Pro-poor Innovation-making, knowledge production and technology implementation for rural areas: Lessons from the Indian Experience

Dinesh Abrol

Introduction

In India pro-poor innovation-making demands efforts especially for the introduction of solutions that peasants, landless rural workers and artisans can adopt to protect and improve their own livelihoods and well being. The population of rural India has increased at 1.15 percent per annum from 743 million in 2001 to 833 million in 2011 (Census of India website). Even now, 68.8 per cent of the Indian people live in rural areas. Rural incomes have been growing at a slower rate than urban income. At the aggregate level, the rural share of incomes in total incomes (net domestic product) has been declining since the 1970s. The proportion of persons employed in agriculture remains high. About 63 percent of the work force in rural India is still engaged in agriculture for their livelihood. In the decade of 1999-2010 rural India showed higher rate of growth of employment in industry. Within industry, the share of rural manufacturing in total manufacturing national domestic product (NDP) rose from 25 percent to 42 percent between the period of 1970-71 and 1999-2000 and then remained constant in 2004-05. But the modern and more dynamic sectors of communication, finance and business services showed a declining share of incomes. Benefits of the dynamic and high earning service sector led growth are not reaching the rural areas (Unni and Naik, 2011).

With agricultural growth fluctuating and employment guarantee scheme still having an impact only on a small section of the workforce, in overall terms employment growth in rural India has not been very encouraging. With the poor growth of agriculture and agrarian distress looming large, even the farm households in rural India are dependent on the nonfarm sector for their livelihood. Much of these activities in the rural nonfarm sector is of low productivity and hence earns low income, often termed as informal employment. Though there has been a decline in self employment over the decade from 55 to 45 per cent in 2009-10 in rural areas, about half of the informal non-agricultural employment is still self-employment. Nearly all of self-employment is own account work, operated with family labour. Such activities are either traditional industry, such as potters, weavers, agro-processing on a small scale, or small shops

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1 Formerly Chief Scientist, NISTADS, Currently working as Professor Institute of Studies in Industrial Development (ISID) visiting Professor, Centre for Studies in Science Policy, Jawahar Lal Nehru University, Delhi
and eating places in rural areas. Much of this isuviable and only provides a subsistence living. However, this component is also declining rapidly. Informal employment rose in rural areas in the form of casual labour in manufacturing and construction².

This raises a serious question about the nature of structural transformation occurring in rural India. In the post-green revolution period especially since 1990s, there is a technological stalemate in the Indian agricultural sector. Owing to rising costs of inputs, the cost of cultivation has been increasing over time. In the absence of proper remunerative price mechanism, the farmers are increasingly exposed to the price volatility in output markets. The ratio of gross value of output to its cost of cultivation has been declining over time for the green revolution crops. The rural poor cannot depend for the maintenance of their livelihoods on the existing socio-technical regime of high external input system of agriculture. A major change in paradigm of agricultural development is now quite essential for the purpose of technological transformation of rural areas. To list the major problems with regard to the achievement of productivity through the existing socio-technical regime, the problems are over and disproportionate use of chemical fertilizers, pesticides and water, depletion of ground water resources in semi-arid and rain-fed region, insecurity of tenant farmers, increasing cost of cultivation, and inadequate public investment. ³

Linkages existing at the level of production system between the traditional rural non-farm economy and the emerging farm sector have become weaker. As big business is rapidly penetrating the economy of rural India and replacing the public sector, it is increasingly transmitting external shocks and becoming a cause of instability in agriculture. Since we expect this new force to actively utilize pro-poor innovation making activities in rural India, it is necessary for the peasants, landless workers and artisans to challenge this new force socio-technically to maximize their resilience in the farm and non-farm activities in an integrated fashion. For the viability of the increasing number of small and marginal holdings, collectives and cooperatives will have to be promoted to give them resilience against natural variability and external economic shocks and by enhancing their bargaining power vis-à-vis big business. As producers in the local economies, peasants, landless rural workers and artisans are fast losing competitiveness and competitive advantage. They are also unable to improve their access to resources, skills, knowledge, capabilities and markets. For them to be able to competitively use the processes of pro-poor innovation-making, there has to be an evolution towards new paradigms of agriculture and agro-industrial production in the local economies, so that already rudimentarily inter-linked farm and rural non-farm sector occupations can also develop as systems - enabling peasants, artisans and landless workers to achieve economies of scale and scope and remain competitive. Practitioners of pro-poor innovation-making must create more of such opportunities for the protection and promotion of livelihoods of the poor (Abrol Dinesh, 2003, 2004, 2006, 2009).

² See the India Rural Development Report, 2012 for the details.

³ See the India Rural Development Report, 2012 for the details.
In this chapter the claim is that the challenge of promotion of pro-poor innovation-making should be viewed as the problem of management of transition to a new path of rural development by shifting to the practice of paradigms of sustainable agro-industrial production. Pro-poor innovation-making calls for an exploration of context specific paradigms of agro-industrial production in which peasants, artisans and rural labour can successfully implement diversity-sensitive agro-ecological approaches for rural development and emerge as social carriers of pro-poor innovations in the emerging Indian context of rural development. Currently the discipline of innovation studies is rapidly moving forward to focus on the problems of transition management in order to usher in sustainable development in high-income capitalist countries, but the challenge of harnessing technology and innovation for poverty alleviation in developing countries remains under-examined, including by scholars of these countries. In particular the relevant political aspects of innovation-making in the case of development of rural areas in developing countries require more study. There is an urgent need to learn from the historical experience and explore new alternate trajectories.

In this context, the present chapter examines the experience of implementation of pro-poor innovation-making at the level of efforts undertaken in particular for the development of rural industries, to improve rural livelihoods since the beginning of Indian independence. It traces the evolution of the three main phases of pro-poor experiments in innovation-making with respect to the development of rural industries. First, during the 1950s and 1960s, there was a lot of diversity in initiatives, and these were put into place by a variety of actors. After the mainstream Nehruvian leadership decided to give priority to the development of basic and capital goods industry, the same leadership also chose to accommodate in the planning process, the technological upgrading of economic activities being undertaken by the poor in India. A trajectory of gradual niche ‘involvements’ to uplift the poor followed during the 1970s and 1980s in which the activists of different political traditions took part and tried innovation-making. Finally, with liberalization, after the 1990s the strategy of State including of the knowledge institutions vis-à-vis pro-poor changed and the scenario of innovation-making underwent a process of adjustment and gradual decline. With the introduction of latest science, technology and innovation (STI) policy of 2013 the efforts for pro-poor innovation making with the help of the corporate sector are again expected to get a boost (DST, 2013).

Today, the actors promoting pro-poor innovations in India include not only the State, public sector research agencies and universities, non-governmental organizations (NGOs) and civil society groups, but also new actors and very unlikely champions of the poor – namely large firms, including foreign multinationals. They are sought to be carriers of development through catering to the effective demands of the poor. But the practice of ‘bottom of pyramid’ (BoP) or ‘frugal’ innovations has not been so far effective in satisfying even the consumption needs of the poor (Kaplinsky R, 2011). Moreover, findings of the UNDP survey of inclusive business also indicate that large corporations, be national or transnational, are mostly unable to include the poor as producers (UNDP Survey, 2008). Corporate self-interest dominates. Either through vertically integrated supply chains or as networked systems, corporations are not able to offer to the poor the benefits of competence enhancement and organization of local production. Reasons can be traced to their their failures to build partnerships with the poor as producers, higher transaction costs given the diversity of interactions, difficulties in interpreting local demand, inability to deal with heterogeneity and underestimation of the investment required in local
capacity building for deeper inclusion of the peasants, artisans and rural workers (Saurab Arora and Henry Romijn, 2009).

Clearly, the challenge of pro-poor innovations has become more complex. Therefore, with a view to understand the implications of the newly emergent scenario for the future interventions, we will focus on the relevant political aspects of pro-poor innovation-making in India. The two crucial political processes: “the politics of knowledge production” and the “politics of technology implementation” are basically analysed for their role in the promotion of capabilities and opportunities that became available for the development of pro-poor socio-technical systems because in the Indian context of capitalist development, the State was able to also accommodate in a limited way the mobilization of knowledge production and technology implementation for the benefit of pro-poor innovation-making during the post-independence period. However, we also show that the efforts put in by these traditions for pro-poor innovation-making using State support were subject to the impacts of the closing and reopening of the political economy space.

In what follows, we discuss the role and contribution of the political traditions in the mobilization of people for pro-poor innovation-making. First of all, the focus is on the socio-technical frames used by the leaders of these political traditions to guide the course of societal interventions for the achievement of a pro-poor socio-technical success in India. Now, the number of social carriers of innovation who can directly contribute in the mobilization of the people for pro-poor innovation-making is greater than ever before. In this connection we ask - what are the lessons that can be learnt from the past efforts of the State and the social movements to stimulate pro-poor innovation generation in India? Second, how well or inadequately did the societal interventions and the State’s innovation policy perform in the past? What determines the success? What causes the failure? Finally, what kind of measures does the State need to take to make the transition to a new path of agro-industrial development?

