance mobilization for start-up needs special address and decision, as part of the entire process.

The Role of Professional Ethics for Sustainable Development of Construction Projects

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Abstract:

The construction industry is the second largest economic sector after agriculture sector among Indian industries. Its growth is increasing multifold in year by year. During the 11th Five Year Plan, 2007 to 2012, the planned outlay was approximately USD $ 500.00 billion. The Planning Commission of India had proposed a planned outlay of investment of around Rs. 44, 19,500.00 crore in the construction sector in the Twelve Five Plan (2012 – 2017). The Global Outlay in 2005 was USD $3.22 trillion. But in construction sector huge resources up to 30% of project cost are plundered away through unethical means. The World Bank estimated the cost of corruption at USD $1.50 trillion per annum (2005 figure) worldwide and this could dramatically reduce world poverty including India, if it was misappropriated. The energy used in constructing, occupying and operating buildings represents approximately 50% of green house emissions.

In spite of the global economic downturn, our construction industries are performing better than other industrial sectors in India. There is tremendous need of sustainable developmental practices of construction industry. The builders and the development agencies should bring the awareness of sustainable development through sustainable design and sustainable construction and its impact on the society and economic growth. There is need of training and development programmes for the employees and management of construction industry on sustainable construction and its benefits. Simultaneously there is a need of ethical practices in construction by the construction professionals. The impact of ethical practices is very high in improving quality of construction in abroad like in USA, UK, Pakistan, Sri Lanka, Malaysia and Singapore. Here in Indian construction industry should also take initiatives on bringing ethical practices by training and development of employees and management of construction industry and its alliances. There is positive co-relation between Professional Ethics, Quality and Sustainability. Here in India, National Academy of Construction (NAC), Construction Industry Development (CIDC), Engineering Council of India (ECI) etc; are major construction development agencies and they should motivate the construction professionals and practitioners to enhance their capabilities in sustainable construction with improved quality by inculcating and applying ethical practices in construction so that the Indian construction industry can achieve the heights of excellence in construction to world standard. In this paper the authors are going to discuss the role of ethics and sustainable development in the contest of Indian construction Industry.

Key words: *Ethics, Sustainable Construction, Construction Quality, Training and Development*

1.1 Introduction

Global Construction Industry size

Size of the construction Industry sector was globally USD $ 3.2 trillion per annum in 2004. Construction of infrastructure accounts for high percentage of government investment budgets in all countries. The Planning Commission of India had proposed an investment of around US$ 500 billion in the construction sector in the Eleventh five-year plan (2007-2012). The Planning Commission of India

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had proposed a planned outlay of investment of around Rs. 44, 19,500.00 crore in the construction sector in the Twelve Five Plan (2012 – 2017). But in construction sector huge resources up to 30% of project cost are plundered away through unethical means. The world Bank estimated the cost of corruption at US $1.50 trillion per annum (2005 figure) worldwide and this could dramatically reduce world poverty including India, if it was not misappropriated. The energy used in constructing, occupying and operating buildings represents approximately 50% of green house emissions

Construction Industry has been negatively stigmatized as the most corrupt sector due to poor ethical conduct. Transparency International has rated the Construction Sector as the most corrupt sector in the world. A report by Transparency International listed construction industry as the business sector most prone to bribery – ahead even the arms , defense, oil and gas industries. In UK, prior to March 2004, National Audit Office estimated the 6.5 billion Pound Sterling per annum is lost to fraud. A bribe of 5% of the project cost would be considered quite low. Bribes as high as 30% are not unknown, 60% of all tropical timber coming into UK is sourced from companies involved in illegal logging. The construction industry accounts for 50% to 70% of all timber of all timber consumed by the UK timber industry, The world Bank estimated the cost of corruption at US $1.50 trillion per annum (2005 figure) .Corruption can no longer be regarded as a necessary part of business life. The damage to developing countries like India by corruption is obvious, with under-development, poverty and starvation and at times suicide, the inevitable consequences. This sum of US $1.50 trillion per annum could dramatically reduce world poverty including India, if it was not misappropriated. Different project construction players possess different perspectives and perceptions, pursue individual objectives to the varying degrees and operate/behave differently. Determination of the appropriate form, content etc; of a construction project is a matter of exercising value judgements and compromises and therefore involves ethical considerations.

The Construction Industry plays a major role in improving the quality of built environment, but it is also responsible for (i) about one third of all industry related pollution incidents (ii) construction and demolition waste represent about one fifth of the total waste,(iii) too many buildings are environmentally inefficient and do not make use of the limited resources like energy and water judiciously and properly. The energy used in constructing, occupying and operating buildings represents approximately 50% of green house emissions.

Ethics means to “DO WHAT IS RIGHT”, Quality means “DOING RIGHT FIRST TIME AND EVERY TIME”. Various forms of unethical conduct have significant impact on construction quality. Professional ethics is the pre-requisite to attaining sustained and acceptable of construction. Sustainable design and construction are to comply with the principles of economic, social and ecological sustainability. The intention of 'sustainable design and construction' is to “eliminate negative environmental impact

completely through skillful design and construction". Manifestations of Sustainable design and construction require (i) no non- renewable resources, (ii) impact the environ minimally and (iii) relate people with the environment.

1.2 Sustainability in Construction

Sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development is to ensure better quality of life for every one, now and generations to come through fulfilling social, economic and environmental goals and sharing by all the benefits of increased economic prosperity with less pollution and more efficient use of natural resource meeting people's needs, expectations and aspirations and ensuring the harmonious growth of our economics society and environment. Sustainable design and construction is the application of sustainable development to the construction industry. The Sustainability practices are beneficial to both owners and operators. The practices improve environmental, economic profitability and relationship with stakeholders. Sustainable development is implemented in the construction industry's private and public sectors through sustainable development, corporate social responsibility, Triple Bottom Line comprising of environmental responsibility, social awareness/ responsibility, economic profitability, sustainable communities plan and sustainable procurement national action plan.

Corporate Social Responsibility (CSR) is a key driver for private sector companies seeking to embrace sustainability in their business by integrating socially responsible behavior into their core values. Key principles of CSR are: integrity, transparency, responsiveness, fairness and diversity. Sustainable Communities plan in a long-term programme of action for delivering sustain communities in both urban and rural areas through major reforms of housing and planning with a new approach to how we build, what to build to meeting the economic, social and environmental needs of the present and future generations.

The construction industry can make huge contribution to improve quality of life. Construction provides the delivery mechanism for the provision and modernization of the nation's infrastructure for example transport, housing, schools, hospital and flood defenses etc;. Buildings and structures change the nature, function and appearance of our towns and countryside. Construction use in repair, maintenance and demolition of buildings and structures consume energy and resources and generate waste on a scale which dwarfs most other industrial sectors. The economic, social and environmental benefits that can flow from a more efficient and sustainable construction industry are potentially immense.

1.3 Strategies for the sustainable development of construction:

- To inculcate awareness and understanding
- To balance construction industry's contribution and Government's expectation.
- To showcase Government policies to bringing change.

- To stimulate individual business action in setting and monitoring progress for more sustainable construction requiring continuous improvement.
- To create a competitive economy more investment in people and equipment.
- To achieve higher growth along with reduction of pollution and use of resources.
- To share more widely and more fairly the benefits of growth.
- To improve our towns and cities and to protect the quality of the countryside.
- To contribute in sustainable development globally.

The construction industry can be the catalyst in achieving the goals of this sustainable development if they:

- Are more profitable and more competitive
- Provide greater satisfaction, well being and value to customers and users by constructing buildings and structures
- Respect and treat its stakeholders more fairly
- Better protect and enhance the natural environment
- Minimize use of natural resources and carbon based energy

Collaborative approach themes of the strategy for sustainable design and construction based on the response of the construction industry, its clients and stakeholders and integrated policy framework for sustainable development is desirable. Government as a major customer and sponsors of the industry is to act as the leader. An inclusive and cooperative approach is required with all stakeholders' umbrella bodies, representative organizations, trade organizations, research associates, business individuals and the Government for raising awareness stimulating action for sustainable construction and measuring performance of sustainable construction by the industry.

1.4 A sustainable economic base for construction:

Economic performance and competitiveness, social progress, environment protection, economic growth, greater economic growth, greater resource use and greater resource efficiency, employment generation in an ambiance of stable and competitive economy are the key to sustainable development.

Work is to be done together for building a modernized construction industry, with the active participation of Govt., industry and its clients, through radical change and improvement in construction performance by embracing challenging targets for year on year improvements in efficiency, quality and sustainability shall result in:

- Fulfilling the needs and expectations of the customers and other stake holders
- Improvements on profit margins
- Improved measurements and comparison of performance
- Better learning and sharing experience

- Development of people and gaining their respect
- Undertaking work in ethical and sustainable manner

Construction Industry level – Key Performance Indicators (KPI) shall be formulated and published. Individual company, supply chains or projects will be able to bench mark their performances and identify strengths and weaknesses. Government will track the progress of the players of the construction industry against the set KPI's.

1.5 Suggestions for waste hierarchy strategy:

- The generation of waste may often be reduced by adopting the most effective environmental solution
- Surplus/waste products and materials can be sometimes reused for the same or different construct projects, in case further reduction of wastage cannot be practicable
- Value should be recovered from waste through recycling, composting or energy recovery from waste
- Waste should be disposed of by using the best practicable environmental option, only if, none of the above solution of construction waste management is appropriate
- Sustainable development can be achieved by working with construction industry, by Govt. intervention through economic instruments like taxation by which prices can be influenced to provide an incentive for more sustainable actions, like The Landfill Tax (of England), influencing waste management practices of greater diversion of waste from landfill. Costs of disposing of construction and demolitions waste to landfill including payment of landfill tax can be minimized through more efficient construction methods and greater and more innovative reuse and recycling of materials.
- Environmental impacts associated with aggregate extraction by quarrying industry can be minimized by using better methods of extraction and transport of quarried materials. Environmental impacts can further may be reduced by good design and specification of materials, by tighter control of waste on sites, by reusing and recycling where ever possible. Introduction of Aggregate Levy will encourage for demand and supply of alternate materials, such as mineral wastes and recycled construction and demolition waste.

In order to mitigate environmental challenge of Climate Change Government may impose Climate Change Levy on business use of energy, and these may impact manufacturers of materials used for construction. For energy intensive industry sectors, including many construction materials producers reduced rates of Climate Change Levy should be granted for meeting energy efficiency improvement target criteria of the Government.

Further, capital alliances and support should provided by the Government for energy efficiency renewable investments. Good quality energy through combination of heat, power and (new) renewable like

offshore wind, energy crops and photo voltaic systems, should be exempted from Climate Change Levy.

Government and public sectors are the largest purchaser of construction products and they should set an example of sustainable procurement, maintenance and operation of their built assets. Govt. should assess whole life costs to get the best value for construction procurement. ISO-14001 environmental management systems and better quality design as per ISO 9001 in to buildings should introduce for sustainable development.

Doing more with less :

- To reduce waste at all stages
- About 90% of extracted non - energy minerals are used to supply the construction industry with materials, but very huge quantity of construction, demolition materials and soils end up as waste. Also large quantity of materials delivered to sites is thrown away as unused. Wastage of time, money, and reduced profits are the consequences of poor design and planning. Construction waste arising are: concrete, bricks, blocks, aggregates, metals, excess motor/concrete, plastic packaging and plastic products, plaster boards and plaster, paper and cardboard, vegetation, soil and others.

Wastage can be minimized :

- Through design by avoiding over specifications of materials and services
- By adopting a coordinated approach to design and construction with in the supply chain resulting in meeting clients' requirements better and less wastage.
- By adopting standardized design solutions, instead of treating every design as a prototype, reducing wastage.
- Encouraging greater efficiency in resource use based on the principles of waste hierarchy
- Through more materials used strategy by adopting lean design and improvement of construction processes.
- Promoting sustainable waste management and markets for secondary materials programmes along with best practice programmes.
- Through greater use of construction and demolition waste of secondary materials, such as colliery spoil, china clay sand, industrial ashes and slag.

1.6 Ethical Issues in Construction Industry

Business Ethics

Ethics is defined as moral principles for judging good or bad, right or wrong rules of conduct for human action. Right act that promotes good is taken as an "ethical act". Earlier concept was that business and ethics should not be mixed up, but it is now recognized ethics are applicable to business because business serves society, meets collective and individual needs. The origin of an unethical conduct is not from a person's upbringing, but through learning in practical business. Little training is provided to employees. Dishonest and unfair conduct is "endemic" in construction industry. Unethical practice: Bribes is

defined as – offering for securing privileged and favorable consideration / purchase of a project. Bribe is inducement for doing something to unentitled person. Other unethical practices are: Fraud, breach of confidence and negligence. Accounting system generated fraud-false expense report, false supplier invoices, alteration of accounts. Negligence – design negligence, design defect, production defect.

Professional Ethics

Profession is service by a group of people with specialized knowledge in the interest of the society. Professions are occupations requiring advanced study, mastery of specialized knowledge undertaken to promote, ensure or safeguard others wellbeing and socialized in indispensable and beneficial manner. Profession sphere of work are colleagues, other specialists, people served such as client and public in "consensual and fiduciary" relationship. Professions are to partake ethical behavior-obligations, duties and responsibilities binding on ordinary people, bound by a set of principles, attitudes, character and term as professional ethics. Fairness to clients, colleagues and public, conflict of interest can keep professional away from meeting of their obligation. Right of conscientious refusal is right of an employee to refuse to partake in unethical conduct when forced by an employer.

Construction Industry Ethics

Architects are talented in design and construction of building and with highest ethical caliber. Current code of ethics is of concept "common good is right". Main types of unethical behavior in architecture are:

- Concealing of construction errors
- Stealing someone else's drawings
- Exaggerating experience and academic achievements in resumes and application for commissions
- Charging clients for work not done, costs not incurred or overstated
- False promises of advancement
- Misleading clients in project management
- Conflict of interest" Involvement

Project Managers are to integrate ethics and social responsibilities as there is no conflict between morality and good management. Construction Contractors are to behave in an ethical manner to mitigate the accident proneness, in order to avoid major injury, getting killed in accidents, they should be honest, realistic, integrity specially in making claims and estimates. Unethical behavior of contractors leads to high level of disputes between proprietors and builders. Lack building construction ethics and greed result in unethical conduct. There shall be a clarion call within the contracting community to license all builders for quality in order to get rid of those within their midst who do not do right thing by self regulation. Quality marks shall be introduced to distinguish rogue and reputable builders: Initiative is in process in USA to curb unethical conduct by contractors and to address different problems in construction industry objectively. Indian construction industry has to take initiatives to get awareness and curb unethical conducts by training and development of employees and management.

Organizational Ethics

Presence and implementation of code of ethical conduct in organizations determines that organization has guiding mechanism for decision making process and enforcement of ethical conduct. To establish ethical infrastructure within the organization good ethical practice shall be instituted by giving importance of ethics. Construction industry players shall belong to professional institutions that have an ethical code of conduct and they should have some form of ethical infrastructure in place to guide them in arriving at ethical decisions and to judge ethical content. "Good ethical practice" is critical to organizational or business goals. Good ethical behavior is to be serious pursued.