The remainder of this chapter is organized as follows. Section 1 presents a brief outline of the accommodation of the pro-poor innovation-making efforts by the three main political schools of thought in India. Section 2 then attempts to answer the central question of learning appropriate lessons through the presentation of three detailed case studies of the “politics of institution building in higher education”, the “promotion of knowledge production in State sector research and development (R&D) agencies” and the “innovation system building by social movements for pro-poor technology implementation”. Section 3 discusses the main results. Section 4 concludes.

Section 1

Evolution of the diversity in the making of social carriers of pro-poor innovation

1.1 The three main schools of political thought: 1930s-1950s

During the formative years of politically independent India, the freedom movement was a key influence on the building of institutions for learning, competence building and innovation-making. Indeed, the politics conducted over the vision and strategy of technology development fruitfully utilized the tools of constructive action, unity and struggle. During the pre-independence period, the
people of India started to develop institutions. There was much space for the making of innovations on the basis of different types of experiments motivated by different orientations, ideological visions and understanding of political strategy. As a result, there was a lot of diversity in terms of institution building for knowledge production, knowledge mobilization and innovation-making. In many ways the directions of ‘pro-poor innovation’ activity were constituted in the course of the debates started between the people of Gandhian, Nehruvian and Left orientation during the formative period of 1930s to 1950s. Even today among the active social carriers of pro-poor innovations many of the actors are known to draw explicitly their ideological inspiration from the ideas and initiatives that emerged during the formative period of post-independent India. The politics of attainment of counter-hegemony against colonialism required the leaders of the national freedom movement to build a multi-class alliance on the ground. Therefore, the leaders of post-independent India were very much ready to practice diversity and people oriented directions in the conduct of their politics of knowledge production.

The ‘Gandhian’, ‘Nehruvian’ and ‘Left’ political traditions differed radically with each other in terms of the conception of “socio-technical imagination”, “vision of path of development” and “social carriers of innovations” to be encouraged. The main points of view existing in the immediate aftermath of independence are summarized below in terms of socio-technical imagination and the vision of path of development of Indian economy, strategy of industrialization, mode of technological & organizational transformation, socio-technical framing of the problem of pro-poor innovation-making, etc. Though it is a drastic simplification of the many points of view within each group, it is necessary to highlight their common features and major differences.

Table 1: Panorama of Political Philosophies

<table>
<thead>
<tr>
<th>Shaping of development process</th>
<th>Gandhian orientation</th>
<th>Nehruvian orientation</th>
<th>Left orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-technical imagination, vision &amp; path of development for Indian economy</td>
<td>A self-sufficient village economy, small is beautiful, redistribution of land through ‘Bhoodan’, non-party system of democracy, adopting anti-statist stance after facing the crisis of Nehruvian path, neo-gandhians resorting to post-modernist / neo-traditionalist politics</td>
<td>Priority to establishment of large technical systems as a blueprint of development, planning for capitalist development with land redistribution attempted mainly as rhetoric and its vision of the public sector in commanding heights, small-scale industry, after the emergence of big business as a major player in the economy &amp; with the deepening of the crisis of Nehruvian imagination shift to market governance</td>
<td>Centrally coordinated workers’ managed large technical systems (LTS), in transition planning as the agency of State capitalism as anti-imperialist step, with radical redistribution of assets, especially land- as transitional demands; later opting for decentralized planning for participatory local area development; State’s accountability to the people.</td>
</tr>
<tr>
<td>Strategy of</td>
<td>Decentralised industrial development; ‘textile-</td>
<td>Industrialization and establishment of basic</td>
<td>Extended support to heavy industry strategy</td>
</tr>
<tr>
<td>industrialisation</td>
<td>first-type’ strategy</td>
<td>industries and capital goods sector; import substitution, protection of cottage industries; after the experience of crisis export promotion, trade as an engine of growth</td>
<td>development of home market via cottage industry employment &amp; irrigated agriculture for food grains supply</td>
</tr>
<tr>
<td>Mode of technological &amp; organizational transformation</td>
<td>Traditional &amp; local knowledge, priority to individual small scale industry, cooperatives in consumer / financial / other service areas</td>
<td>Import substitution via replication of duplicative / imitative technological strategy as more of replacement of import effort, S&amp;T self-reliance &amp; technological learning confined to strategic sectors.</td>
<td>S&amp;T to meet basic needs of people; Self-reliance in large systems (LTS), irrigation, rail, road, telecom, steel, heavy industries, rail, roads, energy, health in public sector; small scale in consumer goods, in agro industry workers cooperatives</td>
</tr>
<tr>
<td>Socio-technical Framing of the challenge of pro-poor innovation-making</td>
<td>Upsizing of traditional small scale industry and peasant based agriculture</td>
<td>Downsizing of modern technology to make it ‘appropriate’ for small scale / tiny / micro enterprises</td>
<td>Use public sector based large technical systems (LTS) to meet the needs of irrigation &amp; energy, rail, road, telecom; support workers’ cooperatives in industries / services amenable to small scale, trying in Kerala decentralized planning of area development and partial support for People’s Science Movement - PSM experiments in the development of technological models for local economy development</td>
</tr>
<tr>
<td>Social carriers of production &amp; innovation for mainstream development</td>
<td>Landowners &amp; big business as trustees of wealth, individual small producer,</td>
<td>State sector in basic industries &amp; strategic areas, foreign and Indian big business in consumer goods, individual small producer in retail</td>
<td>Minimize dependence on big business, more reliance on public sector, small scale business in retail &amp; workers cooperatives</td>
</tr>
<tr>
<td>Priorities for rural</td>
<td>Protection of village</td>
<td>Access to irrigation &amp;</td>
<td>Land reforms, access</td>
</tr>
</tbody>
</table>
### Priorities for the poor

<table>
<thead>
<tr>
<th>Development</th>
<th>Industries, power, roads, etc.</th>
<th>Irrigation &amp; power, education &amp; health to poor on priority, target poor peasants by adapting technology of green revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local self-government, Sanitation</td>
<td>Area development, small scale business, targeting of credit &amp; information for poverty alleviation, provide school education for all</td>
<td>Public distribution of food, availability of transport &amp; health through public sector agencies, provide universal education</td>
</tr>
</tbody>
</table>

During the 1950s fluidity in the notions of development, national planning and self-reliance was still visible at the level of the political leadership. Not only experiments for innovation-making were possible but also their results were incorporated in the plans under preparation. Ideas of diverse natures with regard to institution building for knowledge production were considered in socially inclusive ways in the committees and commissions carefully set up with appropriate political composition, keeping in mind the aspirations and interests of the people.

### 1.2 Accommodation of the pro-poor innovation-making challenge within the political traditions during the 1950s and 1960s

At the time of independence, a pre-capitalist traditional manufacturing for subsistence living was the dominant mode of production. Cottage industries existed in large numbers as family labour oriented labour units. Moreover as India entered a period of transition to modern form of large scale industry, there was a need to promote cottage industries for employment considerations as the economy was in no position to absorb the surplus labour that was being released. Therefore, their viability was important and the mainstream Nehruvian leadership accommodated the Gandhian tradition through the policy of promotion and protection of the cottage industries. Thereafter, Governmental protection, economic support and incremental technological upgrading of traditional manufacturing became accepted features of the Nehruvian state policy. The cottage industries sector acted as a bargain sector; its existence allowing the Nehruvian leadership to bargain with both the big business as well as the landed gentry.

In terms of its “socio-technical” frame, the Gandhian imagination followed the heuristics of upsizing by modernizing the indigenous technology. The individual producer was sought to be made competitive by upgrading the local / traditional technology. When Schumacher inspired appropriate / intermediate technology movement the practitioners were using the same frame of Gandhian tradition. During the decade of seventies this frame became the heuristics of State sponsored appropriate technology movement for a wide range of departments and agencies. The governmental agencies encouraged the practitioners to upgrade the technologies embedded in indigenous / local knowledge, local raw materials, skills and capabilities to make the individual producers competitive. In the
Gandhian tradition, the holistic meant an individual producer completing the production process without any or minimum division of labour. In this movement the “small was beautiful” but the small could not be made powerful.

Peoples’ participation in agenda setting for innovation-making activity was also officially accommodated in the planning process by the State formed of mainstream Nehruvian leadership. The State accepted and agreed to give support to the activists of Gandhian orientation for the protection, modernization and development of cottage industries in parallel to the mainstream programmes envisaged for industrialization. In the strategy of industrialization formulated by Mahalanobis during the Second Five Year Plan (FYP), Gandhian experiments had encouragement directly from the State via the Khadi and Village Industries Commission (KVIC). The KVIC had the benefit of policy space and financial support for the practice of ‘constructive action’ for pro-poor development. Activists of the Gandhian orientation could use the support of KVIC to implement programmes for the development of cottage industries and strive to meet the challenge of technological upgrading of traditional manufacturing.