Importance of ethical practices to organization

Good ethical practice is critical to organizational or business goals. Good ethical behavior to be seriously worth pursuing.

Business ethics Vs Personal ethics

Most construction players at present may think that business ethics should not take precedence over personal ethics and many believe there shall be a balance of business and personal ethics, but quite a large percentage of stake holders believe personal ethics should drive business ethics i.e. business ethics is acceptable until personal moral code is not violated.

1.7 Professionalism in the Industry

Professional obligation: Trend is prioritize professionals their obligations to clients higher than their obligations to public concerning commitment to environmental ethics, public health safety like:

- Contamination of soil
- Degradation of vegetation
- Erosion of soil
- Inadequate perimeter fencing on construction sites
- Careless execution of demolition and construction
- Storage of construction waste products and offsite
- Inadequate protection of public from debris

Dilemma persists– if public obligation dominates the client obligation business cannot survive and if client obligation dominates over public obligation then unethical and illegal conduct increases. Maximum percentage of construction players prioritizes their professional obligations equally between the client and the public. Professional responsibility rests on construction players to avoid breaches of professional responsibilities; conflict of interest confidentially and propriety information infringement, breaching environmental ethics.

Conflict of interest breaches are:

- Consultants use their positions for financial gain
- Clients award contracts to companies in which they hold interest
- Government role is to deliver service, but government is in competition through business units with private sectors

- Awarding contracts to former employees and friends
- Maintaining impartiality when representing clients

Confidential and propriety information infringements are:

- Developer using architects drawings with other parties
- Improper information flow
- Revealing tender information
- Revealing product information
- Clients using drawings not paying architects
- Consultant and builder discuss client details

Breach of environmental ethics is :

- builders / contractors failure to stop soil erosion and acid sulphate leeching during construction
- unsolicited clearing of vegetation
- illegal dumping of building debris

Violation of professional right by employers or clients by forcing employees to conduct activities considered immoral in nature is not considered as acceptable ethical behavior.

Ethical Improprieties

Collusive tendering, bribery, fraud, negligence, dishonesty, unfairness are ethical improprieties.

Collusive tendering is through cover pricing, bid cutting, hidden fees and commission compensation of tendering costs etc. Frequent parties in collusion are clients and contractors, contractor to contractor, contractor to subcontractor. Bribery is offer of cash, gifts, favors, entertainment, round robins, work to private homes, additional work from clients, free travel etc;

NEGLIGENCE are :

- Poor quality documents
- Poor workmanship
- Poor material quality
- Inadequate safety standards at site
- Inadequate information flow from client / consultants to contractors
- Inadequate construction technique

FRAUD : Deceit is most fraudulent conduct. Deceit comprises of (1) covering up poor workmanship with material quality during inspections (2) constructing with materials not included in their quotations (3) tampering of signed contract documents (4) altering of construction documents (5) client not disclosing all information to all tenderers, enabling an unfair advantage to a preferred tenderer.

Dishonesty and unfairness in tendering processes are : (a) client divulging more tender information to preferred tenderer and with holding vital information from other tenderers (b) Bias in tendering evaluation (c) Re-tendering after publishing prices (d) Re-tendering using a consultants design obtained during first tender (e) Shopping prices after tender is closed (f) Clients pre-selecting consultant then calling tenders to fulfill organizational or statutory requirements (g) Competitors overstating their capacity and qualifications to secure work (h) Competitors overstating their experience and capabilities and pacification of qualifications.

Unethical Bureaucratic or government policy are : (a) competition at very low prices which do not reflect the true cost of their operations (b) government tender practice system of exclusion unfairly penalizes private organizations (c) government bodies bid against private firms while being part of tender selection process (d) government tenders being awarded to organizations at less than 30 percent of the mean which is against state purchase policy (e) government states low tender price is only 10 percent of the criteria but the job is offered to the lowest bidder.

Unethical behavior relating to consultant fees and project costs are:

- Developers not paying consultants
- Client wanted upfront work and went to another architect
- Consultant with holding information from the client resulting in variations
- Loading sub-contractors" prices to cancel other costs within the project
- Client manipulating consultant fee by playing them off against each other
- Main contractor not paying fees / bills without justification.

Unethical design and Construct contract arrangements are:

- Losing architect's tender design may be used by client without making payment to Loosing architect
- Manipulating profit share between contractor and client.

Other unethical activities committed by the consultant and engineers are aiding contractor in the above unethical behavior are by the means of:

Unfair tendering practices such as :

- Biased tendering evaluation systems
- Practice of re-tendering
- Shopping for prices after the tender is closed
- Under cutting the market by providing services that do not reflect the true product cost

Correlation of unethical conduct by profession:

Relative extent of unethical conduct is practiced by project manager, architects, contractors, client and other participants. Contractor is more unethical over-all in all areas. Architects are highest in negligence; Contractor and Client are almost at the same level in dishonesty and unfair conduct. Client is second to all areas of unethical conduct after contractor other than negligence in which architects is on the highest unethical scale. Impact of association with unethical organization, a very high percentage of construction players perceive that associations with companies that conduct business in an unethical manner do not affect their travels of business.

1.7 Recommendations

All types of 'unethical conduct' must be eradicated from the construction industry. Vision, Mission, Strategy and Action Plan for Sustainable Development shall have to be formulated in details and implemented in Construction Projects. Oath of Integrity has to be signed by all construction players. If any party flouts the signed Oath of Integrity, then the party shall automatically be subjected to heavy penalty. Integrity assessor shall be appointed at the

conceptual stage of the project till commissioning of the project to see that every decision and action is being taken ethically. He should have adequate qualifications and experience with spotless integrity of character, which the job demands. If any of the bribe money is not allowed to siphon off and invested in the projects the planned project objectives shall be met adhering to time, cost, specifications and drawing. Without leakage more resources will be infused in the project creating a chain action for nationwide development and growth. Every citizen of India will have enough income with overall economic development of the nation. With elimination of destruction of non renewable resources, bio-diversity will be maintained and balanced and the future of all future generations will be secured and safe.

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Challenges For 12th Five Year Plan in Arena of Water and Hydro-Power Resources Development – Role of Engineers & Technologists

– Er. Radhey Shyam Goel

Abstract

Social tensions, political instability and street fights are already being experienced in India, on account of fast deteriorating of availability of water in adequate quantity and of acceptable quality. As per World Bank estimates, water pollution accounts for about 60% of the major annual environmental costs in India. Availability of water is under tremendous stress due to growing population, rapid urbanization, increased per-capita consumption, industrial growth competing demands for many uses and demands for maintaining ecology. There are very large inequities in the availability and demand scenario amongst the India river basins. Non-development of water storage projects is not a viable or available option; due to the very high temporal variations in river flows in our monsoonic climate. Highly dismal share of hydrothermal mix is adversely affecting optimal utilisation of natural and financial resources besides frequent failure of power grids. Still few non-credible NGOs and self styled non-professional environmentalists leave no stone unturned to oppose almost each water storage dam, hydel plant and continue fighting tooth and nail against vitally needed inter-linking of rivers, perhaps also siphon off foreign funds mainly to garner awards, fame and monopoly.

Such self acclaimed activists are generally ignorant of even basic facts and intricate 'dose response functions' of complicated environmental processes and techniques of water resources and hydro power development due to no professional background. Such persons repeatedly use media to create fantasies and tirade against water storage projects on many shifting grounds. In every sector other than water and power, specialists like doctors, surgeons, economists, space & atomic scientists etc. are considered competent but any 'Tom', 'Dick' and 'Harry' claims to be expert to oppose large dams, hydel projects and inter-basin transfer of water projects.

This article presents basic facts on limitations and efficacy of large water storage versus small dams and rain water harvesting structures and 'traditional wisdom'. Great contribution of this article is expected to raise the debate in truly scientific manner, whether such large scale requirements of irrigation, power, flood moderation, water supply for urban and rural population as well as industrial and power sector cooling requirements, can be met through so called 'traditional wisdom', check dams, by a series of run-of-river and small river valley projects?. Basic objectives and drivers of the most important Indian Project- Inter-basin Transfer of Water (IBTW) now commonly- known as Interlinking of Rivers (ILR) are also summarised. Even though such presentation cannot be an exhaustive treatise; nevertheless, authors hope that the policy planners, administrators, professionals, media, NGOs and public at large should understand basic facts to avoid street fights and social tensions almost every where now in India, due to breaking down of water and power supplies. Our policy makers and engineers should not only create scientific public awareness about the need of large storage dams & mega hydro- power projects but also ensure to blend techno-economic and socio-ecological improvements with advancements in science & engineering. Policy makers and engineers should not

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only create scientific public awareness about the need of large storage dams & mega hydro- power projects but also ensure to blend techno-economic and socio-ecological improvements with advancements in science & engineering. This is an essential message for engineers and technologists involved in formulation and implementation of 12th Five Year Plan.

Key words: *water wealth, storage dams, hydro-power projects, interlinking of rivers, Role of Engineers .*

Introduction

India supports 1/6th of the world's population on 1/50th of global land with meager 1/25th of the world's water resources. 80% of all diseases and over 1/3rd of deaths are caused by consumption of contaminated water. As much as 1/10th of countrymen's productive time is sacrificed to water related diseases in addition to bulk amount of time of women spent on carrying water for domestic needs by long walk in hills and deserts. Deteriorating water quality has become a serious problem at their heads. Unless facilities for the treatment of domestic sewage and industrial effluents are manifold increased, the increasing pollution load due to urbanization will further deteriorate the quality of water bodies. Safe water supply and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty.

Indian water and hydro resources sectors development are confronted with the controversies of inter-state disputes vs. integrated basin development, reliance on water-shed development vs. reservoir projects, Government owned vs. private utilities and large Vs. small projects. On one side, the technological advances in the fields of meteorology, hydrology, geology, seismology and the techniques of investigation, planning, construction and operation of the projects are making possible the optimisation of scarce national resources. On the other hand, a fear syndrome has been created against river valley and hydro projects by exaggerated likely or assumed adverse environmental impacts and by ignoring or suppressing their need and tremendous benefits by few non-credible NGOs like NBA and novelists self styled activists. As a result, many potential economic developmental activities, which could generate wealth and employment in India have been blocked in large cities, towns and villages due to acute shortage of water especially during the dry season. At the same time, fury of floods routinely continue to affect the economic activities causing large scale loss of life, properties and flora & fauna. We must act fast in such an alarming situation otherwise Indian civilization may doom facing shortage of potable water and power.

Social & Ecological Aspects of Floods – Are They Ever Reported by Media?

Over 40 m.ha. of India experiences periodic floods. The average area affected by floods annually in India is about 7.5 m. ha of which crop area affected is about 3.5 m.ha. Floods have claimed on an average 1529 human lives and 94000 cattle ever year. Apart from loss of life and domestic property, the devastating effects of floods, sense of insecurity and fear in the minds of people living in the flood plains is enormous. The after effects of floods like the agony of survivors, spread of epidemics, non availability of essential commodities and medicines and loss of their dwellings make floods most feared natural disaster being faced by human kind. Crops grown in the flood plains suffer from congestion of water on the farmlands. Management of the surface water becomes a very tricky operation in the flood prone areas during periods of heavy rainfall. Floods also affect the vulnerable aquatic and wild life, forests, mangroves and precious bio-

diversity in the flood plains. Large-scale damages to forests, crops & precious plants and deaths of aquatic and wildlife, migratory and native birds in various National Parks, Delta region, low altitude hilly areas and alluvial flood plains of Assam, Arunachal, Uttrakhand, U.P., Bihar, Orissa, West Bengal etc. are matter of serious concern but hardly reported by media. River Valley Projects moderate the magnitudes as well as frequencies of floods. While some projects are specially designed to provide flood cushion in the reservoirs along with other benefits, others also help in reducing the magnitude of floods with proper operation and control of gates.

Social & Ecological Aspects of Droughts - Are They Ever Reported by Media?

Over 265 million people live in drought prone area of about 108 m. ha. (1/3rd of the total area). Thus, more than 26% of total population of the country face the consequences of recurring droughts. During drought years, there is a marked tendency of intensive exploitation of ground water, resulting in abnormal lowering of ground water table thus accentuating the distress. Grave adverse impacts are borne by flora, fauna and domestic cattle and the very life itself fights against nature for its survival. Droughts affect rural life in several ways. This accentuates problems in cities in the form of mushrooming of slums and pressure on the existing civil amenities thereby adversely affecting urban life. River Valley Projects are designed to provide 'carry-over' storage in the reservoirs to help in mitigating the droughts.

Power Management - Are We Not Heading for Dark Days?

Thermal and hydro are the two major sources of powers. Thermal power production requires burning of fossil fuels, which seriously affect the environment adversely. Pollution caused by burning of fossil fuel to meet energy requirements is causing global concerns. Option lies in using the alternate non-polluting sources of energy like solar and hydropower. It is a matter of alarming concern that the share of hydropower in the total installed capacity in India has been declining in successive plans. In 1962-63, hydro projects had a 50% share in the total installed capacity which has gradually declined to 24% against ideal ratio of 40%. Such a dismal share of hydrothermal mix is adversely affecting the optimal utilisation of natural and financial resources besides resulting in failure of power grids. Economic rapid exhaustion of the exploitable sources and superiority of hydropower has been further enhanced in the recent years with the steep increases in the prices of fossil fuel. India has to import fossil fuel to meet the thermal power needs at a huge cost.

Hydro power generation by constructing large and medium storage reservoir projects to use the head for water drop substantially helps in utilisation of water resources, 75% of which is presently draining down to the sea unutilised. Notwithstanding its inherent benefits and availability of vast potential in India, the pace of hydro development has so far been very slow. Major constraints for slow development of hydro potential are mainly obstacles by activists, difficulties in investigations, R&R problems, delay in land acquisition, funds constraints and geological surprises. National Policy on Hydropower Development may help in boosting the pace of hydro development in country; but most of the hydro-power projects under construction are being halted on frivolous grounds and unrealistic assumed ecological impacts. .

Ecological Impacts of Water Storage & Mega Hydro Projects

There are numerous incidental benefits from the construction of large and high dams such as

improving environment, health, afForestation, fisheries development, tourism and recreational facilities, employment generation, development of agro-based industries, network of roads in catchment & command areas, development of land and improving general socio-economic standards. Numerous case studies prove that significant improvement occurs in food and nutritional level with higher per capita food availability and diversification of crop production, especially cash crops after introduction of irrigation. New employment opportunities generated by the intensification of agricultural and associated economic activities further improve financial conditions of people including landless labourers. As a multiplier effect, large river valley projects tremendously improve the health of rural population by significantly enhancing the education, health care, transportation facilities and the life styles particularly of women like Western U.P. and Punjab.