Scaling up from cottage industries, the micro, small and medium scale industry (MSMEs) was sought to be developed through “downsizing of modern technology”. This technology was to be implemented by the small scale industry. In order to make the technology appropriate for tiny / micro / small & medium enterprises, the mainstream Nehruvian thinking actually promoted this frame of “appropriate” / “economical” / “commercial” sizing & designing everywhere in the country. This socio-technical frame was implemented not only in the Council of Scientific and Industrial Research (CSIR) but also in the Indian Council of Agricultural Research (ICAR). It was implemented through the Department of Textiles, Small-scale Industry Development Corporations and National Small-scale Industry Corporation. In the mainstream science and technology (S&T), it was these heuristics which provided innovators the rules of the thumb on how to adjust with the social carriers of local ingenuity, jugaad\(^4\) and appropriate technology movement. This socio-technical frame allowed the State to accommodate the role of micro, small and medium scale enterprises (MSMEs) in the emerging mainstream economy for the first four decades of post-independent India.

Similarly, the State accommodated the Left through supporting the public sector and small scale industry from the beginning of sixties in the plans and policies. The Left tradition supported the promotion of public sector and small scale industry. By the end of sixties the measures like protection of small producers, promotion of public sector and restrictions on foreign direct investment, bank nationalization and many other such policy developments were an integral component of the policies enunciated by the mainstream Nehruvian tradition in the country. Because of the massive success that the State sector had achieved in the case of Soviet Union in respect of industrialization, the State was willing to offer commanding heights to the public sector in industry, finance and many areas of development. Thus, in line with the Left orientation, State ownership of basic industries was enunciated as a principle of policy, and it received a high level of priority in the process of planning up to the mid-1980s. In terms of the socio-technical frame, the Left imagination encouraged the heuristics of workers’ participation in the management of the state sector to build the accountability of large technical systems, strengthen the cooperatives of workers as a mechanism of ownership, management

\(^4\) frugal and flexible innovation coming from a Hindi word meaning an improvised solution born from ingenuity and cleverness.
& control - wherever the organized sector was making an exit, and develop multi-level systems of networked production.

Finally, the State adopted a strategy of import substitution as an important pathway to self-reliance. However, in many sectors, the practice of import substitution was reduced to nothing more than ‘import replacement’ which means that the practitioners merely followed a strategy of duplicative and imitative replication of systems obtained from elsewhere. Imports from the developed market economy embedded in the frame of large technical systems countries were as such replicated. These products were pushed by the large State corporations and private sector into the local markets and they were import intensive at the level of energy, materials and components.

1.3 The impact of accommodation

There were both positive and negative impacts. There were indeed success stories where unorganized petty producers cooperatives were formed in production and achieved the economies of scale and scope, promoting the experiments of technological upgrading with a view to develop the competitiveness of peasant-artisan economies with decentralised local area planning. India Coffee House, a chain of eateries set up all over India, was managed as a workers’ cooperative, and the Left provided leadership to this initiative of the workers. Many enterprises including banks are being run as workers’ cooperatives in Kerala. During the decade of eighties with the involvement of peoples’ science movements’ (PSM), experiments succeeded in establishing models that even acquired the status of technology missions. For example, we can make a mention of the leather technology mission, which was inspired by the models developed by the peoples’ science movements (PSM) members.

On the other hand, for rural-industries like milk, food processing, housing and buildings, drinking water, etc., the main problem was the imposition of large technical systems (LTS) used in the developed market economies. Indeed, petty producers in many sectors lost economically as LTS were most inappropriate. Adoption of exotic breeds and seeds, nitrogen cooled vans and refrigeration for the transport and processing of milk and the neglect of utilization of local resources and capabilities took place due to the adoption of imported LTS as a blueprint. This blueprint was replicated for the technological upgrading of not only dairy sector, but also of input supply for crop production, fisheries, agro-processing, food processing and traditional health systems. Sectors where small producers could have been easily upgraded by the State, suffered from the adoption of LTS. Indeed, both Gandhian and Left critiques pointed out that the country needed to invest in the creation of appropriate technology and not promote capital and import intensive technology systems.

Although the gainful employment provided by the small scale industry was quite large during the pre-liberalization period, the fraction of production based on indigenous technologies which the agencies developed remained comparatively small. In this socio-technical frame, there was far more success when the social carriers of innovations were capitalists of non-big business origin, who had acquired the social characteristics of large corporations; and also when the innovations involved standard equipment and only needed process know-how. Moreover, when the innovations involved adaptation of the equipment, technologists, technicians - artisans from families carrying out trade and small business were far more successful than others. Technology implementation was successful when the individuals themselves became entrepreneurs. On the other hand, failures were common
whenever the poor individual producers were made to undertake business with inappropriate technologies developed by outside public agencies.

There were also objections raised to the practice of import replacement at the socio-cultural level. The Left’s preference for public transport and the Gandhian advocacy for non-motorized personal transport vis-à-vis automobile were socio-cultural objections. Indian policymakers also experienced a resistance to the mainstream thinking within the sectors of buildings, housing, energy, health, etc. But the people who were critical from among these traditions essentially had their focus fixed on the luxury dimension or the socio-cultural dimension of lifestyle challenges. These critiques did not yet have a focus on dimensions such as ‘social justice’, ‘ecological justice’, ‘sustainable production and consumption’ and the relations of production under formation vis-à-vis the poor producers through the strategy of import replacement.

1.4 Mainstream development path, closing and opening of the space for pro-poor innovation-making during the 1960s

In India, the macro socio-economic landscape faced extreme pressures during the 1960s. These appeared in the form of a food crisis and a crisis of foreign exchange. These pressures also enabled the mainstream Nehruvian leadership to achieve a closure on some of the debates. Although the process of closure remained fragile and vulnerable to be opened up again, the Nehruvian leadership was able to consolidate the socio-technical frames of large technical systems (LTS) which are in place even today as dominant frames.

However, winds of change were to blow soon. Since only the big business and landed gentry were the key beneficiaries of the mainstream pathways, the incumbent leadership could not also fully hold on to the closure attained in the beginning of the 1960s for very long. When the congress party was defeated in several states in the elections of 1967, Indira Gandhi the political inheritor of Nehruvian tradition, was compelled to revisit the issues of the poor. Thus, the congress under Indira Gandhi brought a new development agenda and used the slogan of ‘Garibi Hatao’ (Get rid of poverty) to win back the people and the pro-poor agenda of development was given a new meaning. This virtually allowed the State to redefine the notions of planning, technological self-reliance and national development. Even the Gandhian tradition of pro-poor innovation-making was accommodated through the plan drawn up by the National Committee on Science and Technology (NCST) in 1971, for the Khadi and Village Industries Commission or KVIC. Nationalisation of banking, coal and many other industrial units were effective wherever implemented. Particularly the step of nationalization of banks played a key role in the pro-poor innovation-making efforts of the State. To the extent small farmers gained from the support of nationalized banks in agriculture, pro-poor innovation-making also received a boost. During the 1980s, the support of nationalized banks to petty producers and small scale industry was a lifeline for the numerous units spread all over the country.

More opportunities for opening up the closed gates came for the Gandhian and Left traditions. For them, new spaces were opened up in 1977, when the congress party lost power at the centre. Not only at the centre, a non-congress government of the opposition was in place for the first time. The left opposition gained in the state of West Bengal, where it remained in the state government for over three decades. Similarly the Left has also been frequently in the state government in Tripura and Kerala. Appropriate technology movement gained from these developments. Experiments that were
started by the new government at the centre came to stay in the programmes of the central and state governments. Even when Indira Gandhi came back to power at the centre in 1980, the technology policy statement of 1983 that the government brought out incorporated the goal of appropriate technology movements. The programme of Science and Society was launched by the Ministry of S&T in 1983. The scheme of S&T for weaker sections was promoted, which the peoples’ science movements have also actively used to undertake their own experiments to practice pro-poor innovation-making. These steps gave the required space to several voluntary organisations to experiment, which were largely created by the people of Gandhian, Left, Nehruvian socialist orientation only.

1.5 From experiments to system building for the development of pro-poor niches in innovation-making: 1970s, 1980s and 1990s

During the 1970s and 1980s, the niche of pro-poor innovation-making was formed and the institutions of State S&T and the followers of social movements were mobilized most actively in the history of post-independent India. Rural technology was enthusiastically taken up by the practitioners of appropriate technology movement. During these two decades the creativity of social movements and State S&T was unleashed with the help of increased state assistance in the field. During the 1980’s, the social movements utilized the niche not only to work on their own notions of pro-poor innovations, but also to develop intermediary organizations with a pro-people orientation. Developmental and educational action related efforts could be conceptualized by them in the field on a massive scale. Pro-poor social carriers of innovation were promoted, and many scientists who had been working on such ideas in the State S&T institutions were brought together. Experimental spaces were created; experiments acted as a tool of ideological debate and political mobilization. Attempts of the S&T volunteers were supported by State S&T and voluntary S&T institutions. India had not been as yet engulfed by the syndrome of there is no alternative (TINA)!

Indeed for two decades from 1970-1990 niches for the ideas that were not socio-technically mainstream were established in some of the finest state sector institutions such as: Application of S&T in Rural Areas (ASTRA) in Indian institute of Science, Gaon Ka Karigar and Science in the CSIR system of laboratories, peoples’ science movement and other S&T based voluntary organizations. Working in collaboration with the institutions of higher learning (IITs, Universities) and CSIR laboratories, these niches have given a meaning to the departments and programmes being set up for the development of rural technologies by the scientists and engineers to encourage the S&T based voluntary organizations to participate in the making of pro-poor innovations as pro-poor social carriers of innovation.