Water resource development requires a judicious mix of large, medium or small reservoirs, which are location specific. Loss of forest area due to submergence is less than five per cent of the total forest area lost in the country in the last five decades. The loss of biomass through submergence is, far smaller than the biomass generated on account of the irrigation. A forest far superior to the original, sans the original bio-diversity, comes up after the creation of the reservoir. Adverse effects like water logging and salinity are being prevented through conjunctive use of groundwater, prevention of canal water leakage, reduction of seepage losses from water carrying bodies, implementation of adequate drainage and adoption of efficient irrigation methods.

Reservoirs may create new conditions for growth of organisms, and ultimately, adjustments are made to, foster new eco-systems. Varieties of new organisms thrive on this new eco-lake system. Additional water made available for dry period of the year, when the environment tends to be harsh and makes the area inhospitable, supports the growth of life around. Such projects provide a dependable source of drinking water. People from the irrigated areas enjoy better health and sanitation facilities, thus reducing the incidences of diseases. A very availability of water leads to improvement in the level of sanitation. The improved economic status also makes people health conscious and capable of availing of requisite health care. As per the UNICEF (1988) report, new water supply facilities sourced from large dams improved the sanitary conditions, which led to significant improvement in general health conditions. Vectoral risks can be reduced by removing sources of stagnant or slow-moving water and by ensuring continual maintenance of drains and canals.

Substantial increase in numbers of tigers, panthers, elephants, cheetals and crocodiles have been observed in the famous Jim Corbett National Park with the availability of green fodder and clean water throughout the year improved climatic conditions and reduced risk of poaching on account of reservoir area on most of the sides of after construction of the Ramganga Multi-purpose Dam Project. Rare species of birds flock there after the reservoir construction. Similar phenomenon of an increase in birds and wildlife has also been observed around Rihand and Matatila reservoirs, which were previously barren lands. Best tourist places area Ukai tourist resort, Periyar wild life sanctuary, Shalimar garden, Vrindavan garden, Pinjore garden, Kalindi-Kunj, Matatila Garden, Dhyaneshwar Udyan and Ramganga Udhyan, which are all bye products of river valley projects.

Rehabilitation and Resettlements – Facts & Myths

Controversies concerning the rehabilitation of persons displaced by dams have muddied the entire debate on the utility of water resources projects and caused much harm to the national economy. As per assessment by Central Water Commission (CWC) through the review of data of 2784 dams, total project affected persons (PAPS) range between 6 to 7 millions. Opponents of large dams blow up this figure up to 70 million by taking the average of the recent few mega dams and multiplying the same by 4291 (total number of dams over 15m height). It has to be borne in mind that most of the high dams (by definition every dam having height of more than 15m is classified as high dam by ICOLD mainly for safety concerns) did not displace persons, firstly due to very thin population in their submergence in earlier dams during construction, secondly very few dams having the height greater than 50m would have the submergence impacts on the upstream habitation those days. Displacement of human settlements is indeed a painful necessity and must be handled with compassion, fairness and even generosity to ensure better quality of life than left behind by PAPs.

Most of such PAPs reside in areas of extreme environmental fragility and largely deprived of nutritional food, potable water, health facilities and productive employment. Employment benefits of river valley projects have been widely experienced. Typically, 60 percent of the capital costs of a major irrigation projects payment to construction workers. Further sizeable recurring onfarm employment benefits are generated because labour use in irrigated farming is more than in unirrigated farming. Irrigation development in a tract stems out migration of job seekers from that tract to distant centers. Availability of water from Sardar Sarovar Project will benefit about 1.91 lakh of people residing in 124 villages in arid and drought-prone border areas of Jalore and Barmer Districts of Rajasthan, which have been suffering grave hardship and on account of scarcity of water, besides checking the advancement of Thar Desert. Voluntary migration in India has been highest from these areas due to scarcted water. National Rehabilitation and Resettlement Policy has already been notified. Judgements of Supreme Court and Shanglu Committees Report have amply proved that liberal provisions and comprehensive plans for implementation are being kept and implemented in recent water resources project (Sardar Sarovar, Tehri, Almatti, Narmada Sagar Dam) ensuring better conditions of PAPs after rehabilitation.

Micro Watershed Development Versus Large Dams

The former captures rain in-situ and supplements/conserves soil moisture for a longer period, whereas the latter holds the run-off in storages of surface waters and make it available through canals for irrigation. The former has a crucial role in treatment of catchment area and non-command areas of irrigation schemes. It recharges ground water for use in local drinking water needs. Also, it provides soil moisture to replace may be one or two irrigation watering, in kharif season. Its main role therefore is important for the vast rainfed areas of the country, which will not be irrigated through surface storages even in ultimate stage of development. The former successfully operates within a narrow band of meteorological phenomena of intensity, duration, antecedent rainfall, potential evaporation, infiltration capacity dictated by topography, geology, slope, vegetative cover etc. Its contribution in increase in productivity of cropped land is rather limited. Both therefore are considered as complementary and not adversarial. Sediment generation is reduced in

the former case. Erosion and deposition in downstream will continues due to hydraulic phenomena. Dams hold bed load of sediment in the designed pockets. Economic analysis on dams accounts for such siltation. Peak flood is reduced for local watersheds but does not have significant impact on generation of floods.

Can Small Dams & RWH Replace Large Dams?

Available data shows that when numerous small projects are constructed to substitute a single large storage project the cost per unit storage, relative submergence and relative evaporation losses are invariably many times more. Evaporation loss would obviously be more because of larger water spread. Claims that only small size (or some claim only large) of dams be adopted are wrong. Only small dams can not capture required quantity of water. In each basin, even if one wants, all dams can't be of only large or only small size. Each size has its advantages and deficiencies.

Another important point quite often missed is the need of large dams in Peninsular India even for minor irrigation purpose (covering lesser than 2000 ha.) due to the limited capacity of the valleys on account of the topography and configuration. On the other hand, large barrages of lesser than 15 m height are required for diversion of voluminous discharge for irrigation of large tracts of land in Indo-Gangetic plains as well as rivers' deltas. It needs to be appreciated that the dams upto a height of 100 m are needed even for the run -of- river projects having no live storage in Himalayan rivers. The steep gradients in the river beds and the large rolling boulders down the hills quickly fill up the storage capacity, quiet often even during the construction period. Apart from cost, the issues of mortality, reliability, dependability, submergence, displacement of inhabitants, loss of forest and cultivated land, adverse impacts, multiplier effects are to be considered while making the decision. A recent study of proposal to revive the old tanks of south India indicates that contrary to popular perception, it will be economically too expensive.

The proposition that a series of small dams can make up one large dam is an abstraction which is not always physically practicable and cost effective. It may often turn out that series of small dams submerge a far larger area and displace much greater number to store less water as a factor of valley geometry. Again one type of techno-economically viable development can not be replaced usually by another for example to replace a single large reservoir with a few small reservoirs will need a large number of alternative sites which is rarely available in practice necessitating again a curtailment in the envisaged development. In different studies carried out by CWC, it has been conclusively proved that when more reservoirs are constructed to substitute a single large reservoir, the cost of storage creation and submergence are high. Also there cannot be a small reservoir on a large river and even if a less storage reservoir is constructed on a large river, it has to be provided with a large spilling arrangement to tackle the expected large size flood. Hence the issue can only be the major, medium and minor reservoirs, each being complementary to the other.

Medium and Small River Valley Projects

It is a established fact that shallow storage causes proportionately greater loss of land area due to submergence. Shallower storage also means greater surface area and hence evaporation as per studies conducted in many river valleys by reputed scientific agencies. Further it is difficult to find large number of alternative sites for medium projects even if such an alternative is preferred over deeper storage. Small and medium projects have to be constructed generally in the upper reaches of hills, causing substantial

loss of valuable forests. Construction of large dams, on the other hand, in the foothills involves submergence of large areas of cultivated lands per unit of storage. Of-course shortcoming is compensated in same ways.

For this reason small and medium hydel projects are not only costlier than the large projects but they also submerge larger land areas for the equal amount of storage and in addition, they have increased evaporation losses. Steep gradients in the river beds, large rolling boulders and sedimentation problems further limit the efficacy of small and medium hydel projects. This became particularly evident in case of Ichhari and Maneri Bhali dams (60 metres and 39 metres height respectively), both being run of the river projects. These were filled up to crest by sedimentation during construction, itself as planned.

It is thus evident that large water storage projects are surely better alternatives wherever the parameters such as the volume of water flow, geological and topographical considerations and regional requirements are satisfied. Historical records establish that dynamic nature of environmental effects, which seem adverse to the environment at the time of construction, generally tend to stabilise and become less unfavourable. In fact extensive green cover develop in submergence and irrigation commands. Large number of migratory bird and wild life starts developing aftyer construction of large dams (case studies for Aswan, Ramganga, Rihand, Matatila, Indira Gandhi Nehar, Beas Sutluj Link, Bhakra and Hirakud projects).

Effectiveness of Rain Water Harvesting

Roof Top Rain Water Harvesting (RTRWH) is an ancient technique of providing domestic water supply and still in use, especially in tropical islands and semi arid rural areas. Many Ministries/Departments of State Governments have encouraged RTRWH with large scale subsidies. During last 20 years, under the hype of 'traditional wisdom' rain water collected from the roofs of entire country (<1bcm) will not be enough even to meet the water requirement of Delhi. Contribution of RTRWH is very small and comes at a very high unit cost with a significant recurring component. The cost of storage is Rs. 2000/- per cubic meter or Rs. 6 Lacs for 300 cubic meter per family. RWHS like RTRWH is at all useful when it comes to power generation and long distance transportation of water. Thus RTRWH can be a solution to the no water situation but definitely they are not substitute for large dams and interlinking of river basins. RTRWH has assumed overriding priority due to unjustified hype created by several NGOs and self-styled environmentalists. RTRWH can hardly solve even fraction of the water requirement needs of the entire country. A family requires 300 cu m of waters per year of domestic use.. In an area having rain fall 100 mm, the roof top size required would be 3600 m^2. The roof top requirement for agriculture purpose would be eight times more than domestic use.

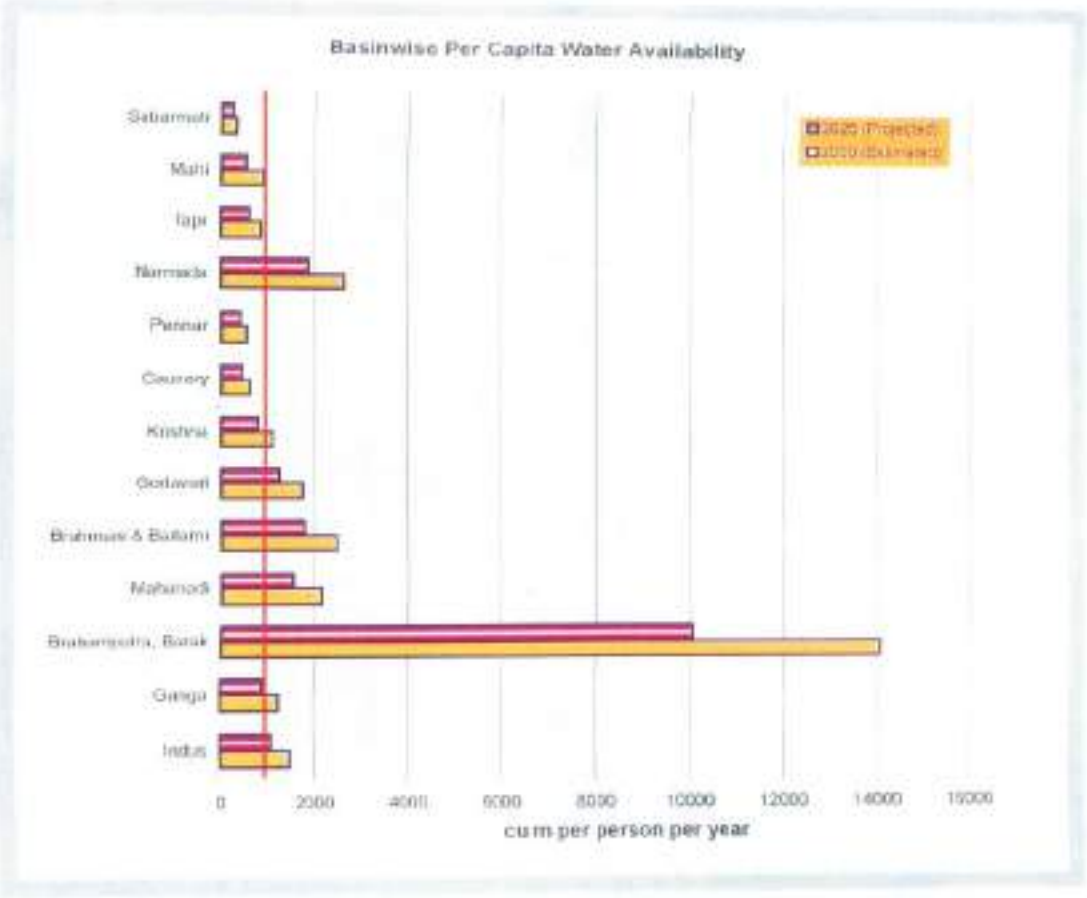
Inter- Linking of Rivers

Although India receives some waters from the upstream countries, the precipitation is the main source of water availability, Which has a very uneven distribution, with an annual rain fall of more than 10m in parts of Meghalaya to less than half a metre in semi arid parts of Rajasthan and Gujarat. In arid regions it could be less than 10 cm. Much of the water is received in a few months of the monsoon, and that to within around 100 hours of the rainy days. As per International standard the limit of 1700 KL of water per person per year is considered satisfactory. If it falls below 1000 KL, it creates condition of stress. The requirement of agriculture for producing food alone is 700 KL. Other requirements like that of

domestic use, industries, ecological requirement, hydro power etc. takes the requirement above 1000 KL. The chart below shows availability of water per capita in the main river basins of India.

Most of the basins in India have availability below 1000 KL whereas in Brahmaputra availability is around 10000 KL and in Narmada, Mahanadi above 2000 KL. Ministry of Water Resources, had recognized need of interlinking of rivers (ILRI) and prepared a National Perspective Plan in 1980 after studying all major basins of the country. The National Water Development (NWDA) Agency was set up in 1982, to work on preparation of feasibility reports. A Task Force was constituted in 2002 to develop consensus for ILR. Supreme Court also advised to prepare action plan and time schedule for completion of ILR so as to finish the project by end of the year 2016. Thus, more than 25 years have passed, since need for Inter-basin transfer of water was recognized If effective actions are not taken quickly the country would face serious water crisis. Food requirement by 2050 is estimated as 450 Million tons. If prompt actions are not taken, the country may have to face serious food crisis and may have to start importing food grains like realuheut (PL480) in 450 and 60. Similarly if hydro power is not developed fastly it would result not only in shortage of power particularly in peak noun but, the country will have to go for more expensive options, which will make our products create significan less competitive in international market

Broad objectives for inter-basin transfers could be envisaged as equitable distribution of the available water resources, increased economic efficiency; self sufficiency in food and energy;



providing livelihood and employment opportunities to avoid migration of population from rural to urban areas. The water resources of India are very unevenly distributed within the basins. National Commission for Integrated Water Development has shown that the per capita availability of waters varies widely from around 300 m.cu per person per year in basins like Sabarmati to very large quantities in the Brahmaputra, with a National average of about 2000 m.cu per person per year. Very large disparities are also noticed in the per capita irrigated and rain fed land available to the rural population for derived lively hood from land. These disparities are likely to increase in future. Self sufficiency in food grains could again be an important driver inter-basin water transfers.