By the 1990s, the practice of technology blending, which demands that traditional and modern shall be appropriately combined by the pro-poor innovation practitioners, eventually became far more acceptable as a socio-technical frame in all the political traditions. With the emergence of new generic technologies namely microelectronics, information and communication technologies, biotechnologies and new materials a number of new opportunities were opened up for the practice of networked development in which the peasants, artisans and rural workers could see opportunities for themselves as social carriers of innovation. Technology blending is being actually recognised as a possibility by the social movements. Social space for the development of non-corporate social carriers has been enhanced. Today there are certainly more possibilities for the social movements to effectively
intervene in the sphere of pro-poor innovation-making in India. This is a facilitating development which the new social movements can use to build a pro-poor path of development.

It is true that in a way all the social movements have been triggered to rethink about the role of technical change in socio-economic development. This idea that at the level of larger landscape the choice of socio-technical imagination and socio-technical frame of innovation-making will have long term consequences is beginning to penetrate the mind of all the political traditions. Therefore, among the older social movements cadres are also getting sensitized to play the politics of development differently now.

In this section, I have described how the Indian State, public S&T organizations and social movements mobilized great efforts to promote pro-poor innovation-making in India. Yet, their combined and sincere efforts have not achieved much. Although all the trends have seemingly undertaken the efforts to organize their followers for the conduct of experiments, perhaps their system building was inadequate because of inappropriate socio-technical frames for the making of pro-poor innovations. It seems likely that socio-technical frames embedded in a primitive conception of competiveness would not be the best fit for rural India. Furthermore, their technology implementation efforts were poorly developed; pro-poor innovation system building needs a serious re-conceptualization. Therefore, efforts of the “State S&T” (S&T being carried out by the KVIC, CSIR, ICAR, IIS and IITs) failed to make their full contribution.

We illustrate this proposition with some case studies that show how good intentions can fail to have good impact. Three case studies illustrate the struggles carried out and the twists and turns of politics of knowledge and technology generation, which have been an integral part of the processes of conceptualization and implementation of pro-poor innovation-making activities and the perusal of the idea of a self reliant India.

2. Case studies on the politics of pro-poor innovation-making

2.1 Knowledge production for pro-poor innovation-making and the politics of institution building in higher education: the case of Higher Education (Radhakrishnan) Commission

_Dreaming a rural university: How it started_

The Radhakrishnan Commission (RC) was instituted in 1948 to review the Indian higher education system. Interestingly, RC proposed a plan for the formation of rural universities an idea for which it was able to evoke the support of all parties namely the Nehruvian, Gandhian & Left leadership. They were proposed as a roadmap to tackle the enormous diversity present on the demand and the supply sides of Indian rural populations through different set of ways of funding, capacity building, organizing and achieving the accountability in innovation-making.

The RC’s proposal for the establishment of ‘rural universities’ was guided by an understanding that the universities established by the colonial masters –besides some qualitative limitations- had only touched the fringes of the world’s newest and most populous democracy. It began by highlighting that, as reported by the 1941 census, about 85% of the population of India
lived in villages. It further argued that new, free beginnings were possible, unhampered by the colonial past, by taking advantage of advances in world educational thought and practice. Given the tendency of an old and dominant institution to impose itself on any new institution in a similar field, it is a matter of practical necessity that new universities aiming at extending educational opportunities to the great mass of rural India by giving vitality and quality to rural life should have their own independent design and programme.

The way the RC addressed the issue of integration of national purpose into the design of rural universities is quite instructive. India was asked to decide whether to aim at its largest sections, making villages prosperous, interesting and culturally rich places, with such a range of opportunity and adventure that young people would find more interesting, more culturally advantageous, and with more pioneering opportunities there, than in the city; or whether to turn to centralized industries, with labour taking direction either from the state or from private corporations. It noted that there should be no feeling of conflict between existing and new types of (rural) universities, any more than between engineering and medical education. However, it suggested that because the pattern and spirit of existing universities is so distinctly urban centric, massive pioneering efforts would be required for evolving new institutions of higher learning to serve the needs and aspirations of our democracy. The commission stressed that rural universities would share many of the qualities and methods of existing universities and, further, that there would be cooperation and interaction, whether with the European universities or with institutions in America, a relation of consultation, friendship and advice but not of authority.

**How it ended**

The RC was the first (and last) committee to discuss how India could inculcate national purposes into higher education through the implementation of appropriately chosen university design and joint planning. The RC’s model of rural university had aimed at the achievement of functional integration of teaching, research and extension by linking the process to the construction of a different kind of agriculture. In the recommendations of RC, the model of integration of the functions of teaching, research and extension was not subordinated to the promotion of high external input agriculture. The model of rural universities was in favour of promoting the development of farm and non-farm production by taking into account the ecological and social diversity and local resource endowments in an integrated way. Extension was not a spill over to be harnessed. Knowledge (re)production would perform by contributing to the goals of rural-urban development ‘Indian style’.

The establishment of rural universities along the lines of the RC recommendations required the cultivation of a political will and the mobilization of public support for the construction of India’s own development path. However, at that time, Indo-US agricultural cooperation teams were recommending help to be taken from the US for institution building in agriculture and small-scale industry. The political-bureaucratic apparatus was being advised to balance the help of Soviet Union in heavy industry with the help of United States in agriculture and small-scale industry. Food shortages were another overwhelming pressure factor. War with China had also shaken the government. All these factors made the government rush to take help from USAID. Thus, a drift occurred in educational policy, when the Kothari Commission formulated the National Educational Policy of 1966. In the Kothari Commission, the planning and orientation of agricultural universities was handed over to teams led by the Rockefeller and Ford Foundations. These two foundations were actively supported via two agreements signed for
Indo-American science and technology cooperation in 1955 and 1960. The Kothari Commission almost completely violated the rural university design model proposed by the RC. Though the Kothari Commission insisted that an agriculture university be created in every State, modern input intensive agriculture was to be taught along the lines of American land-grant agriculture universities (whereby land is granted by the state for a university to build capabilities in agriculture). Thus, the RC committee’s vision of a rural university failed to become a reality because it needed the political-bureaucratic apparatus, the scientific community, and the people to jointly stand firm in favour of its implementation but this did not happen.

Recently the RC recommendations were again revived during the 10th Five Year Plan (FYP). Not only that this revival happened after a lapse of eight or nine plans through the efforts of a very small section of S&T community led by Prof S.K. Sinha, former Director IARI but because of the lack of sufficient mobilization of the S&T community the Indo–US Knowledge Initiative for Agriculture came back to raise its head again. While the programmes of agricultural research of the 10th FYP envisaged the agenda setting of agricultural development to shift to the implantation of agro-ecological approaches, the Indo-US Knowledge initiative is geared to the introduction of precision agriculture.

It is clear from the history of unsuccessful implementation of the recommendations of the RC that the challenge faced with regard to the implementation of the visions and strategies of pro-poor innovation is political. Because the politics of knowledge production is no more on the priority of the socio-political forces active among the people, there is no viable political force to take up the political battle of pro-poor innovation-making in the Indian agricultural system of innovation.

Other similar experiments – which did not take off

City universities: Similarly, when the RC recommended the formation of ‘city universities’, it had clearly recognized that rural and urban universities should supplement each other through a framework of regional development to benefit the development of local economies. It argued that since universities had so far been established to meet the needs of cities or limited areas, fresh thought needed to be given to the formation of regional universities to serve the distinct requirements of diverse natural, linguistic, cultural or economic regions. The RC was clear that the full genius of a country can develop only with freedom to create variety; that foreign control could best advance itself by regimented uniformity. It also recognized that given a tendency towards bureaucratic unimaginativeness and administrative convenience, regimented authority had become a habit of mind in Indian higher education. The commission, therefore, recommended that when the UGC was to decide the degree of recognition and support to be given to any institution, the criteria should not be the likeness of that institution to others of a standard type, but a judgment about whether that institution is making a substantial contribution to the economic, intellectual, cultural and spiritual life of India.

The Nai-Taleem model: The Gandhian tradition had put forward the model of Nai Taleem to link the sector of education with the practice of innovation-making for the poor. This model had been conceived as an unconventional mode of learning wherein the students are regularly exposed to both classroom teaching and training in concrete projects. Teachers act as masters who endow student apprentices with both knowledge and skills. Such institutions remained marginal to the plans of
education under implementation; only fifteen rural institutes exist today. Moreover, a lack of appropriate teachers for the task at hand (i.e. Master (Ustaad)-Shagird (apprentice) type of learning) remains a big handicap for the model. These institutes have failed to sustain themselves as viable social carriers of innovation. Attempts to overcome this handicap have not had enough support either from state or from society.

2.2 Knowledge production, pro-poor innovations and the politics of technology implementation: The example of the CSIR

According to its website, the mission of the Council of Scientific and Industrial Research (CSIR), created in 1942, is "To provide scientific and industrial R&D that maximises the economic, environmental and societal benefits for the people of India." The CSIR is the largest public funded network of laboratories in India. Its motivation in the case of pro-poor innovation generation came directly from the influence of the freedom movement but the socio-technical frame it adopted for pro-poor innovation-making has become its important limitation in respect of the generation of appropriate rural technologies. Some of its notable pro-poor achievements are however presented in respect of rural technologies in table 2.