In order to be self sufficient in food, increased irrigation through long distance water transfers may be required. Investments in long distance water transfers may be economically less efficient as compared to say industrial and other commercial investments. It may not be prudent to make investments to achieve complete food sufficiency through long distance transfer of water. Deficiency in any out put including food if it occurs can be met from imports, from those who can produce that out put more efficiently. There are instances where many smaller nations depend on import for meeting their food requirements. Countries like Japan, England, Saudi Arabia etc. depend on imports to meet a large part of their food requirements. How-ever many others feel that a nation of the size of India cannot afford to be not self sufficient in food requirements. The world trade in food grains is not large enough to meet the needs of a large country like India. World trade in rice for example is only 18 million tonnes at present. Large imports by India would affect the price stability. Also many of the nations who do not chase food self sufficiency as a goal seem to occupy a more commanding position, politically and economically. Thus, the threat of use of food as a weapon may not be a deterrent to them. After consideration of these aspects, most decision makers feel that food self sufficiency should be an explicit objective of inter-linking of rivers.

Social and Environmental Impacts of Inter-linking of Rivers

In India, the planners are familiar with the social and environmental concerns caused by small, medium and large in-basin projects. Few NGOs have expressed that inter-basin transfers may cause socio-economic and environmental impacts much different from those caused by in-basin developments. The social and environmental concerns associated with these inter-basin transfers would mainly on account of the largeness of the totality of the measures in the region in which the system of links passes. Each individual storage dam such as the Ichampally, the Polavaram, the Manibhadra/ Tikarpara etc involved in the peninsular links would not be much different in its storage or in its displacement from the large reservoirs like Gandhisagar, Sardar Sarovar, Srisailam, Nagarjunasagar etc which are existing. Similarly, we already have experienced about large canals exceeding discharge capacities of 1000 cumec and the link canals would be not of much larger magnitude through these would be of much larger links. The existing inter-basin transfers in India do not seem to have experienced any such problem.

Questionable Use of Water as a Carrier of Wastes

The traditional way of removing wastes from industries, and homes has been to dilute them in water and then carry this wastewater over long distances to extract most of the waste in the sludge, leaving polluted water as effluent. Such traditional and highly unscientific method of using water carriers of wastes need to be closely

examined. There are many better alternatives to treat the waste at its origin, without using so much water. Use of low flushing and dry toilets as well as use of 'grey water' drained from showers, kitchens and laundries to flush the toilets, should be targeted for adoption in at least in all new construction of commercial institutions and planned colonies in all class I and II cities.

Marketing Bottled Water

Considerably more satisfaction and benefit can be obtained from the present water supply system, if managed efficiently. Costly systems are constructed, but for want of proper operation and maintenance, the benefits are not received by the people who have to incur considerable private costs and have to resort to alternate means or supplementary sources. Fast catching up practice of selling mineral water bottles at rates even more than milk and more than 1000 times than the tap water in India is paradoxical. While half of our population is unable to afford even the absolute minimum needs to quench their thirst. Only water supply utilities should be allowed to bottle and market the bottled water to generate much-needed funds for modernization and proper maintenance of existing infrastructure.

Professionals Vs. Non-professionals

Even a layman can appreciate that in the situation of monsoonic weather in our country, storage of river flows during floods is unavoidable not only to meet the basic needs of bulging population for diverse uses but also to moderate the floods, droughts and poverty. Most of the people associated with environmental activism and press reporting in India have very little understanding of the complex multi-disciplinary environmental processes. Most of the personnel associated with the tirade against water storage projects have very little understanding of the 'dose-response functions' of the complex environmental processes and are ignorant of intricate multi-disciplinary techniques of water resources development. An overview of the environmental impacts of the water resources development in India is of particular interest at the present stage of development. We should aim at minimising the adverse environmental effects through appropriate changes in projects design along with adopting environmental management plan and have to take a balanced view considering both direct and indirect benefits as well as cost together with positive and negative impacts on environment and socio-economic status of the society. Many of the NGOs believe in myths even; when though such myths are clearly contradicted by scientific facts. Multi-disciplinary teamwork, though advocated easily, is indeed a difficult task to accomplish, specially when the individual's training is in the narrow disciplinary field of specialisation. Subjects of water resources management, environmental concerns and the process of planning and operation of various types of water projects should be rightly taught at different levels of education as well as to the experts of different disciplines.

Supreme Court Judgement Related To Narmada Project

Following excerpts of Hon'ble Supreme Court in their judgement delivered on 18th October, 2000 for Narmada Project, in writ petition of Narmada Bachhao Andolan Vs. Government of India and Others are eye opening. (C.A. No. 6014/1994 W.P.(C) Nos. 345/94 with 104/1997, S.L.P. (C) No. 3608/1985 & T.C. (C) No. 35 of 19995).

Dams and Environment -Supreme Court in its majority judgement stated 'that in the present case, they were not concerned with the polluting industry, but a large dam. The dam is neither a nuclear establishment nor a polluting industry. The construction of a dam undoubtedly would result in the change of environment but it will not

be correct to presume that the construction of a large dam like Sardar Sarovar will result in ecological disaster.'

'India has an experience over 40 years in the construction of dams. The experience does not show that the construction of a large dam is not cost effective or leads to ecological or environmental degradation. On the contrary, there has been ecological up-gradation with the construction of large dam. What is the impact on environment with the construction of a dam is well known in India and therefore, the 'precautionary principle' and the 'polluter pays principle' will have no application in the present case. So far, a number of such river valley projects have been undertaken in all parts of India. The petitioner has not been able to point out a single instance where the construction of a dam has, on the whole, had an adverse environmental impact. On the contrary, the environment has improved. That being so, there is no reason to suspect, with all the experience gained so far, that the position here will be any different and there will not be over all improvement and prosperity. It should not be forgotten that poverty is regarded as one of the causes of degradation of environment. With improved irrigation system, the people will prosper. The construction of Bhakra Dam is a shining example for all to see, how the backward area of erstwhile undivided Punjab has now become the granary of India with improved environment than what was before the completion of Bhakra Nangal Project. We are not convinced that the construction of dam will result in there being an adverse ecological impact. There is no reason to conclude that the Environmental Sub-group is not functioning effectively. The Group, which is headed by the Secretary, Ministry of Environment and Forests is a high powered body, which can not be belittled merely on the basis of conjectures or surmises.'

Hon'ble Court was satisfied that substantial compliance of stipulated environmental safeguards was undertaken in SSD Project. Surprisingly, the Supreme Court noted that the Narmada Bacchao Andolan (NBA) had not even allowed surveys for demarcation for R&R of the PAFs and that the NBA's efforts to stall SSDP through FMG had failed. The NBA's plea that environmental clearance for Sardar Sarovar Dam Project had lapsed; was not agreed to by the Supreme Court. It was ruled that Narmada Bachhao Andolan (NBA) could not give a single example of the whole advese environmental impacts of even a single dam in India.

World Commision on Dams Report & India Country Study Report

NBA and particularly Ms. Arun Dhatti Ray even dared to censor their lords for Ms. Ray was token imprisoned for a day 'being a lady'. Later-on, Ms. Medha Patkar (main spirit behind NBA) became judge of World Commission on Dams (WCD) and her spokesperson Sh. Jain (nominee of NBA in Govt. of India Committee) was appointed Vice-chairman of WCD.

Total reliance in INDIA COUNTRY STUDY REPORT (ICSD) was laid on the figures given by the NGOs especially regarding the displaced persons, submerged forests or the effective command; on the other hand, the government figures were stated to be unreliable inferring that such departments interpret and present the data to promote their own interests best. The achievement of water resources development of last 50 years in India have been totally neglected in ICSD. Large beneficial environmental and social impacts of the Bhakra Dam, Hirakud Dam, Ukai Dam, Nagarjuna Sagar Dam, Pong Dam, Ramganga Dam and several other major dams were available in numerous publications. Tremendous environmental and social benefits of Brindavan Garden (Krishna Raj Sagar Dam), Ukai

& Ramganga Gardens, Periyar wildlife resorts, Kalindi Kunj, as by-products of large dams and improved environmental and social conditions in Rajasthan, Punjab, Haryana and western UP after the construction of large dams were left out in the study report. On the other hand, the three on-going projects namely, the Tehri, Indira Sagar and Sardar Sarovar Projects were cited, without associating the project authorities but laying total reliance on the views of activists fighting against these three projects.

Thus ICSR was a truly malafide play enacted under the shadow of the WCD. Surprisingly, against all norms of decency and law, the litigants and their prime supporters in Indian Supreme Court against the Sardar Sarovar and Tehri Dam Projects were either positioned as Commissioners of the World Commission on Dams or authors of India Country Study Report.

WCD report was critically reviewed by 3 top International Professional Organisations International Commission on Large Dams (ICOLD), International Commission on Irrigation & Drainage (ICID), International Association of Hydropower Association (IHPPA). Their valuable observations were conveyed to prominent international organizations, professional bodies and Governments of various countries. They pointed out serious flaws & ambiguities in WCD Report and impracticability of the WCD recommendations.

How can WCD recommendations regarding joint negotiations with the stake holders leading towards negotiated agreements at national and international levels, be accepted by India; in view of the massive programme for utilization of water, power and environmental resources; for accelerated economic development. Govt. of India had very rightly rejected WCD Report due to the report being not only biased & ambiguous but also due to one-sided India Country Study Report wherein, the minor adverse environmental impacts of large dams were highly blown up and tremendous socio-economic and environmental benefits of even major dams like Bhakra, BSL, IGNP, Damodar, Ramganga, Nagarjunasagar, etc. were omitted.

Conclusion

Social tensions, political instability and street fights are already on the horizon; due to stoppage and slowing down the construction of almost all major dams; ignoring the bulging demands of water and power for municipal uses in metro cities, by few environmental activists and novelists; without professional analysis. Non-development of water storage projects is not a viable or available option; due to the large temporal variations in river flows in Indian monsoonic climate. A series of smaller dams, even if feasible, would entail higher costs, greater submergence, far more displacement, greater evaporation losses, increased maintenance cost and far less benefits. Small dams are prone to fall in critical years of drought because they depend on tiny catchments. Moreover, a large dam site is a natural resource depending on the rock formation, geometry of valley, foundation-conditions and hydrological features. Medium and small water projects as well as water harvesting schemes cannot substitute the need of large water storages but can at best complement the larger projects. This, too, depends upon the hydrological, geological, topographical and regional limitations. A large dam site is a natural resource depending on rocks formation, geometry of valley, foundations and hydrological features.

Benefits accrued from large river valley projects are so immense that they substantially outweigh the costs of immediate human and environmental disruptions. On the other hand, long-term adverse effects of not utilising the water resources

would be catastrophic due to recurrence of floods, droughts and the resulting unemployment, which further increases the backwardness in countries like India. Catchment area treatment and watershed management are development projects in their own right and should be planned and executed as such independently without putting undue financial burden on water resources projects. At best, treatment of direct draining sub-watersheds along the reservoir rim could be charged to the cost of the reservoir project.

Even fraction of large scale requirements of irrigation, power, flood moderation, water supply for urban and rural population as well as industrial and power sector cooling requirements, can not be met through rain water harvesting and by a series of run-of-river and small river valley projects? Pressure groups, have already created an environment of hatred opposing large hydropower and irrigation projects in particular. It is time to re-emphasise the requirements of these large river valley projects in order to ensure a better and stronger future.

Supreme Court in their judgement in PIL by NBA expressed its deep concern that against the utilisable storage 690 cu. km. of surface water resources out of 1869 cu. km.; so far storage capacity of all dams in India is only 174 cu. km., which is incidentally less than the capacity of Kariba Dam in Zambia/Zimbabwe with capacity of 180.6 cu. km. and only 12 cu. km. more than the Aswan High Dam of Egypt. Supreme Court observed that the Public Interest Litigation (PIL) is ballooning and can't be allowed to burst. The lords in majority judgment stated that that PILs cannot be allowed to degenerate into "Publicity Interest Litigation" nor "Private Inquisitiveness Litigation". Supreme Court very clearly observed that with channelisation of development, ecology & environment gets enhanced and that biggest dam to smallest structures are water harvesting structures. Supreme Court ruled that "Dam is neither nuclear establishment nor an industry. Since long, India has derived benefits of river valley projects. High dam decision can't be faulted. Large dams upgrade ecology".

Some non-credible NGOs and self styled non-professional environmentalists leave no stone unturned to oppose almost each water storage dam, hydel plant and continue fighting tooth and nail against vitally needed inter-linking of rivers, perhaps through foreign funding and to garner awards, fame and monopoly even though they are totally ignorant of even basic facts and intricate 'dose response functions' of complicated environmental processes and techniques of water resources and hydro power development, since they have no scientific or technical background. Environment is either science or engineering, which can not be so well understood by novelists, journalists and self styled activists. Such persons repeatedly use media to create fantasies since they have excellent command on language, media relationship and have nothing else to do except whole hearted full time tirade against water storage projects, on many shifting grounds. In every sector other than water and power, specialists like doctors, surgeons, economists, space & atomic scientists etc. are considered competent but any 'Tom', 'Dick' and 'Harry' claims to be expert to oppose large dams, hydel projects and inter-basin transfer of water projects. Adequate laws and Governing mechanism should be quickly evolved so that such non credible NGOs and self styled environmentalists are no longer allowed to create obstacles in national task of water and power supply for competing uses for such a vast humanity. Our policy makers and engineers should not only create scientific public awareness about the need of large storage dams & mega hydro- power projects but also ensure to blend techno-economic and socio-ecological improvements with

advancements in science & engineering. This is an essential message for engineers and technologists involved in formulation and implementation of 12th Five Year Plan.

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Enhancing Skills and Faster Generation of Employment - the role of Engineers & Technocrats

YP Chawla*

Abstract

India is entering into the 12th Five Year Plan for continued development. The Planning Commission has identified 12 Strategies for Inclusive Growth. For 9% targeted growth in GDP, Technology related skill gaps will damage the Indian Economy if Skill gaps are not corrected - the Studies warn. Current Skilled Manpower Gap in is 20 Industry Sectors in India. India has a window of 25 Years to take advantage of the Demographic. This, if not converted to a dividend can be catastrophic for the nation and youth may turn violent, if no new job opportunities are created. The Engineers & Technocrats in India are required to join hand in making this situation into a nation building reality.