Table 2: Selected notable pro-poor innovations of the CSIR

<table>
<thead>
<tr>
<th>Product/Process</th>
<th>Nature of the innovation</th>
<th>Impact on rural/urban households/producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amul – leading brand of dairy products in India</td>
<td>Process developed by the Central Food Technology Research Institute (CFTRI) to make condensed milk powder from buffalo milk- a difficult challenge by the dairy technologists at that time.</td>
<td>Access to milk, butter and dairy products across the entire country; livelihoods for hundreds of households</td>
</tr>
<tr>
<td>Improved vegetable tanned leather</td>
<td>Process innovations by the Central Leather Research Institute on whose strength the national leather technology mission has made an impact on the leather industry as a whole.</td>
<td>The units working across the country could shift to a low cost solution which not only solved the problem of pollution facing this important export oriented Indian industry but also provided for improved incomes, associated value added products out of fallen carcass utilization and social justice.</td>
</tr>
<tr>
<td>Extracts of citronella, lemon grass, Japanese Mint</td>
<td>Agro-processing technologies</td>
<td>Provided livelihoods to hundreds of farmers.</td>
</tr>
<tr>
<td>Development of improved hand pump, low cost culverts for rural roads, red clay based sanitary wares, leaf cup production, leaf cup</td>
<td>These technologies contributed to the use of local raw materials and</td>
<td></td>
</tr>
</tbody>
</table>
making machines, iron removal plants, technology for the two-pit latrine system etc. skills and benefited the local economies.

The Karimnagar project

During the period 1972-1979, rural technological development got a big push within the CSIR because the government of the day was inclined to support initiatives for rural technology development. In quite a few CSIR laboratories rural development projects were identified and taken up. Internally, the leadership came mainly from the then DGCSIR (Director General – CSIR), Dr. Y. Nayadumma, who was keen to take up work on rural technologies. With his involvement the initiative taken on Karimnagar became a major programme for the CSIR system.

The Karimnagar project was initiated in Andhra Pradesh in 1972 with the aim of taking science and technology to the people in an integrated manner to rural areas. The approach to technology implementation consisted of the identification of a number of schemes and proven technologies, which could help in socio-economic development of the participating community irrespective of their economic and social levels. For the CSIR system extension of the outcomes of the ongoing R&D work with the aim to field-test the pooled results of research was also an important motive. The emphasis was on selecting projects and providing S&T inputs based on for the following purposes survey of resources, establishment of industries and development of public utilities and implementing on priority the technologies for following purposes: the introduction of technologies for rural water supply and road construction rural development.

The Director General of the CSIR appointed an evaluation committee in January 1977 to review the experiment undertaken in Karimnagar in the state of Andhra Pradesh with a view to taking S&T to the people in an integrated manner to rural areas. The detailed evaluation of the process of technology implementation undertaken by the committee, discussed here only in brief, also demonstrates how ineffective the technology implementation approach of a technology push, modern sector spin-off programme can ultimately turn out to be in the case of rural technologies. Cited below are the evaluative comments of this committee on the performance of Karimnagar project. For example, this evaluation committee was of the view that: "No project was undertaken or demonstrated which could directly improve the condition of the rural poor and other disadvantaged groups like small and marginal farmers, landless labourers, scheduled castes and scheduled tribes, nomads and rural women as a group". "In the absence of a planned approach and methodology of implementation and with the “scatteredness” of the schemes in whole of the district, the impact of the experiment was getting diluted and diffused”.

In order to deal with this criticism, the CSIR decided eventually to confine its work in only seven clusters of 56 villages of the district. In May 1977 using this methodology the CSIR even prepared a revised project report. The evaluation committee had the opportunity of also going through this revised document. And it came to conclusion that "even this approach lacked objectives desired to be achieved". The committee felt that "in the revised document the activities were not clearly defined and mode of implementation was not spelt out". The committee also commented on the type of partners mobilised by the CSIR system. It said clearly
that “in the new approach the Karimnagar project envisaged assistance and co-operation of other agencies about which CSIR already had its sad experience”. The committee also commented that "the CSIR has made its own internal assessment of the project; however, it appeared to be very general in nature. The assessment was not very sharp, well exposed, and objective. No definite programme was worked out to implement the project and translate the idea into action as which area was having the gap, what technology could bridge this gap, how many demonstrations were required to establish the innovation, who will do extension work and serve the related needs and demands etc. Whatever projects were implemented again were selected in an adhoc manner on the basis of whoever was available to try out an experiment as a giver or receiver, whether he had full faith or not in it”. From the above comments it is certain that often, when an organisation is following the technology push approach, it also usually ignores the need to have even a feedback on the implementation. In fact it is not possible in this approach to develop the inter-active structures needed for the purpose of planning, monitoring and evaluation.

In the Karimnagar project, the approach taken was of a technology push, modern sector spin-off programme for the villages without interaction with targeted beneficiaries or any form of feedback loop. The evaluation committee confirms this by stating clearly that “one of the objectives of the CSIR laboratories has been extension of the results of the research in the prospective areas in different parts of the country. In fact, it seems to have been the main objective that Karimnagar Project would provide a good ground for field testing of pooled results of research”. This becomes also evident when the committee notes clearly in its final recommendations that “research and development have little meaning unless these are tuned to the needs of the people and taken to a stage which could help in their successful development and adoption. The next stage comes of making the laboratory techniques and technologies known to and adopted by their prospective users. This is to be followed by ‘service after sales’ and removing any teething trouble experienced by the users. Further improvement in the technologies could be brought under a continuous process of R&D. The feedback information should be regularly conveyed to concerned scientists or the technologists so that they may be exposed to real field conditions”. From the above discussion on experience of the Karimnagar experiment it should not be difficult to conclude that the failure of the CSIR in respect of rural technology development has a direct connection with the methodology of technology push without any form of feedback loop.

**Why did the CSIR fail in the Karimnagar project?**

The Karimnagar episode raises a number of questions that are fundamental. Is this not surprising that for a country like India having a large rural population whose basic needs are yet not met, a project such as the Karimnagar one utterly failed? Did the later leaders attempt to overturn this understanding? If not, was there any resistance on the part of CSIR scientists? Is the issue connected in any way with the ethos of CSIR scientists? Is it connected with the institutionalisation of a particular strategy out of which the CSIR leadership is finding quite difficult to come out? What must the CSIR leadership do to bring about the change? We attempt to answer at least a few of these questions with respect to the Karimnagar project now – starting with the government, then going into the CSIR system and ending with the nature of the innovation generated. They provide insight on how ‘technology transfer’ projects must be designed by public agencies in order to be useful and effective in promoting rural development.
The government strategy: The Indian government was faced with a number of questions while carving out a developmental path during the 1970s. Should the industrialisation of India continue to mean the development of only those industries that cater to the needs of classes whose life styles have become dependent on the imitation of goods being produced in the industrialised countries? Should Indian industrial development strategy continue with a bias against the possibility of rural industrialisation, which has an enormous potential to cater to the requirements of local markets? Can rural industrialization be undertaken through the strategy of upgrading the existing local skills and local resources? Was not the CSIR system set up to be an organisation devoted to generating technologies for the Indian industrial development? If political will at the top had decided the answer was ‘no’ to the above questions, the Karimnagar fiasco would not have happened.

Lack of continuity in an investment trajectory as government leadership/strategy changes: In 1980, there was a change in the central government in 1980. And the new leadership that came through on its appointment in the CSIR was of the view that the CSIR had not been created to generate technical know-how for the rural sector. One can ask, just because the government of the day is changing its course and stressing less on rural industrialisation, should the CSIR drop its efforts for rural industrialisation? The reality is that the CSIR is completely dependent on the funds and executive support being made available by the government under its policy, both for infrastructure development and for establishment of industrial estates. Thus, when the government changed and withdrew the funds, the local district collectors completely lost interest in a programme like Karimnagar. The next government of the day was interested in shifting the focus of rural industrialisation away from the rural industrial estates based programmes to the support for village industries. In response, the CSIR had to withdraw from the district development programme of Karimnagar. In programmes of industrial development, formulated as a part of the fourth plan when the planners formulated a massive area-development exercise, the experiment of Karimnagar was to be implemented through a rural industrialisation programme of creating rural industrial estates. Without the help of district collectors and associated development agencies it was not possible to continue the programme. Only by establishing a new set of bridging institutions the CSIR could have kept the experiments alive. But no such efforts were made in the CSIR system.