Strategy Challenges of the 12th Five Year Plan

1. Enhancing the Capacity for Growth (needs Enhanced Skill Sets)
2. Enhancing Skills and Faster Generation of Employment
3. Managing the Environment
4. Markets for Efficiency and Inclusion
5. Decentralisation, Empowerment and Information
6. Technology and Innovation (needs Enhanced Skill Sets)
7. Securing the Energy Future for India (Shortage of Manpower for Projects Development)
8. Accelerated Development of Transport Infrastructure
9. Rural Transformation and Sustained Growth of Agriculture
10. Managing Urbanization
11. Improved Access to Quality Education (will lead to Enhanced Skill Sets)
12. Better Preventive and Curative Health Care (additional Manpower with High Skill is required)

Sector- Wise Employment (Recently Published Data)

Industry	Employment % in Industry		Value added per Worker in Rs./ Annum
	1983	2006-07	2004-05
Agriculture	65.42	50.19	20,937
Mining	0.66	0.61	170,801
Manufacturing	11.27	13.3	355,318
Electricity	0.34	0.33	228,650
Construction	2.56	6.1	59,193
Trade, Hotels	6.98	13.18	75,080
Transport	2.88	5.06	110,403
Various others	9.89	11.23	
Total	100%	100%	No Data

All the above strategies are pointing to enhanced Skill sets. The Macro Parameters of Indian Economy 9% average annual growth have been fixed with:

AGRICULTURE contributing : 4% average annual growth; **INDUSTRY's contribution as:** 9.6% average annual growth **SERVICES will**

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add: 10% average annual growth, with Industry making the maximum value addition. The Manufacturing Sector value addition remains the highest amongst various sectors. It is the **Engineers & Technocrats of the Industry** have to take on the Economic Growth more aggressively. The Govt. of India has to set the course by rightly aligning the School Education with Vocational Programs to achieve Education & Career growth through modular educational Credit based programs.

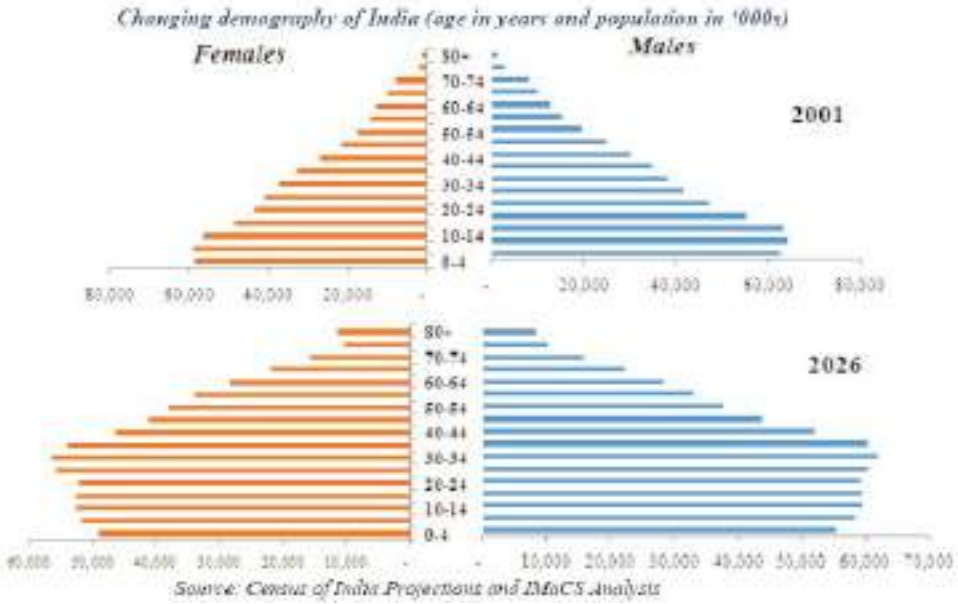
Various Studies conclude 75% of Technical Graduates & 85% of General Graduates are Unemployable by India's High Growth Global Industries, unless Skills are added (The Wall Street Journal) and India Aspires to be a Knowledge Superpower. In Asia Pacific market Employers (45%) facing difficulty in Job filling because of Lack of Available Talent (Talent Shortage Survey 2011). Indian has to take fast action on taking advantage of its demographic strength which is >50 % Population < 35 Yrs. India will be able to utilise the dividend meaningfully, only if India is able to equip the workforce with the appropriate skills. In this respect, skills development emerges as one of the most critical aspect of India's economic policies.

Although productivity has been increasing and education levels rising, India still needs to improve education and training quality. While significant improvements will need to be made on quantitative indicators, little is known about qualitative indicators - e.g. because India does not participate in standardized international examinations, there are no good comparative measures of quality.

Providing more education and skills cannot, by itself, be enough - quality and labor market relevance is crucial.

The education and skills provided must be relevant to the labor market. Acquiring skills is essential, provided those skills are not out-dated or do not meet industry requirements

The Indian economy is widely expected to grow at sustained high rates over the next few decades and emerge as the second largest economy by 2050. These robust projections have much to do with the demographic profile of the country. India is slated to have one of the youngest populations in the world, with the bulk of the population figuring in the working age. Low dependency ratio and a surplus workforce put



Source: Census of India Projections and IMaCS Analysis

India at a strong comparative advantage vis-à-vis most major economies. However, in order to utilise this 'demographic dividend' effectively, India needs to impart adequate and appropriate skills to its workforce.

The Programs being Technology based, the Academia- Engineers & Technocrats (Industry) have to be Partners for:

- Empowering youth force to be successful Entrepreneurs or to be gainfully employed and be a partner in the Nation's progress.
- Increasing capacity & capability of existing system to ensure equitable access to all.
- Taking the Skill enhancement to new heights with a objective to achieve the requirements of Knowledge Economy
- Allows Blend of Private Sector Best Practices in the Education Curricula.
- Achieve Inclusive & Sustainable Growth in Education
- Working on 3 E's : Education - Employment- Employability

Motivating Environment of Govt. is permitting - Imbibing of Govt. Resources / Infrastructure with Industry

- Adding Private Sector's - Training Kits for Igniting the Minds for an Holistic Approach in Education
- India's Agenda 2022 " Higher Education Sector"

Proposal to start in association with the Industry: Apollo Tyre is ready for the launch of the programmes

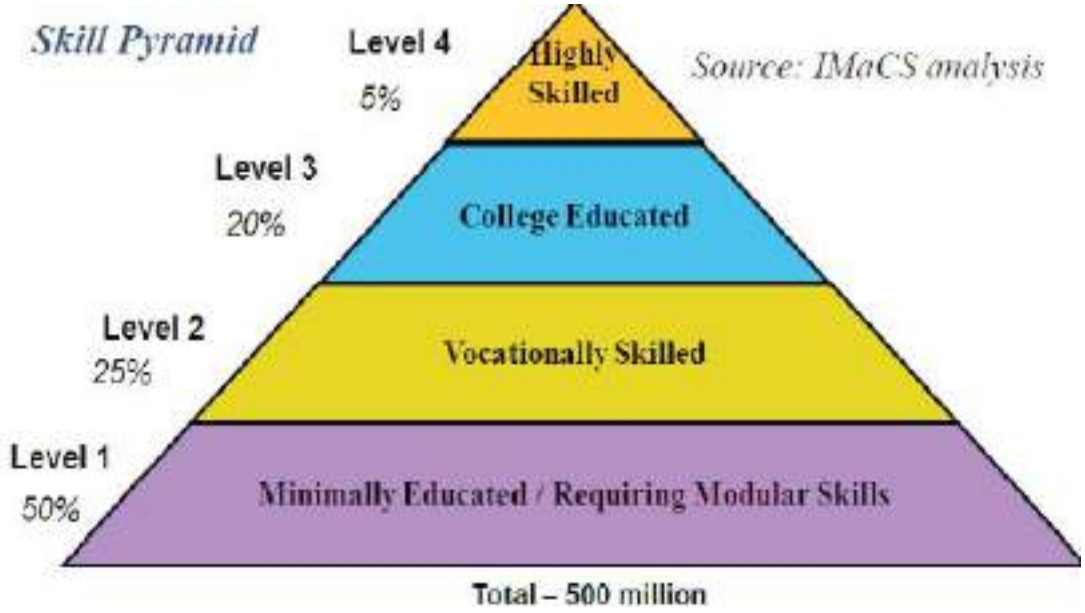
- Modular Courses / Open Architecture Programs
- Mkt. Demand based
- Bridge Program for ITI -(ITI type Programs planned for breaking to < 6 months for modular & scale it up for Diploma & beyond).

Certificate (16 Credits), Diploma (32 Credits), Advanced Diploma, Associate Degree, Post Graduate (64 Credits &+)

- Educational Enhancement for Working Professional - Part timers - ITI to Diploma, School leavers to Diploma Engg., Diploma to Engg. Degree etc.
- E Learning
- Judicious Blending of Class Room, Industry Hand's on Exposure and E learning.
- Self Learning & Self Education Kits
- Net Working & Collaborative Approach with Experts.
- Flexi Learning Programs - Training, Retraining & updating the skills, Training & Qualification.
- To adopt Technology Enabled Education - Video Conferencing
- Modular Employable Skills - Modular Programs
- Skill Enhancement Programs- High & Middle Level Skills (not basic)
- Bridge Programs
- Qualifications Improvement while Serving
- Making Candidates Industry ready/ Entrepreneurs

A big challenge for India for Skilling 500 Mn. by 2022, If the Infrastructure is not ready in next three years, we miss the bus.

It has to happen and India will be able to achieve the target of 30 per cent of Gross Employment



Ratio by 2020. It will require three ingredients - excellence, equity and expansion.

India to face huge skills gap due to high migration to other countries (due to Youth not available with them in numbers required for their growth)

India to face further skills gap due to high migration to other countries by skilled Indians, when world Economy will come back on Track might be in next 1 year. In last 20 years around 25 million migrated to developed countries, which will continue next 20 years also. Today's global and fast changing business environment, access to highly skilled people not just top talent, but also people who possess essential expertise is crucial to succeed and grow for all global companies and Techies.

The gap in getting employed triggers greater dissatisfaction and destructive mind sets specially in youth who generally carries high energy, courage and dreams. The right skills certainly help in placing youth and mobilize those at right places is additional challenge. It looks like simple demand n' supply equation, but in practice it a real challenge. It is also a great opportunity to countries like India to skill and involves its large youth population. This is to boost economy as well for social reforms

The GoI has put the Employability Strategy through Skill Enhancement as one of the twelve Strategies for 12th Plan. In addition, the University curriculum has to align itself towards employability with teaching and assessment of employability skills are to be enhanced; and universities to systematically review their work on developing employability skills. This is applicable for the conventional route of Education & Employment.

The non- traditional route of Vocational Programs and then enhancing skill for Education and Career growth Path is to be developed by the Industry. This being mostly Industry based the Engineers & Technocrats have to chip in their effort and bring in some radical changes and come out of the conventional mode of education.

We will have to diversify in various employment Skills because at present more than 60 per cent student enrolment is in arts faculty and have to bring in more skill oriented courses.

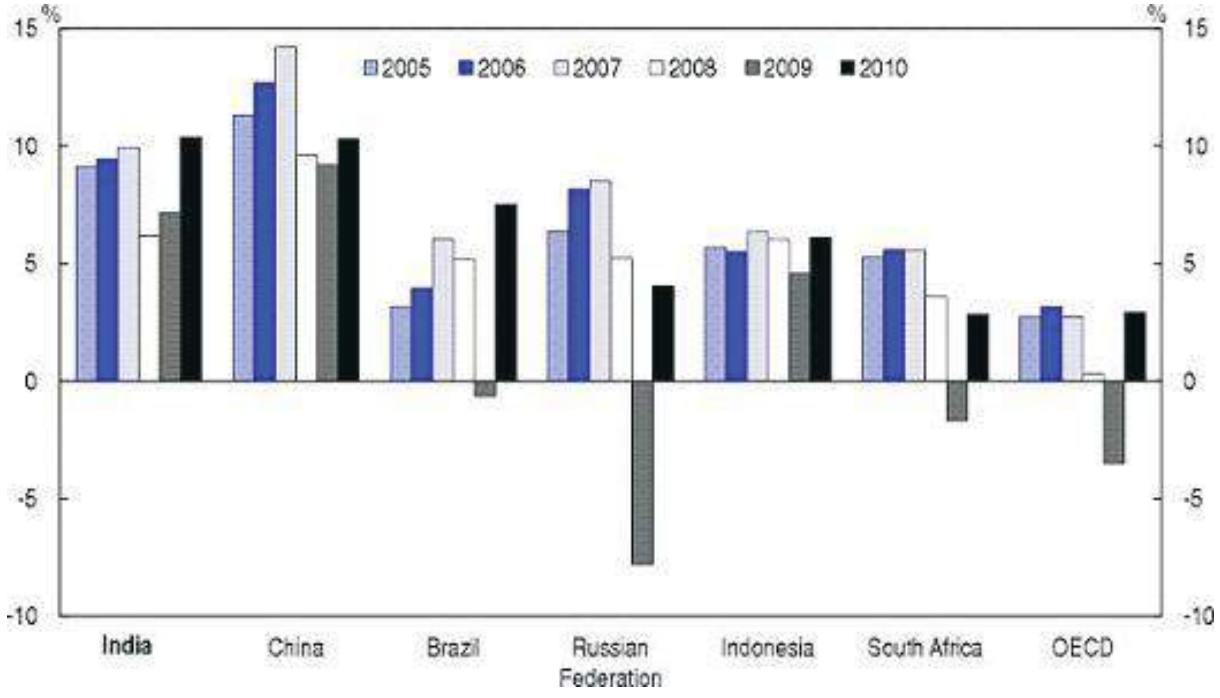
Prof. Govinda further added, "It cannot be done alone by the government of India, states will also have to play an important role in it, and universities will have to diversify.

More inclusive growth is one target of the 12th Plan. Yes, it is true that Poverty rates continue to fall but still remains high despite strong growth: making growth more inclusive is therefore a top government priority. The introduction of the national rural employment guarantee NREGA has helped reducing Poverty in some cases but it has made some people sit idle and enjoy NREGA rather than remaining Employed.

Government of India spending is higher in various other areas aimed at lowering poverty and for inclusive growth, which include subsidisation of kerosene, liquefied petroleum gas and fertilisers. It has now to focus on Education & Skill Enhancement, as, a large part of such outlays otherwise do not reach the poor.

While the Government remains a major financier of pre-employment training & Skill Enhancement, emerging skill needs with changing Technologies needs innovative solutions.

The public Skill Enhancement system still constitutes an important provider and financier of pre-employment Skill enhancement and training in India. This simple financing framework has become inadequate to meet the skill development needs in a rapidly globalizing `economy, and it has become important to consider how financing can also foster increased in-service training among enterprises, greater private provision of training, as well as greater cost-sharing with beneficiaries utilising the experienced Engineers & Technocrats. Given this, there are two sets of issues: (a) how to best mobilize resources for training; and (b) how to allocate resources most effectively to arrive at the desired objectives.



Sustained Growth of Agriculture : Role of Agricultural Engineers in the 12th Plan

Dr. V. M. Mayande*

Abstract

The innovative engineering technologies have prime importance in the modern economy. The agricultural engineering involves the intensive and precise application of various technologies for the development of agriculture. Agricultural eengineering is a critical component for helping to meet the challenges facing increased crop production. In the early years of the Green Revolution, engineering made many technical contributions to reduce drudgery and help increase labour productivity. The opportunity is for contributing to an integrated system from field preparation all the way through the chain to end users.