Being clear about the mandate: Is CSIR only for industry or also for rural development? In a paper published by Dr. J. C. Srivastava of CSIR on the ‘Role of CSIR in the Development and Application of Technology for Rural and Backward Areas’ (1984), this issue has been discussed with a lot of bitterness. Dr. J. C. Srivastava, who used to manage the rural development activities, records that “with a new Director General taking over the helm of CSIR towards the end of 1978, the CSIR’s interest in rural development seems to have almost ceased. Directors of CSIR laboratories (Refer Directors Conference, Bangalore 1978-79) seemed to be of the view that CSIR had little role to play in promotion of rural development which should be normally left to ICAR, Agricultural Universities, State Governments, voluntary agencies and the like. Indeed it appears to the author that CSIR authorities during recent years have even frowned upon its laboratories undertaking R&D programmes related to rural development. Such work was considered to be outside the purview of CSIR, which was expected to confine itself to basic research and development of industrial technology. Work on technology delivery was firmly rejected on the plea that rather than being guided by passion, we should work for what the CSIR has been actually set up".
Problem of leadership or lack of it at the top: The CSIR leadership dropped rural industrialisation from its basket only because it had a particular role and division of labour in mind. The CSIR leadership had this division of labour in view where by itself the CSIR would take the risk only in basic research. And if the leadership was ever required to be undertaking the risk for the development of technology where the users themselves had to be developed, its view was that it should rather wait for the government to take a lead. Of course, it would be altogether another matter if the CSIR had a strategy of pursuing leadership in the markets. Then, like a product champion, it would have even tried championing the rural technological development programmes to the government. The problem lay in the fact leadership of CSIR pursued pro-poor innovation as a defensive strategy; because it gets funding from the government for R&D.

A mind-set problem of CSIR scientists themselves: CSIR scientists tend to view themselves as scientists working to strengthen the technology capabilities of the modern small and medium scale enterprises – leaving rural development actions to emerge as a spin-off from the mainstream programmes. Under this mindset, rural development is viewed as a burden rather than an opportunity. In the spirit of true spin-off approach the CSIR system neglects the fact that the technology transfer has to take into account user capabilities and resources. Since the users are in the unorganized sector, lacking skills to communicate their demands effectively to CSIR scientists, unless the scientists reach out to understand the rural users, technology transfer will not be effective. Of course, we must look for a consistent explanation for the ethos of the CSIR scientists. A part of the burden of responsibility needs to be taken also by the leadership which does not value the pro-poor innovation-making. The evaluation system that the leadership is following requires a major change in its objectives and methods.

Too capital intensive process technologies: Many CSIR rural technologies have been based on the processes intended for being used in capital-intensive small-scale industries. These technologies were meant for catering to the urban markets and needed high inputs of non-renewable energy source to operationalise machines to be utilized in the course of production. Entrepreneurs who successfully used these technologies tended to come from well-established business families.

Lack of ‘appropriate design’ and ‘interaction with targeted beneficiaries’ in ‘technology push’ projects: Evaluations clearly point out that the CSIR R&D personnel do not configure their R&D projects for the appropriate economies of scale and scope of rural contexts. Technologies developed do not meet the real needs of targeted regions and cannot be fitted into the industrial and social infrastructure existing in rural areas. The process of technology transfer is undertaken by pushing the available solutions without the technology adaptation effort required for fitting the technology to the conditions of the users. This is because interaction of R&D workers with users is weak. There has been no attempt to understand the users as systems and to manage technology transfer as an interactive process.

Weak external networks with non-CSIR experts - Technology programmes for rural development continue to be weak on the aspect of networking of external resources such as expertise and funding. During the phase of technology development the interaction with users is very poor. The laboratories continue to depend mainly on the efforts and inputs of their scientists alone and in-house R&D funding for technology development. Involvement of external experts and multi-disciplinary background of laboratory scientists significantly improved the technologies. The situation of networking is no better during the phase of technology implementation.
Today, the CSIR has a programme called ‘CSIR for 800 million people’ to support the projects for rural development and weaker sections, but the efforts being undertaken in the laboratories are essentially still very much the same technologies and processes which the CSIR system has been undertaking as a residual activity.

In the case of village industries, the conditions for technology development have not changed in any kind of significant way. From a recent survey of the five hundred users of CSIR rural technologies that the author took in collaboration with his colleagues, it has come out quite clearly that even the newly developed technologies are failing to make an impact on the rural scene. Only 18% of CSIR rural technology users were in production and the rest have either not started or have chosen to discontinue the production (Abrol, 1998). This report shows that the programmes of rural development have been apparently going on in the laboratories without any kind of critical evaluation being undertaken by the CSIR headquarters.

The rural non-farm sector (RNFS) is a field where the CSIR has had the possibility of contributing a great deal, but even after twenty five years of involvement it remains an area of extremely low priority for the CSIR leadership. In the document entitled ‘Creating an Enabling Environment for Commercialisation of CSIR Knowledge Base: A New Perspective’ (1993), this sector is completely missed out from the attention of the committee. In the latest CSIR Vision document of Dr. R. A. Mashelkar, this area does not get any kind of attention. Dr. Mashelkar can be presumed indirectly to have mentioned it in the document through the reference made to the objective of technology for human welfare. There are no specific targets with respect to this area in the Vision document, though in all the other domains the numbers are clearly indicated in the document. Dr. Samir Brahmachari, the new Director General leads the CSIR to implement Vigyan Kutirs in the same way as also done by most of the past director-generals. Implementing rural development residually, as a part of the CSIR-800 mission programme, through again technology push approach, is the fate of pro-poor innovation-making even today.

From the top to the bottom, there has been very little learning in respect of the management of R&D and technology transfer for rural development in the last twenty years. Scientists continue to self-indulgently believe that their technologies are fully viable economically in rural areas. There is very little record being kept by the laboratories on the status of technology utilisation. Since the top management has been mostly indifferent to the efforts of R&D and technology transfer for rural development, there have been hardly any investments in bringing the users closer through the encouragement to link organisations/ agencies that could have acted as the bridge. This lack of investment is reinforcing the habits of CSIR scientists in favour of technology spin-offs without any feedback loops that embed it appropriately in the rural context for which it was designed. Both technology development and implementation continue to be oriented toward the linear model of innovation, where the laboratories produce spin-off technologies without fitting them to the conditions of users or involving them in the adaptive efforts (Pulamte and Abrol, 2003).

To conclude this case study, we again note that CSIR leaders take up technology development projects for the rural areas only when the government of the day wants them to pursue this objective. The Karimnagar initiative got formulated when the government of the day
was taking keen interest in the implementation of area development exercises. The government of the day was the driving force for this programme – without any internal momentum within the CSIR. Since the CSIR leadership’s lack of commitment to the development of rural technology comes from the fact of that the political bureaucratic apparatus treats pro-poor innovation-making as a residual activity for its own design of development, it is important the CSIR’s becomes accountable through the introduction of a special research audit system to parliament. Of course, this is not only the responsibility of CSIR; but the CSIR will succeed only when its partners in the government and the private sector are also ready to give a priority to pro-poor innovation-making activity.

2.3 Pro-poor rural non-farm innovations and the politics of technology implementation: An assessment of KVIC, CSIR and other rural industries development programmes

Much of the rural non-farm sector (RNFS) occupations are subsistence employment. They survive because the RNFS occupations are linked to either serving the local rural markets or meeting those needs of the urban poor that the modern industrial sector is yet not able to satisfy. However, millions have lost their livelihood on account of the lack of technological upgrading in the face of increased market competition. In this section we analyze some of the strategies deployed that failed to stem this problem with examples taken from the Khadi and Village Industries Commission (KVIC).

In the past fifty years of development in India, the governments of both the states and the Union have sponsored a number of programmes to upgrade the rural non-farm sector occupations. The promotional policies and technology support programmes that have been applied directly or indirectly to the rural non-farm sector development, can be categorised in the Indian context as policies and programmes for promoting: i) self-employment among the rural poor and ii) traditional rural industries.

2.3.1 Strategy 1: Subsidize to maximize rural self employment

During the sixth five-year plan (1980-1985), the government launched a new package of incentives for the rural poor to make use of opportunities for self-employment through programmes like the Integrated Rural Development Programme (IRDP), Training of Rural Youth for Self-Employment (TRYSEM), Development of Women Children in Rural Areas (DWCRA) and State-specific schemes for self-employment of SCs & STs and Women. These programmes were initiated with the aim of targeting households below the poverty line, and the idea was to provide each of them with a productive asset through a subsidised loan so that they can rise above the poverty line. The assets provided to rural poor under these programmes included milch cattle, goats, sheep and poultry; equipment such as sewing machines, tool kits, camel carts, handcarts, rickshaws or bicycles for hiring out; or working capital for petty trading, tea or pan shops and the like. During the seventh five-year plan (1985-1990) this strategy was supported in a bigger way through large allocations in the form of both government funds and bank credit. This emphasis was continued during the eighth five-year plan (1992-1997). Throughout this period cottage scale units such as the individual weaver, the potter, the blacksmith, and the village shoemaker were also subsidized to ensure maximum employment per unit. For example, both Khadi and handloom were protected, the former through subsidised credit and
subsidies to consumers on purchases, the latter through non-imposition of excise on hank yarn.

However, this policy had just the opposite effects. The cottage scale units had no incentives to explore technology upgrading. Low productivity, low wages and underdevelopment prevailed. Programmes for self-employment failed because of inefficient implementation via wrong selection of beneficiaries, ‘leakages’, failures of enterprises, loss of assets, saturation of small markets for produce, etc. Moreover, projects were not on a cost-effective basis; backward and forward linkages were absent; beneficiaries selected among rural poor were not adequately skilled and lacked management competence; the role of the middlemen and contractors was inimical, leading to ‘leakages’, training in isolation without integrating them with specific projects, and often without reference to local demand for skills.