Introduction

The potential and crucial role of agricultural engineering, and therefore of agricultural engineers in development has not always been recognized. A number of spectacular failures in the past involving poorly adapted schemes of agricultural engineering let planners to neglect and even resist investment in this sector. Yet, to neglect investment in this sector denies a society the possibility of raising its agricultural performance beyond subsistence levels. Manpower development is recognized as being of prime importance for the successful execution of agricultural development programs of the country. The level of input of engineering technology into agriculture is generally still low. The nature of these inputs has been different in various regions of the country. The engineering intervention like land preparation by using tractor operated machineries on the custom hiring basis is the emerging trend. The mechanization in farming systems contributes to seed bed preparation, sowing, inter-culture, crop protection, irrigation, threshing and to some extent harvesting of the cereals and others crops. Still there is huge gap to fulfil the demand of operations by mechanized ones. In India, a tractor industry is growing with the support of the financial assistance from the institution through the leading banks. The farm machinery industry in the country is scattered in nature having various local standards. The manufacturing of machineries for seed bed preparation, sowing, planting, plant protection, irrigation, harvesting/ cutting, and threshing are mostly produced in India. The tractors and equipment like plant protection, tillage also exported from the country.

The public concern for sustainable development defined as the strategy to meet the needs of the present without compromising the ability of future generations to achieve their own needs (Anon., 1987) is still growing. The global food security and the sustainable resource management are key issues for agricultural production. About 840 million people in developing countries do not get sufficient protein and energy (Brown, 1999). Resource management is linked to land use, energy and water. In the food production chain, there is the necessity for the control of quality, also in terms of absence of toxic compounds. Knowledge generation, technology development and innovation must be distinguished. These three elements are important for the agricultural engineering discipline. Scientists must not only have analytical skills, but also the competence for the design or redesign. Innovation is a concept,

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which means more than expertise and knowledge. Innovation is related to new products, processes or concepts for integrated systems and is market oriented (Verkaik, 1997). The 20th century has brought for agricultural engineering quite a number of extensions with evolution of the various fields. Especially the breakthroughs from other disciplines, such as microelectronics in transponders, sensors and information technology, have opened wide perspectives.

Agriculture Scenario in 11th Five Year Plan

An important sectoral target of the Eleventh Plan was to raise the rate of growth of GDP in agriculture from about 2.5 per cent in the Tenth Plan to 4 per cent during the Eleventh Plan period. Higher agricultural growth was expected to contribute directly to overall GDP growth and even more so to inclusiveness. Since more than half of the labour force still derives its income from agriculture, faster agricultural growth is perhaps the most effective instrument for reducing rural poverty. It would mean raising farm incomes for landowning farmers and wage income for landless labourers. It is difficult to judge growth performance in agriculture based on short periods because of the volatility to which agriculture is subjected. The average growth rate of agriculture in the first two years of the Eleventh Plan was 3.2 per cent, which was better than that of the Tenth Plan, but the drought in 2009-10 reduced the average for the first three years to a little over 2 per cent.

An important aspect of 'inclusive growth' in the Eleventh Five Year Plan (2007-12) was its target of 4 per cent per annum growth in GDP from agriculture and allied sectors. This target was not only necessary to achieve the overall GDP growth target of 9 per cent per annum without undue inflation, but it was an important element of 'inclusiveness' since the global experience of growth and poverty reduction showed that GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture.

Food security at the national level remains of paramount concern for the government and therefore growth in food grain production must be a central policy focus. However, food grains account for less than 25 per cent of the value of output in agriculture and allied sectors. So the future sources of growth have to come mainly from the non-grain sector, which have to grow at much higher rate than 4 per cent. This is well recognized and spelt out in the Eleventh Plan document. After ensuring a stable growth rate of 2.0-2.5 per cent per annum in food grains and building up adequate stocks the focus should be on diversification to augment farmers' incomes and to accelerate growth. Commercial crops like cotton have displayed dramatic growth since 2002-03 (by more than 10 per cent per annum), doubling production and yields, and making India the second largest exporter of cotton (more than 8 million bales) in 2007-08. Significantly higher investments are needed in modern bulk handling, storage of basic food grains, preferably under the private sector or under the PPP mode. The current storage capacity with state agencies is much lower than the stocks that they often carry, leading to large wastages (8-10 per cent); reassessment of the optimal level of storage of food grains in the wake of increasing volatility needs to be taken up on a high priority. Special focus groups, including reputable agri-business leaders, on eastern India need to be set-up to harness groundwater to help raise rice, wheat, and maize yields with a combination of incentives and infrastructure investments.

Development of Agricultural Engineering-Social and Economic Context

Agricultural engineering is deeply involved in the process of social and economic change and has strongly affected development, as now witnessed in the modern world. Viewed in its broadest context agricultural engineering lay at the heart of the earliest forms of civilization, which developed around the river systems of the Middle East, Egypt and China. On the mechanical side, agricultural engineering has its roots in the village blacksmiths and artisans making hand tools and equipment. Agricultural engineering is still at the black smithy stage in many developing countries whereas in the developed world, many families of the more progressive artisans of the last century have developed from their village forges into some of the largest national and multinational manufacturers of agricultural machinery. The striking difference between a modern developing economy and most of the developed nations of the world today is that a developing country, with its developing economy, can choose its path of development. It may either pursue the path of gradual and slowly accelerating progress towards higher levels of agricultural mechanization; or, it may attempt to take immediate advantage of the advances in technology that are available from the developed world. The process of rural change accompanying agricultural mechanization development is beset with social and economic difficulties. All engaged in agricultural mechanization programs should be made aware of the hazards, possibilities, and successes that have emerged during their establishment.

Development of Agricultural Engineering as a Profession

Agricultural engineering has most commonly been defined as the application of engineering principles to agriculture. It thus involves many different established branches of engineering and associated disciplines, and progressed to the stage where its own professional institutions are established in many countries.

Generally speaking, the farmer level should be looked at first with a detailed analysis of the profitability of farming. If the farmer is not making money then he will have no surplus cash resources to purchase mechanization inputs nor any means of paying back any credit taken out to purchase farm machinery. It is necessary to identify the major farming systems in each of the regions of the country and the importance of farm mechanization in those systems and its potential to increase productivity. The final stage in the preliminary analysis of farming systems is to collate the available statistics and studies for each of the farming systems indicating:

- The number of farms in each system;
- Average farm size;
- Dominant crop/livestock production systems, including types of crops and method of production;
- Input use and production;
- Farm power and equipment use;
- Crop and livestock budgets;
- Average farm incomes; and
- Off- and non-farm income which should enable a preliminary identification of those systems where farm power is, or has potential to be, important.

Agricultural Engineers have, for some years, been discussing the present and future position of their profession. Actions like changing the name of the higher education institutes and title of the degrees to those more attractive and publicly

well-known and acknowledged terminology or converting the agricultural engineering to and/or merging more with biological systems engineering were taken. However, besides these public awareness efforts, significant focus should also be given to how to realize their roles in sustainable rural development as engineers of agriculture. Agricultural engineers should therefore:

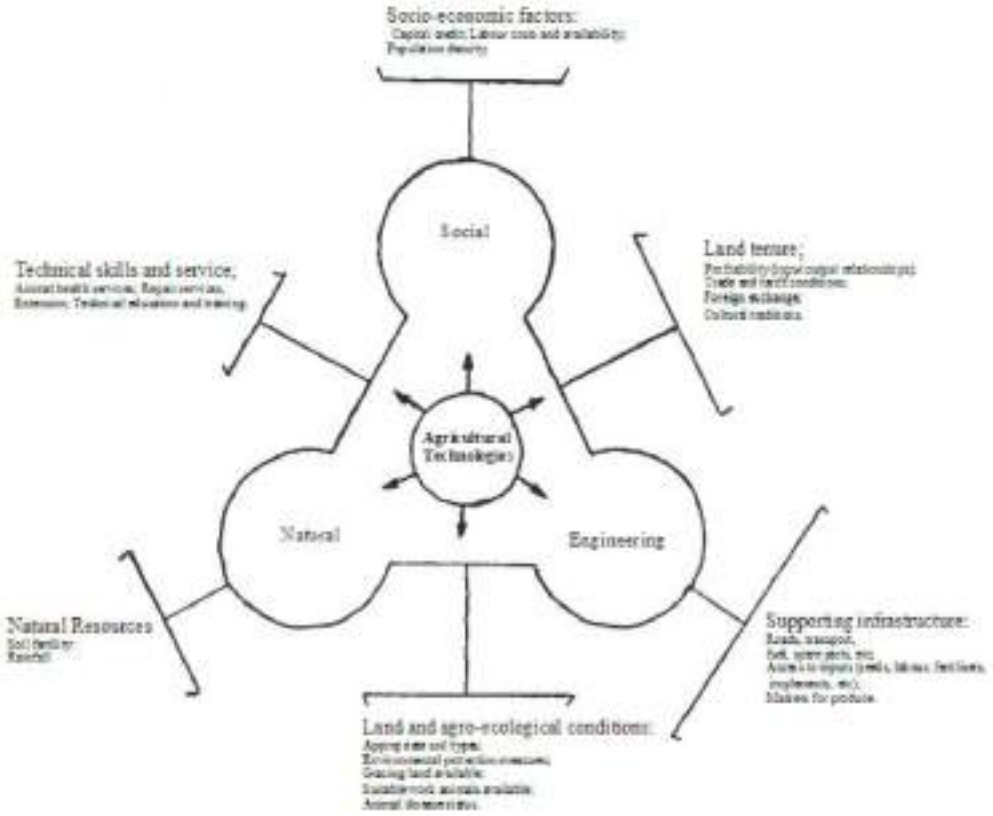
- ensure an adequate and safe food supply for an expanding world population,
- manage and protect the world's vital water, soil, air and energy resources,
- help people through contribution to food production, food quality and safety,
- food storage, food processing, transport, packaging and marketing,
- help reduce the rural poverty and improve farmers' welfare,
- help poor farmers raise their incomes by "face to face" contacts,
- avoid environmental degradation, conserve natural resources and control pollution,
- reduce drudgery of work carried out in rural life, ensure labour productivity whilst enabling more timely operations for a better production

It is important to note that young generations in both developed and developing countries prefer living in urban areas and leaving parents on their own at rural activities. This limits the sustainability of rural development. As United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panels on Climate Change (IPCC) warn about the impacts of global warming and climate change, such as scarcity of food and water supplies, draughts, floods, migrations, increasing frequency of natural disasters, safety of food and water resources etc. In light of these climate change considerations, promotion of sustainable forms of agriculture; research on, and promotion, development and increased use of, new and renewable forms of energy, and of advanced and innovative environmentally sound technologies are to be implemented. All these and many other measures are directly related with the profession of agricultural engineering. It is, therefore crucial to pay particular attention to conservation and management of soil and water resources, adaptation and breeding of draught-resistant crop and livestock varieties and create awareness of rural communities through intensive training and extension services in the region. Agricultural engineers will certainly play a critical role in fight with these impacts of climate change.

For a sustainable rural development, farmers need to secure their income through adequate prices and also secure market conditions. Integration of farming activities with agro-industry, in other words a complete chain of food production from farm to consumers brings about an important role for agricultural engineers.

Problem of retrofitting agricultural technologies in farming

Agricultural technologies are powerful tool in achieving sustainable agricultural production. Human, animal and mechanical power sources are becoming inevitable in farming system. These technologies enhances human capacity, it does necessarily increase productivity in terms of yield, return on capital and return on energy inputs. If land is fragmented, mechanization tends to intensification, and increase in yield per unit area. Mechanization can improve timeliness and precision of tillage, seeding, weeding and harvesting which may increase production and productivity. The potential users or beneficiaries of mechanization can be men, women and



children. To avoid accelerating erosion and soil degradation, sustainable agricultural technologies must include measures to conserve soil fertility. The key factors responsible for successful adoption of agricultural technologies are depicted below :

Agricultural Engineering in India

The level of input of engineering technology into agriculture is generally still low. The nature of these inputs has been different in various regions of the country. The engineering intervention like land preparation by using tractor operated machineries on the custom hiring basis is the emerging trend. The mechanization in farming systems contributes to seed bed preparation, sowing, inter-culture, crop protection, irrigation, threshing and to some extent harvesting of the cereals and others crops. Still there is huge gap to fulfil the demand of operations by mechanized ones. In India, a tractor industry is growing with the support of the financial assistance from the institution through the leading banks. The farm machinery industry in the country is scattered in nature having various local standards. The manufacturing of machineries for seed bed preparation, sowing, planting, plant protection, irrigation, harvesting/cutting, and threshing are mostly produced in India. The tractors and equipment like plant protection, tillage also exported from the country.

Most of the agro processing industries are concern of small size or tiny nature. It is associated with the family nature and working with traditional nature concern on hygiene or quality control. The typically small-scale pulse processing, cleaning and grading of grain, etc. are the examples of the small agro processing industries in the country.

Agricultural engineering plays a increasingly pivotal role in supporting the continuous growth

of the agriculture and agro based industries under the labour scarcity and costly situation. To reduce dependence on traditional resources of farming it is necessary to adopt the capital-intensive and management-intensive agricultural engineering.

Challenges of Agricultural Engineering in 12th Plan

Agricultural technologies are powerful tool in achieving sustainable agricultural production. Human, animal and motor power sources can be complementary in an area or in a farming system. If land is plentiful, mechanisation tends to lead to extensification. Mechanisation can improve timeliness and/or precision of tillage, seeding, weeding and harvesting which may increase production and productivity. The potential users or beneficiaries of mechanisation can be men, women and children. A sustainable production system is one that maintains optimal production without jeopardising the production factors in future. To avoid accelerating erosion and soil degradation, sustainable agricultural technologies must include measures to conserve soil fertility.

The key factors that influence successful adoption of agricultural technologies include:

- Socio-economic factors: Capital/credit; Labour costs and availability; Population density;
- Land tenure; Profitability (input/output relationships); Trade and tariff conditions; Foreign exchange; Cultural traditions.
- Supporting infrastructure: Roads, transport, fuel, spare parts, etc; Access to inputs (seeds, labour, fertilisers, implements, etc); Markets for produce.
- Land and agro-ecological conditions: Appropriate soil types; Environmental protection measures; Grazing land available; Suitable work animals available; Animal disease status.
- Technical skills and service; Animal health services; Repair services (blacksmiths, mechanics); Extension; Technical education and training.

In most situations there will be clear limiting factors, such as lack of capital/credit, lack of inputs or support services, or lack of profitable markets have restricted the spread of the use of technologies in farming. One role of development agencies (governmental or non-governmental) is to identify the crucial limiting factors in an area (using participatory techniques) and, where appropriate, overcome the problems in partnership with local communities.