2.3.2 Strategy 2: Improve competitiveness of rural industries by modernizing traditional equipment

In the seventies the efforts for the advancement of the practice of S&T for the industrial upgrading of traditional manufacturing received from the government for the first time a big push in India. But most of the technological solutions that this effort offered were unable to connect well with the local markets and capabilities accessible to rural poor and hence were mainly ineffective in improving competitiveness. Unfortunately, this technology push approach persists till date uniformly in all the agencies.

An illustration is readily provided through some examples of technology upgrading attempted by the Khadi and Village Industries Commission (KVIC). The KVIC’s strategy was to improve traditional technologies by scaling them up to intermediate levels and introducing power-driven machines. However, this approach increased the costs, made practical functioning difficult and adversely affected the formulation of viable projects. For example, although the semi-automatic improved loom was developed in 1972, 90 percent of handloom weavers continue to use the pit loom. The power pottery wheel entered the market about two decades ago (1970); yet the village potter continues to operate the traditional wheel. The traditional ghani (oil expeller) is fast disappearing but it has not yet been replaced by a power-driven ghani. The large producer using solvent extraction/ expellers is more competitive. Improved gur (jaggery or molasses) furnaces have been developed but not adopted adequately. These are only a few illustrations.

The basic problem was that in most cases technologies had been developed keeping the individual enterprise of a small producer in mind while totally neglecting to incorporate local resources, raw materials, engineering materials, energy sources immediately accessible by or with the people. Local markets were ignored. There were no efforts to develop technologies that could strengthen inter-links in the local economy by developing input output relations among existing occupations, in terms of specific products and services. There were no attempts to innovate using local engineering capabilities and materials to substitute non-local products e.g. replace stainless steel vessels by glazed clayware and, if necessary, metal bottom or internal pipes, etc. for heat transfer. Then, it would have been possible for the agencies to lower investments and scales, and develop inter-links in the local economy. Non-conventional energy sources were not suitably integrated into industrial activities requiring machines. The focus was more on providing non-conventional energy sources for the purpose of cooking and lighting. Technology for co-products and by-product
formation was given very little attention (Panditrao, Y. A., 1994).

Efforts made by the KVIC to overcome the limitations of individual artisan’s resources through the use of common facilities centres also failed to finally upgrade the production of rural artisans in an economically viable way. These centres have ended up serving only those artisans who are working for large urban markets under the control of large traders or a state sector owned bureaucratic marketing facility.

Section 3
Best Practices and Recommendations

First, analysis based on the above said discussion including case studies indicates that the dominant political mainstream did not accommodate the efforts for pro-poor innovation-making automatically. Second, though at regular intervals of almost every ten years the politics of technology implementation has been revisited by the political-bureaucratic apparatus, failures continue with respect the process of mainstream development meeting the expectations of the poor. Third, analysis also clearly shows that till this date for the expansion of contribution of pro-poor innovation making the nation remains largely subject to the dynamics of closing and reopening of the political economy space available. As politicians come and go following the changing fortunes of mainstream development process, socio-technical frames of pro-poor innovation making remains an unattended factor. Fourth, counter-hegemonic political traditions need to realize the critical role of the socio-technical frames in the achievement of competitiveness of pro-poor innovations. For the accumulation of counter-hegemonic ability by the relevant socio-political traditions their carriers should undertake their own efforts for pro-poor innovation-making as a cultural, political economy endeavour. Socio-technical frames and the imagination embedded in them must be treated as an instrument of resistance required to be developed by the poor themselves and with collaboration with other economic actors, to achieve the required results with regard to the building of pro-poor innovation systems. In this section, we first examine the obstacles and then we outline some success factors for pro-poor innovation making.

3.1 Factors that limit the creation of pro-poor innovation

*Application of a primitive notion of competitiveness to rural producers:* The case studies of the previous section reveal that in India, pro-poor innovation-making activity in rural industries has suffered from the implementation of a primitive conception of competitiveness. The view that innovation in rural industries should be restricted to the transitional objectives of poverty alleviation has its roots in the practice of a primitive conception of industrial competitiveness. The approach towards implementation of technological upgrading in the rural industries has been to target the individual small producer to become individually competitive. In this approach, competitiveness of this segment gets judged by comparing the existing relative costs and prices to individual producers because there is no recognition of potential competitive advantages that might accrue through the exploitation of economies of scale and scope and cluster or network effects. Therefore, these synergies are not generated or captured and in their place, small producers are forced to accept intermediate technologies with higher costs of inputs per unit of production.
Lack of cooperation between small producers combined with lack of bargaining power: Competing large capitalist enterprises are in a position of erecting barriers to competitive access for small producers in the input and product markets and often use it. Mutual competition amongst small producers also leads to narrowed access to inputs and technologies and adversely affects the effective demand for their products. In those cases where small producers are being organized only for access to inputs and credit, the absence of cooperation in production results in mutual competition at the marketing stage that in turn breaks their existing alliances. Often both, the traders and the large-scale capitalist enterprises (competing with them in the market for the sale of products) have an interest in aiding the processes that can disrupt the cooperation of small producers. As in turn this failure of cooperation among small producers leads to the establishment of a vicious circle for the utilization of intermediate technologies in these sectors, it is having an impact of the slowing of innovation diffusion as a whole in the economy of a country like India.

Viewing the rural producers as passive recipients rather than co-producers of innovations: A common feature of failed ventures evoked in the case studies was that the process of technology implementation was largely guided by the notion of the end users of innovation, namely poor peasants, artisans and agricultural labourers, to continue as passive recipients of the technologies selected for promotion by intermediaries. Predominantly, machine training and process demonstration is the practice in technology implementation. Technology support has been conceived in the form of one-time injection of improved hardware. This means that in the case of rural poor user support is not oriented to the task of improving the ‘participation’ of these end users in the process of development of intermediate or appropriate technologies.

Applying a pure market cost-benefit analysis without taking into account externalities: In the case studies presented technology evaluation was built around market cost-benefit analyses. Assessment of the negative externalities was rejected as a manageable problem through regulation and compensatory solutions. Technology assessment at the level of impacts of the systems on ecological and social justice is another recent development that has to be considered. Even today in these political traditions, technology assessment is not a major feature of their pro-poor innovation interventions. The green revolution technology was critiqued for the landed gentry preferring technical change to land reforms. However, it is important to note that the selected technical solution of high external input agriculture threatened more the poor peasants, artisans and landless labourers. But it is only now evident that poor peasants, artisans and rural labour have lost a lot on account of the adoption of inappropriate technological choices even when implemented through the State or cooperative sectors.

Vested interests: For a vibrant pro-poor innovation-making, diversity and experimentation must be encouraged and it must also be recognized that this may go against the interests of some actors in the innovation system such as elites (who may change according to context and issue considered), and some big business, politicians, bureaucrats foreign firms, power-groups of all kinds etc. And the constraints posed by the vested interests should never be underestimated. Ultimately poverty elimination needs the poor to organise themselves for the cooperation in production to get redistributive justice. Poor will have to compete and bargain with all the other actors in the innovation system, including the corporate sector and private business. When in business it is not possible to escape the iron law of competition in the market driven economies.
3.2 Factors that contribute to success

Technology and market are interlinked issues. Often, for the markets where the rural poor can compete with ease, even the ready to transfer technologies are not available. For the rural poor the problem of access to markets is a systemic problem. They cannot compete with everyone anywhere and everywhere. The markets for which the rural poor should compete must be within their reach. Further, for the enterprises of rural poor to succeed the programmes of industrial modernisation must have a strategy of developing the local economy as a production system in itself. Despite these challenges, there have been success stories and they yield the following insight.

Useful technologies are created through the assessment of conditions of competition facing the targeted beneficiaries: For many traditional industries the users come mostly from among the rural poor. Therefore, there must be an assessment of the needs of potential users especially in terms of the type of competition they face and their market and non-market opportunities as well as their current level of access to markets, resources and capabilities. There must be a close collaboration between the scientists and the prospective users, otherwise it will not be possible for S&T agencies to help them become competitive users of the technologies developed. Analysis of the pattern of success indicates that the formulation of strategy for system transition starts from the standpoint of how to improve the ‘participation’ of the end users in the system of innovation.

New technology is effective if it is compatible with a higher returns yielding business model appropriate for a local context: Efforts of public agencies to improve the competitiveness of rural firms because their efforts tend to conceptualise the problem of technology support as only of a one-time injection of improved hardware. Moreover, the concept of improved hardware was limited to creating the machinery and equipment through mainly downsizing of large-scale modern technologies, upgrading of traditional technologies, or blending modern with traditional technologies with the aim of making an individual producer efficient. But, since the improved technologies were poorly connected with their existing local production as well as technology systems, the targeted users could not be convinced to adopt the new technology. Finally, it was assumed that for every improved technology there was an obvious business model that would increase the profitability of the user. But this assumption was never explored and constructed.