Constrains and challenges in Agricultural Engineering

The problems in farming system to produce food, fodder vary in nature according to the land conditions. Some of the major constrains in adopting the agricultural technologies in India are as follows:

Increasing cost of production

Indian agriculture is operating under competitive global environment with the increasing cost of the labours, machineries use, and water resources for production. The inputs like seed, fertilizers and the plant protection are also increasing. Apart from these there is a serious problem of agricultural labours due to the competition from other sectors of economy like construction and manufacturing industries. In near future these will impact on the major food crop production, which will result in the increasing cost of production.

Intensification of crop production

The land and water resources in the agricultural production are limiting factors. Therefore there is need to optimize the use of land resources such as by intensifying the production capacity of the land, to reduce the risk factor of the water in production to stabilize the yield and quality. This means the change in the approach towards the better planning which incorporates high level of agricultural engineering inputs.

Competition from the allied sector

The agricultural engineering is mostly of capital intensive nature requiring long term commitment in term of resources such as finance support. In such situation, the agricultural sector has to compete with the others sector of the economy. The finance facilities available in the country have been mostly availed by the larger farmers. The small farmers have reluctance for such huge investment of agricultural technologies in term of the machineries and prefer custom hiring of the machineries and the others short-term options.

Scare water availability

In India about 65 per cent of water resources have been utilised for the farming irrigating about 40 per cent of agricultural land. Other sectors like industries are using 25 per cent of water sources in the country and increasing continuously. The population of India utilises the 10 per cent of the water resources in the country for household purposes. It has been clear that we have to provide the food for the growing population of the country with limited water resources. Irrigated agriculture must therefore improve on the efficiency of water use.

Limit of land sources

With the rapid growth of the population and industrialization in the country the agricultural land near to the urban areas are converted into residential or industrial areas. The productivity of the land has to increase by the vertical expansion.

Concept of modernization

The agricultural modernization is an application of agricultural engineering technologies for proper development of the farming system. The concept of the farm mechanization is not fully understood and practiced in the farming sector of the country. In the coming era due to the labour and the cost constrains only the crop that can be highly and effectively mechanized will be able to sustain the local and global markets.

Education, research and development facilities

The agricultural engineering technologies are still lacking. There is urgent need to develop sufficient research and education facilities to explore the latest technologies to accelerate the research and development efforts in the generation of the better innovative technologies to solve the immediate and long term problem in the farming system.

Unavailability of suitable technology

The manufacturers, dealers and the suppliers are reluctant to supply specialised machineries that are not commonly used in the country due to the uncertainty involved and the high cost of the stocking spares parts. Under such situation, it would be impossible to obtain and utilize the most economical agricultural engineering technologies packages.

Linkage of farmers and industries

Current effort towards the establishment of formal linkage of the agricultural engineering research and development centres with machinery manufacturers, dealers and the

extension workers need to be intensified for the better and more efficient flow of information to and from the farmers. Similarly the linkages with the international development in agricultural engineering technologies to exchange the latest information for the suitability and reliability of the technologies are the coming age challenge to Indian agriculture.

Certification of the agricultural engineering technologies

The developed technologies have to be mandatory certified by the central agricultural technology certification agency (CGTCA) by keeping in view the local conditions with site specific requirements. This will affect the identification of appropriate machineries that are of good quality a determinant to the environment, specific to soil structure and the ease in operation to the operators.

High investment of capital

The application of the advanced technologies requires higher capital investment than the tradition system. But with this agriculture enterprises involve higher risks compared to the others economic investments of lower yields. The strategies that ensure cost effectiveness and viable mechanised system in time bound nature of application are needed to be evolved.

Demand of advancement in agricultural engineering

Agricultural engineering is the application of various engineering intervention in agriculture to produce agriculture products and improve the living standard of the farmers. It is dedicated to the application of engineering principles for the advancement of the food-feed-fibre-fuel production with the precision use of natural resources.

The scientific methods applied to the pest control, limiting the widespread use of insecticides, fungicides and applying more varied and target techniques the new understanding of significant biological control measures have made possible more effective control on specific kind of insects and diseases. The agricultural engineering provides the site-specific chemical applicator of safe nature. Field operation such as irrigation, drainage, soil conservation and the environment conservation are important in the successful farming and they make use of knowledge in agricultural engineering that are integrated with knowledge in biological and other advanced sciences. Agricultural engineering provides appropriate machineries and equipment to apply the fertilizers more efficiently with the knowledge of the modern agro chemistry.

Plant breeding and genetics contributed immensely to the farm productivity. Meanwhile the agricultural engineering provides machinery for mechanization to reduce the drudgery of farm work and to cope with the increased farm productivity. More significantly, farm mechanization has enormously increased farm efficiency and productivity. Agricultural engineering covers environment systems, food production, biological resources, and power and machinery systems. Agricultural engineering has advanced in the following stages.

Rural engineering

The agricultural engineering profession has made some inroads into areas such as rural engineering, previously the preserve of other engineering disciplines. Such engineering tasks include rural water supply and sanitation, rural roads design and construction, design and construction of small to medium sized dams and irrigation schemes, and small process engineering plants. This is a significant advance

for agricultural engineering. As development moves towards smaller parcelled projects, the profession of agricultural engineering stands to play a significant role.

Biological engineering

It is one of the most rapidly growing disciplines of agricultural engineering that applies engineering practice to problem and opportunities presented by living thing and the natural environment. Areas of interest range from the environment protection, food-feed production, to medicine and plant based pharmaceuticals and packaging materials. These engineers may involve in development of technique and strategies for natural pest control and treatment of hazardous waste, for composting, and for the enzymes for the processing of biomass, food-feed and the waste.

Power and machinery engineering

This discipline of engineering focuses on the design of robust machineries, making them more efficient with conservation of natural resources. It involves development of equipment for the food processing, reliable and precision farm equipment, agricultural commodity and waste transport, and landscape maintenance. The work remains challenging as technology advances, production practices change and the equipment manufacturers expand globally.

Natural resources engineering

In Indian context the environment is changeable. The global effect of the various factors of environment has impacted on the monsoon creation in the country. The advances in the prediction of natural resources equipped with expertise in environment work to better understand the complex mechanism of these resources so that they can be used efficiently without degradation. The expertise of this engineering can be utilising in the crop-soil-water determination for the effective use of the water resources for better production. Natural resources engineering includes design and development of soil and water conservation measures for reservoirs, flood ways and the channel optimization. The treatment of recycled water used for conservative farming is included in natural resources engineering.

Food and bioprocess engineering

This engineering discipline combines design expertise with manufacturing methods to develop economical and reasonable processing solutions as well as look for the ways to reduce waste by treatment, safe disposal and alternate utilization.

Structure and building environmental engineering

This engineering is involved in the creation and maintenance of the proper and healthy environment for the production of agriculture produce. The expertise of this engineering helps in soil less cultivation of the crop with creating the required essential environment for the growth of plants.

Alternative energy engineering

This agricultural engineering area is to identify and develop viable energy sources such as biomass, methane and the vegetable oil and to make these and other systems cleaner and efficient. These engineers also develop energy conservation strategies to reduce cost and protect environment with designing alternative energy solution for the agricultural operations.

Other engineering areas (information, electrical, forest, aquaculture, health and safety)

These are involved in solving the problem of natural resources and environment problem in the forest production system and related manufacturing industries. These help in improving the inland fish practices by building the fish structures etc. The betterment of the agricultural practices, safety of equipment and machines are constantly studied so that safety and health issues can be communicated to the farmers.

Strategic and direction of agricultural engineering

It has become clear that agricultural engineers will play a crucial role in the development of sustainable agricultural production systems in the 12th plan. Modern agricultural engineers will be working in the frontlines of the application of new technologies in the agricultural environment. A large investment in strengthening the academic and research programme of agricultural engineering in the country is urgently needed. The present facilities available in the country are old which have to be replaced for the sustainable growth of engineering in agriculture. This will reduce the dependency on the labour in the agricultural sector. Due to shortage of labour occurring in agricultural sector, the development of agricultural machinery industry is very critical. The incentives and assistance could be given to the farm growers to adopt the intensive mechanization and automation technologies. The introduction of high and robust technology in mechanization and automation of agricultural operation would be identified with the wide innovation in the transfer of technology among the farmers. Private sector involvement in agricultural engineering would be promoted by providing the financial incentives, and creating favourable business environment for their participation.

Sustainable Development - Critical Role of Engineers & Technologists

L Pugazhenthy*

Sustainable Development is a noble cause for all times and for all sections of the population across the globe. Engineers and Technologists who convert natural sources into useful products and services have a greater and critical role in Sustainable Development.

At this juncture, one needs to understand what Sustainable Development means. Sustainable Development, as per the well known definition, is "meeting today's requirements and leaving enough for future generations". At any one point of time, everyone is more concerned about his immediate or present day needs and hardly thinks about conservation or efficient utilization or future needs. That is how the society ignores the concept of Sustainable Development and uses materials and natural resources unwisely and indiscriminately, with the result the future generation is going to face an acute crisis in respect of some of the natural resources, products etc.

Thanks to economic liberation in 1991, India made quantum jumps in economic growth and has reached the big league, second fastest growing economy in the world. This is a laudable achievement indeed and at the same time, this is where India's worries also begin. The country's requirements of materials, natural resources, products have increased manifold due to the increasing disposable incomes, affluence and the population's desire for improved living standards.

India is also the world's second largest population with 1.21 billion. The population grew at 17.6% during the last decade (it is time there is some moderation in this rate). Based on this, India is set to overtake China as the world's most populous nation. That is the day when India's demand for the natural resources, services, products, etc., would also have peaked to the maximum and hence the need for a greater adherence to Sustainable Development.

Engineers and technologists can contribute to Sustainable Development in the following ways:

- innovations, new ideas, new techniques, new practices etc.,
- development, introduction & adoption of cleaner and energy efficient processes
- efficient and economic utilization of natural resources, input materials etc.,
- reduction in excessive consumption or wastage of materials, resources
- recycling and reuse of waste materials, products etc.,
- substitution by alternate resources, materials
- research & development for new products, new materials

Perhaps the greatest challenges for engineers and technologists will come from the energy and

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environmental fronts. Energy efficient products and processes will be in greater demand while cleaner and environment friendly processes will become the order of the day. Obviously engineers and technologists will have to develop and adopt energy efficient as well as eco-friendly products and processes. Also engineers should play their legitimate roles in achieving an equitable and inclusive growth by increased communication, market access, education, health care etc., among the lesser privileged as well as the rural population.

Of the above aspects, the concept of recycling and reusage of natural resources, materials, products etc., also needs the greatest attention and wider adoption for achieving Sustainable Development. Engineers and technologists ought to play the expected role to attain the goals of Sustainable Development. Today is too late for achieving this noble objective. Will mankind make upto this reality?

8th National Conference on Sustainable Development - Role of Engineers and Technologists

held on November 29, 2010 at New Delhi

Recommendations

- The engineering education system should emphasize an understanding of sustainability in its harmony with the historical, cultural and social traditions of the society. Emphasis on practical engineering education should also include sustainability aspects; and the engineering curriculum should have a compulsory core subject on sustainability to include the philosophy, the basic and general concepts of sustainability and its practical application".
- Water management should get a very high priority in our policy frame work on sustainable development.
- The Government should continue to facilitate indigenous efforts both for innovations in the conventional technologies for making them sustainable and for the development of new sustainable technologies, wherever considered very necessary. For this, India should increase its spending on R&D- both by the government and the corporate sector.
- The Government should facilitate transfer of sustainable technology from abroad selectively and pragmatically.
- India needs a transition time and funds for making a changeover to taking up its future development programmes which are sustainable; and for enabling it to accept legally binding emission targets.
- Policies on sustainability should also include mandatory actions that are consistent with the cultural values and diversity of a pluralistic society.
- There is a need to regulate engineering profession in India like the other professions such as Medical. Legal. Architects, Chartered Accounts, etc., are regulated. It should also include a statutory code of ethics for engineers, which must reflect a strong commitment to principles of sustainable development.
- Policies and programmes which encourage energy efficiency and conservation need to be strengthened.
- Future energy needs will rest on Hydrogen. We have not been in step with the rest of the world in contemporary research on Hydrogen. We must put in a lot of efforts on this research to be at par with the best in the world.
- The role of engineers and technologists in our future policy planning for sustainable development needs to be underscored. There is a need for their full involvement in formulating policies and taking decisions on projects that should be designed for realizing the essential sustainability goals across the sectors.

Executive Summary

A consensus emerged at the 8th conference that engineers and technologists have to play a major role in realizing the sustainable goals that have been set for the growing Indian economy, particularly in developing new renewable resources - based technologies, innovating the conventional technologies, tapping the full potential of hydro power, developing viable and sustainable technologies for using hydrogen, nuclear power etc. India needs to bring in sustainable aspects in the curricula of engineering education and training. It has also to be an important component of our basic and higher education. The society as a whole should be brought in the net of sustainable development philosophy. Member Associations of the Engineering Council of India (ECI) can play a major role in realizing these goals. ECI is contemplating to discuss about how to facilitate actions that are required to be taken, particularly in training and development as a matter of continuing professional development of engineers. Engineers and technologists will also have to play a role in developing the training curricula of the CPD programmes for ensuring that the sustainable developmental aspects also get covered in the curricula adequately, as required.

We should ensure that India develops in such a way that it does not emit carbon dioxide more than 2 tonnes per capita in the year 2025. From the long-term sustainable energy security point of view, solar energy will have got to be made competitive. We need to develop a sustainable mass transport. Though much progress has been made in this area, still a very long ground is to be covered in technical innovations. Chinese magnetic levitated train is a very good example of future sustainable mass rapid transport. India has proposed climate innovation centres to help developing countries find technology solutions to tackle increasing energy demands, climate constraints and investment needs, and thus put an end to dependency for technical assistance.

Engineers and technologists have to play their role for providing solutions to the pressing global problems of sustainability by creating an environment that is enabling, dynamic and inspiring for the development of solutions to problems in the fields of energy, environment and current patterns of development, which are largely unsustainable. They have not only to identify and articulate intellectual challenges straddling a number of disciplines of knowledge, but also in mounting research, training and demonstration projects leading to development of specific problem-based advanced technologies that help carry benefits to society at large. Engineers and technologists alone will enable us to reach to the target of sustainable energy security, sustainable industrial, mineral and agricultural production, and sustainable transport. Without them, it would not be possible. Engineers and technologists need the full involvement in formulating policies and taking decisions on projects that should be taken up for realizing the sustainability goals across the sectors.

According to the United Nations World Summit, 2005, New York, there are three pillars of sustainability, which often overlap and can have a synergistic effect on each other. These three pillars are: environmental, economical and social sustainability. Environmental sustainability refers to those resources which are finite; commercial sustainability refers to economic development operations which consume natural and mineral resources and have direct impacts on environment; and social sustainability refers to

impact of these two on the society in terms of carbon emissions and hence the climate change, apart from depletion of natural resources' happening due to fast consumption of them, and impacts on environment in terms of waste generation. These are some of the major anxieties that contribute to the immediate and future concerns of sustainability. The social sustainability refers to any operation, which has to closely deal with the locals by adequately addressing the local level social issues like health, education, etc. When an eco-system and the operating environment are disturbed from their equilibrium position, the connected economic activity takes a hit as well. Sustainability is reached within the area of intersection of these three pillars of sustainability.

As a part of the National Voluntary Actions for addressing climate change related concerns, India released its National Action Plan on Climate Change (NAPCC) on 30th June 2008. The Action Plan outlines our strategy to adapt to climate change and enhance the ecological sustainability of our development path. It recognizes that climate change is a global challenge, and that it should be successfully overcome through a globally collaborative and cooperative effort based on the principle of equity. The Action Plan suggests that long - term convergence of per capita Green House Gases (GHG) emissions is the only equitable basis for a global agreement to tackle climate change. The Action Plan assures the international community that India's per capita GHG emissions would not exceed the per capita GHG emissions of developed countries, despite India's development imperatives.

India has signed and ratified a number of key multilateral agreements on environment issues in recognition of the trans-boundary nature of several environmental problems, and of its impact on economic development including international trade. We are committed to complying with the obligations under these agreements/conventions. It will require inter alia enhancement of our capacity and adequate flow of resources. At the Copenhagen Summit, India has made a significant statement that it would reduce emissions by intensity of carbon dioxide emission- which means carbon dioxide emission per rupee worth of its GDP (Dollar worth of GDP). India has also said that it will reduce emissions as such by 25 percent by 2020. It is a challenge that we have to meet.

If we want to limit the global climate threat size to 2 degree C rise in the global warming, it will mean that we should stabilize the concentration of carbon dioxide in the atmosphere at 450 ppm by 2050. If that is to happen then, the rich countries like the US and European countries should bring down their emissions of carbon dioxide to less than 2.5 tonnes per capita by 2050. We should ensure that India develops in such a way that it does not emit carbon dioxide more than 2 tonnes per capita in the year 2025.

A significant emphasis today is on minimizing the consumption of energy and materials. A technology which does this is sustainable. Ensuring energy conservation will help in realizing sustainable energy security in a greater measure. Energy conservation, therefore, has merged as a major policy objective. The Energy Conservation Act 2001 was passed by the Indian Parliament in September 2001. This Act requires large energy consumers to adhere to energy consumption norms, new buildings to follow the Energy Conservation Building Code, and appliances to meet energy performance standards and to display energy consumption labels. The Act also created the Bureau of Energy Efficiency for implementing the provisions of the Act.

We will need to intensify our R&D efforts for developing new sustainable technologies for enhancing our production capacities, across the sectors of our economy. We also will need to train workforce accordingly, including engineers. Besides, at the grass roots level for capacity building purposes, it is necessary to educate school/college teachers as well as the general public. Training of teachers in environmental awareness is not given sufficient emphasis at present even though textbooks are available. To train a large number of about 5 million school teachers in India requires gigantic efforts. Additionally, a large number of college teachers also need to be trained.

The Ministry of Environment and forests has taken many initiatives on environment education including developing educational/teaching materials and aids in the formal education sector; ensuring training and workforce development in environment education, promoting environment education through existing educational/ scientific/ research means.

A committee comprising representatives from Management Institutions, AICTE, UGC, Industry and MoEF is already looking into various aspects like course content and syllabi of the existing management courses so that gaps could be identified and suggestion could be given for enhancing/introducing the environmental content wherever necessary. Apparently, the Ministry has not taken similar initiatives for promoting environmental concepts in engineering education and training. This is perhaps the grey area from the point of view of policy initiatives of the ministry.

A country cannot progress without engineers and technologists. You may talk about the development of infrastructure, industry, agriculture, irrigation, telecommunications, space, atomic energy, and services sector, engineers and technologists play a major role in the development of these sectors. Today we are concerned with the sustainability issues, and the future development of our economy will have to be sustainable, we cannot afford otherwise. *Engineers and technologists have to play a role in mitigation of negative impact of industrial development through engineering and technological innovations in the areas of energy efficiency, least or inferior raw material demanding technologies, suggesting better materials to reduce volume and weight requirements, designs and engineering for longer life cycle, in designing and developing "Green" plants which emits lesser carbon dioxide, and in "Green Chemistry".*

We need to plan and design our new urban settlements that are sustainable. We need to pay more attention to functional utility of buildings that we built. We need to design buildings, therefore, having only those facilities that are needed in functional sense and not for any thing else, apart from also being energy efficient.

We are targeting a capacity of 20,000 MW of solar energy by the year 2020. To get this kind of capacity on ground, we need a lot of technical innovations. Today, solar energy costs may be between Rs 11-15/kwh. Solar power plants can replace coal-based power plants in the long-term provided we innovate technologies of solar cells, energy storage and other related facilities. We will have to bring down the cost of generation of solar energy to the level of coal-based power plants. Here lies the challenge for our engineers and technologists.

Our coal position is also not that comfortable. While we cannot think of eliminating fully the coal-based thermal power generation, we can think of making it efficient by reducing coal consumption / MW of power generation. We know that the efficiency of coal consumption in power sector is around 30-35 %. The super critical boilers can give a coal consumption efficiency of

around 40-45 %, if not more. If we go for ultra super critical boilers, we can get 50 % coal efficiency. This can be a significant improvement in coal efficiency. Consequently, it will also result in reduction in carbon dioxide emissions from the coal-based thermal power plants. This is certainly a challenge that requires special steels, and other special materials that can withstand high temperatures and pressure.

Coming to the sector-specific issues, today, the cost and energy consumed are the important parameters of a technology. In the sustainability terms, lowest energy units consumed by a technology will make it attractive. The second consideration is of the raw materials that the technology will need- non renewable or renewable. The later will make the technology attractive in the sustainable terms if it can deliver the same output, at the same capacity in volume terms and at near the same price. We need technologies that are sustainable. It does not mean all new technologies; it also means conventional technologies that have been made sustainable through innovations. it has been projected that the electricity consumption will touch a figure of around 950-1000 Twh by the year 2014-15. The infrastructure industry and Indian auto sector will grow to 110US$ billion and 60 US $ billion respectively by the year 2014-15. Indian industry will also have a significant growth during the coming decade. According to the Business Monitor International study, July-Sep 2010, various weaknesses of our steel industry are highlighted which essentially include high energy consumption, high carbon dioxide load and low R&D investments. This is not very good for sustainable steel production in India.

The outlook, based on the research work receiving priority in many of the leading laboratories of the world, is that Hydrogen will be the primary source of energy in the long term. Hydrogen presents many challenges, particularly there are a number of catalysts the efficacy of which are still a subject to laboratory research. Further, there is a big challenge in storing, transporting, delivery, etc. of Hydrogen. We need specialized technologies and logistic arrangements for this. Most of the time, we have not been in step with the rest of the world in contemporary research. We must put in a lot of efforts on Hydrogen research to be at par with the best in the world. The projections are that by 2017, Hydrogen, as a source of energy, will become viable.

We have taken policy initiatives on sustainable development which include inter alia development and promotion of cleaner technologies, abetment of pollution through preventive strategies, carrying capacity-based regional development planning, life cycle assessment, natural resource accounting, etc. The use of timber has been stopped in civil construction; and its substitutes are being used in all construction works. For better conservation of electric power, low powered CFL fittings are being used in all common places; and solar water heating system is used in hostels and office buildings at high attitudes.

Practising engineers should satisfy themselves with the balance struck between the economic, environmental and social impacts of the proposed solutions. Their own everyday practices should not be at variance with what is being asked of others. They must not expect more of others, than they do to themselves. They should be prepared to be accountable for their designs and engineering and uphold the beliefs it reflects by example. They should change themselves before they seek to change others. They have a duty to become and remain competent to deliver the concept and practice of sustainable development in their day- to-day work. They need to inspire every engineer to make a difference to the world through sustainable development. We should take advantage of the

demographic dividend that we have by involving young engineers and not so young engineers in policy making, strategic plannings, formulating the future plans, in discussions of national issues concerning environment.

More importantly, technologies have advanced many folds during the last couple of decades. Sustainability concerns are generating many challenges. Knowledge and skills of our engineers have not been in step with these developments. The demand for multidisciplinary, multi-skilled and quality degree engineers, diploma engineers and engineer technicians is increasing. We need to upgrade, therefore, the quality of our engineering education, skills of degree engineers, diploma engineers and engineer technicians.

In sum : world's population is expected to grow from nearly 6 billion today to 8.5 billion by 2025. It means that the global energy requirement will increase. India is experiencing a rapid economic growth. China, Brazil and some other developing countries are also growing. All this will add to the modern society's environmental problems- air and water pollution, waste generation, etc- in wider areas of the world, a global village of today, if sustainability concerns are ignored. Industrialized world will have to accept special responsibility in addressing these concerns not only because of their past ecological sins, but also because of the level of their present technological know-how and financial resources. Beside, there is the challenge of recognizing interrelationships and interactions between ecological, economic, and social factors and taking account of these factors when seeking solution strategies. The policy makers will have to addressing these concerns.

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Mr. Chander Verma
Treasurer

Engineering Council of India (ECI)

ECI was established on April 4, 2002, by coming together of a large number of Professional Organizations /Institutions of engineers, to work for the advancement of engineering profession in various disciplines, for enhancing the image of engineers in society, by focusing on quality and accountability of engineers and to enable the recognition of expertise of Indian engineers and their mobility at international level in the emerging WTO/GATS environment. It has emerged as a common voice of its member organizations.

Objectives

The main objectives of ECI are to work for the advancement of engineering profession in various disciplines and for enhancing the image of engineers in the society. To this end, ECI is focusing on quality and accountability of engineers, professionalism and their mobility for delivering engineering services in other countries, with expertise of Indian engineers developed, recognized and accepted at the international level.

Tasks

- Representing Member Associations in government and non- government bodies, and interacting on common policy matters relating to engineering profession
- Working for the setting up of a Statutory Council of Engineers and later interfacing with it, providing support and inputs for developing systems and procedures for the registration of engineers, CPD, code of ethics
- Facilitating authorization of member associations to register engineers; assisting them in developing internal systems for undertaking registration, CPD, enforcing code of ethics; and providing common forum for CPD to support the member associations
- Assisting member associations in interaction with academic institutions and regulatory bodies in regard to their examinations, award of degrees etc
- Providing forum for exchange of information and experience among member associations, coordination, common thinking and views on important matters
- Helping in the analysis of existing education systems/bodies and making suggestions in order to make the education relevant for the engineering profession and employability
- Setting up a Resource Centre and Database of Engineers, which can provide necessary information required for the development of the profession
- Interacting with professional associations/bodies in other countries & international bodies
- Undertaking and supporting research for the development of the engineering profession

Engineers' Bill

ECI has facilitated formulation of a conscious draft Engineers' Bill for the consideration of the Govt. of India. Which lays down the criteria for the process of registration of Practising Engineers and provide necessary statutory framework for the same. The draft is being processed by the Ministry of Human Resource Development.

Membership

Membership of the ECI is open to societies/organisations of engineers who meet the following requirements :

- having been established statutorily or registered in accordance with law.
- having atleast 100 corporate members
- having existed for at least four years, and
- the accounts being audited annually.

Board of Governors

Chairman	
Dr. Uddesh Kohli	Chairman Emeritus, Construction Industry Development Council
Vice -Chairman	
Shri Mahendra Raj	President, Indian Association of Structural Engineers
Treasurer	
Shri Chander Verma	President, International Council of Consultants Chairman, Construction Industry Development Council & Indian Society for Trenchless Technology
Members	
Dr. S. S. Mantha	Acting Chairman, All India Council for Technical Education
Shri S. Ratnavel	Member, Association of Consulting Civil Engineers (India)
Dr. S. Gangopadhyay	Advisor, Head - RDPD, Council of Scientific and Industrial Research
Dr. P. R. Swarup	Director General, Construction Industry Development Council
Dr. S. Chatterjee	President, Consulting Engineers Association of India
Prof. P. Trimurthy	President, Computer Society of India
Shri Rajeev Kher	Jt. Secretary, Dept. of Commerce, Ministry of Commerce and Industry
Prof. D.V. Singh	Member, Indian National Academy of Engineers
Shri B. N. Puri	Sr. Consultant, Planning Commission
Lt. Gen. (Retd.) A.K. Puri PVSM, AVSM	Chairman, Indian Institution of Bridge Engineers (DSC)
Commander B M Bhandarkar	Chairman, Indian Institution of Industrial Engineering
Prof. V.K. Srivastava	Past President, Indian Institute of Chemical Engineers
Shri J. S. Saluja	Member, Indian Institution of Plant Engineers
Prof. Kasi Rajgopal	Chairman, The Institute of Electrical and Electronics Engineers Inc.
Prof. Niranjan Swarup	Executive Director, Indian Society for Trenchless Technology
Shri R. S. Prasad	ADG (Trg), CPWD, Ministry of Urban Development & Poverty Alleviation
Shri Lalit Gupta	Director (R&D), DGCA, The Aeronautical Society of India
Shri S. L. Swami	Chairman, The Institution of Civil Engineers (India)
Shri R.K. Gupta	President, The Institution of Electronics and Telecommunication Engineers
Dr. Sanak Mishra	Past President, The Indian Institute of Metals
Shri Ashok K. Sehgal	Member, The Institute of Marine Engineers (India)

Executive Committee

Dr. Uddesh Kohli *Chairman*	Chairman Emeritus Construction Industry Development Council
Shri Mahendra Raj *Vice Chairman*	President Indian Association of Structural Engineers
Shri Chander Verma *Treasurer*	President International Council of Consultants
	Chairman Construction Industry Development Council & Indian Society for Trenchless Technology
Members	
Dr. S. Chatterjee	President Consulting Engineers Association of India
Shri P. R. Swarup	Director General Construction Industry Development Council
Shri R.K. Gupta	President The Institution of Electronics and Telecommunication Engineers
Shri P. N. Shali	Director Engineering Council of India

Advertisements

Engineering Council of India

ECI has been formed by coming together of a large number of professional associations / institutes of engineers. The present members are :

1. Association of Consulting Civil Engineers (India)
2. Broadcast Engineering Society (India)
3. Computer Society of India
4. Construction Industry Development Council
5. Consultancy Development Centre
6. Consulting Engineers Association of India
7. Indian Association of Structural Engineers
8. Indian Buildings Congress
9. Indian Concrete Institute
10. Indian Geotechnical Society
11. Indian Institute of Chemical Engineers
12. Indian Institution of Bridge Engineers
13. Indian Institution of Industrial Engineering
14. Indian Institution of Plant Engineers
15. Indian National Group of IABSE
16. Indian Society for Non Destructive Testing
17. Indian Society for Technical Education
18. Indian Society for Trenchless Technology
19. Indian Society of Agricultural Engineers
20. Institute of Urban Transport (India)
21. Institution of Mechanical Engineers (India)
22. International Council of Consultants
23. The Aeronautical Society of India
24. The Automobile Society of India
25. The Indian Institute of Metals
26. The Institute of Electrical and Electronics Engineers. Inc.
27. The Institute of Marine Engineers (India)
28. The Institution of Civil Engineers (India)
29. The Institution of Electronics and Telecommunication Engineers
30. The Institution of Surveyors