Scale, network and cluster effects should be explored, initiated and used: Calculations of the economic viability of technologies cannot be made with the assumption that small producers in village industries are incapable of organizing themselves for a better access to the higher scales of production. Selection of technology development objectives and choice of partners for user development need to be designed with the perspective of organizing small producers in village industries to interface for achieving economies of scale and scope through their appropriate organization and assuring network and cluster effects, so far ignored in competitiveness evaluation.

Technology implementation has to be guided by a systemic conception of competitiveness: The production and technology systems of the targeted users must be identified such that any new technology package reduces their costs by either resorting to alternate input-using technologies or using the present inputs more efficiently. It is necessary for the social carriers of pro-poor innovation to actively co-operate among themselves in production with the aim of breaking the monopoly of large capitalist enterprises. In order to be systemic in the approach to innovation, small producers have not only to utilise those technological opportunities that connect well with the local markets,
capabilities and resources, but also have to organise, develop and obtain technology for co-operation in production among themselves. This also implies the maximum utilization of local advantage while linking them internally and developing their capacities to plan for better market access and egalitarian organisation of production. They need to undertake technology choices that enhance co-operation in production via the development of production linkages, value addition, improved production & greater diversification.

**Change in the paradigm of rural development:** History tells us that the contribution to rural industrialization process was seen by the dominant leadership of scientific community working in the CSIR system of laboratories as falling outside their domain. In their understanding, the development of modern industry did not include the technological transformation of rural areas. Rural industrialization was seen through the lens of a developmental conception which was embedded in the dichotomy of traditional and modern industry. Since the framing of upgrading of traditional industries was embedded in the individual, small producer becoming competitive and did not fit well with the imagination of large technology system the scientific community did not consider this work to be working on the frontiers. Today when the world is seeking eco-restructuring of the development process a vision and strategy of multi-level industrial development is considered to be high technology and a frontier to be captured.

As an alternate socio-technical regime agroecology based approaches to agricultural and rural industrial development have the potential to resist agribusiness and agro-food companies in the retail market. Agro-ecological approaches have the wherewithal to make the Indian agriculture economically, ecologically and socially viable. Agro-ecological approaches have the capacity to reduce the farming risk on the input side by shifting the peasantry away from the non-local inputs and on the output side in the market on account of the diversification of outputs. Agro-ecology based approaches allow peasants to move away from the existing system of mono-cropping which faces is increasing to an integrated system of primary production integrating all the relevant subsystems of primary production, namely, crop production, livestock management, aquaculture and silvi-pastoral cover areas. The core principles of agroecology include recycling nutrients and energy on the farm from within the local systems of ecology and economy, rather than introducing external inputs from the outside; integrating crops and livestock; diversifying species and genetic resources in agro-ecosystems over time and space; and focusing on interactions and productivity across the agricultural system, rather than focusing on individual species.

Agro-industrial production systems have the possibility of contributing materials of all kinds of use values besides food. Biomass based dispersed industrialisation is conceptually and technologically considered feasible by the engineers (Datye, 1997). Agroecology is highly knowledge-intensive, based on techniques that are not delivered top-down but generated within the local economy on the basis of knowledge and experimentation of peasants and landless workers and through the development of group enterprises of rural labour and artisans. Since the approach of agroecology as a mode of agricultural development is capable of strongly contributing to the broader goals of regional economic development, public health and wider ecological health transformation now the pro-poor innovation making can be geared to provide solutions for the evolution of new kind of agriculture and rural industries as a part of socio-ecological and socio-technical restructuring to be undertaken in the case of the Indian economy (Abrol Dinesh, 2010).
4. Concluding remarks and reflections on new trends

The politics of Indian economic development have been shaped by debates and bargaining between the cadres of Gandhian, Nehruvian and Left right from pre-independence times. Debates have not ceased even today and are continuing in a vigorous way between the cadres of these three orientations in the new context of struggles emerging for the achievement of ecologically and socially just development among the people of the country. But the challenge posed to present State policy which favours now an open, liberalised economy in contrast the original Nehruvian, Gandhian and Left traditions, which are nowhere near reaching the stage of becoming a viable political alternative. Even today the force of their challenge is a function of the crisis and of the ability to overcome the political and economic dimensions of the crisis facing the mainstream. Since everyone is required to work within the framework of parliamentary democracy the State has been accommodating and adjusting with the niches under formation in the country through the efforts of the people of varying political persuasion. Nevertheless, the capacity of the different factions to bargain with each other and the mainstream and vice-versa has always been important. Within all these bargaining games, pro-poor innovation-making has been treated right through as a residual activity by the State and even today it is no different and practices of pro-poor innovation-making are yet to gain the required success and ascent. The present work has tried to offer insight on why and how it is so.

Starting from the assumption that there should be an improvement in the technological resilience of local economies to prevent their continuing destruction through the expansion of the ‘modern’ capitalist sector, this chapter examined the Indian experience in pro-poor innovation-making. It first demonstrated that the practice of innovation-making has been influenced by the choice of pathways of development, strategy of technological modernization and the heuristics of innovation-making adopted by the Gandhian, Nehruvian and left leadership. Then, it examined the activities of economic actors such as S&T institutions, development agencies and public sector corporations in the making of pro-poor innovations with a view to derive insight on the interaction of policy, practice and theory of innovation-making.

Our analysis demonstrated that pro-poor innovation generation and diffusion in India has not been successful, because the mainstream pathway of development and the socio-technical models of technological transformation adopted by the social carriers of innovation in the case of pro-poor innovation-making have continued to be mostly guided by a non-systemic conception of competitiveness. Technology platforms and ecologies and pro-poor innovation systems were not constructed with the pragmatic aim of achievement of ecological and social justice and economic empowerment of the poor – but as a residual socio-technical system without ensuring their systemic competitiveness. Thus, the past experience of technology implementation provides valuable insight on how not to address the challenge of creation of models of governance of pro-poor innovation-making. It also confirms that the policymakers are perhaps expecting too much to be accomplished in respect of poverty alleviation through innovation, especially given the fact that poverty is embedded in structures of exploitation.

In India, the politics of knowledge production has been driven by the strategic objectives set up by the State grounded in the assumption that only large scale technical systems can foster economic development and other socio-technical frames can play only a transitional role. The impact of this understanding is clearly reflected in the pattern of investments undertaken in research and development in atomic energy, space, defence, industry, agriculture, health, etc, and the maintenance
of broad based capabilities in basic research and generic technologies. As far as the politics of technology generation and implementation for the benefit of Indian economy is concerned, the innovation policy agenda has been driven far more by the response necessitated from the State to overcome immediate crises of the day rather than by the political, economic and ecological challenges facing the Indian society as a whole. In India, paradoxically, at regular intervals of almost every ten years, the politics of technology implementation has been revisited by the political bureaucratic apparatus due to the crisis facing the governments at the centre, with the yardstick being the current expectations of the poor. In particular, the agenda of pro-poor innovations has been explicitly revisited and used by the political and bureaucratic apparatus to reframe the innovation policy. However, indigenous efforts in science and technology have been better translated into opportunities for the incumbent large corporations, which continue to depend otherwise on foreign technology than to the strengthening of pro-poor innovation systems.

Public-private partnerships and the corporate sector are being roped in increasingly as partners of the State in bringing about economic development. However, given its own record of pro-poor innovation generation and delivery, policymakers need to be wary of the possibility of adverse inclusion of the poor by the corporate sector. It is self-evident that policymakers should not expect the corporate sector either to perform miracles through pro-poor innovations. Even in the past the state sector agencies did end up treating the poor adversely by encroaching on the local economies by making the petty producers either the consumers of their goods and services or the sources of cheap labour and raw material providers. Policymakers are seemingly putting too much confidence into the ability of the corporate sector. In the so far practiced demand led models of innovation, corporate governance means homogenisation of the systems of production and consumption rather than tackling the issues of diversity in demand, flexibility in production, resource regeneration, skill enhancement and organisational and technological capability building Economic inducements alone do not determine the bias of technological change. Public values matter to the social design of innovation.

A vision and strategy of pro-poor innovation-making is required to aim at the development of a new production paradigm and a radically new mode of innovation creation. This vision must be founded on the critical lesson from the Indian historical experience – which shows the poor must be allowed to become the effective social carriers of innovation. This in turn can happen only if the rural poor are aided to organise themselves into co-operatives and collectives and given opportunities to improve their bargaining power so that they can establish a degree of control over the pace and direction of technological and structural change. Of course this means that the model of ‘pure market governance’ is unlikely to do any better than the ‘technology push’ approach in facilitating rural development. Finally, policymakers have to remember history – and remember it well. Innovation-making in the social sectors such as food, fuel and fodder, electricity and transport, water and sanitation, health and education involves the development of physical infrastructure with lumpy supporting investments having a common pool character. In the past, system failures occurred in such sectors to the detriment of access to the poor, due to the initial selection of ill-suited technological paradigms and their continuation even after becoming clear that the selected systems of technologies are not sustainable. Such mistakes of the past should be avoided.
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Alternative Technology Proceedings of the Seminar held in September 1975 under the joint auspices of the IIAS, Simla and CSIR, New Delhi Edited by K D Sharma M A Qureshi Indian Institute of Advanced Studies, Shimla