The contributions of People’s Science Movements (PSMs) in India for the creation of ‘alternative’ technologies and forms of organization are best known through the work of Kerala Sasthra Sahithya Parishad (KSSP), a state-wide active PSM group (to be introduced later), but are much broader. Academic writings focus on the state-wide introduction of decentralized people’s planning, diffusion of fuel-efficient smokeless cook stoves and hot cases for food storage, mass installation of biogas, promotion of micro-hydro systems and electronic chokes, and the establishment of Kudumbashree (women’s self-help groups) and labour collectives in the southern Indian state of Kerala (Chathukulam and John, 2002; Chattopadhyay and Franke, 2006; Franke and Chasin, 1997; Parayil, 1992; Prasad, 2001; Zachariah and Sooryamoorthy, 1994).

Significant additional contributions exist on the part of PSMs that do not have a state-wide reach in many other states. PSMs are active in the districts of Mandi in Himachal Pradesh; Dehradun in Uttarakhand; Patalkot, Sheopur and Kanker in Madhya Pradesh; Puducherry, Kanyakumari and Ramanathapuram in Tamil Nadu; Guntur in Andhra Pradesh; Koraput in Odisha; Agartala in Tripura; 24 Parganas in West Bengal; and Mumbai, Thane and Pune in Maharashtra (Abrol, 2014b; Giri, 2005; Pattnaik and Sahoo, 2006). Grassroots innovation activities under the PSMs are thus diverse. The variety of challenges that PSMs have tried addressing and their contributions to the landscape of pro-poor grassroots innovation in India in the sphere of livelihood development are listed in Table 5.1.

Without trying to cover the PSM activities exhaustively, the chapter studies the contribution of PSMs, with the aim of understanding the dynamics of development of alternative technologies and forms of organization that have contributed to innovation emerging in collaboration with the rural poor, who presently constitute the majority of the grassroots in India. We show how the PSMs’ framings and strategies define the ideological and material spaces in various parts of the country.
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and contribute to ecological, social and technological justice for the Indian poor. We discuss the challenge of pathway construction with the aim of reflecting on the potential of PSM experiments in achieving self-reliance within the sphere of local economies in order to advance the wider process of structural change in India.

**Origins and background**

Constituted as the mainstream approach of the Congress party, the ‘Nehruvian’ path of development of the economy – focusing on heavy industries in general and machine tools in particular and food self-sufficiency – was in crisis by the beginning of the 1980s. With parliamentary democracy in place for the purpose of political governance of development, the state priorities were beginning to shift to the introduction of new and emerging technologies available in the form of personal computers and automation, biotechnology and non-conventional energy resources, and to the development of appropriate and alternative technologies in the case of rural industries to promote the pathway of ‘production by the masses’ to accelerate the pace of employment generation and poverty reduction.

The government was trying to mobilize the publicly funded science and technology (S&T) sector to link itself, on the one hand, with the local industry in sectors such as pharmaceuticals, automobiles and information and communications technologies and, on the other hand, with non-governmental organizations (NGOs) for the development of S&T for economically and socially weaker sections. The policy of external liberalization of trade and investment was still on hold. Grassroots innovation movements were beginning to find takers within the S&T departments. Decentralized governance of the development process was gathering strength. The polity was getting ready to adopt the idea of implementation of political democracy at the village and district level. India adopted the 73rd and 74th amendments to the Indian constitution in 1992.

During the Sixth Five Year Plan period under the Scheme of Science and Technology for Weaker Sections (established in 1983–84), the Department of Science and Technology (DST) provided a window of opportunity to PSMs for the development of alternative technologies and forms of organization. The technology policy statement of 1983 identified the need to push S&T institutions to take up the challenge of technology development for ‘production by the masses’. At that time, due to the prevailing rigid framework of division of labour within the government, the Council of Scientific and Industrial Research (CSIR) was mainly interested in contributing to the technological upgrading of rural non-farm occupations. Agriculture also offered far less scope for the diffusion of non-conventional technologies. The DST’s funding mechanisms were less tied. At the level of ideological and material conditions, favourable space for the exploration of alternatives to the PSM was available in the sphere of rural non-farm occupations.

When the PSMs began their experiments in grassroots innovation, a constant refrain was that it was inappropriate to sell to the poor those marginalized solutions that the rich and powerful themselves would not be willing to adopt. In India, the
focus of practitioners of the appropriate technology (AT) movement was still limited to the implementation of intermediate technologies that were being created either through the downsizing of modern technologies (as in the case of CSIR) or through the upsizing of traditional technology (as in the case of the Khadhi and the Village Industries Commission in India) (Abrol, 2004). Experience of ‘walking on two legs’, using alternative technologies along with heavy industries (based on the implementation of backyard furnaces, fertilizer units and many other such artefacts in China), also existed as the other reference point.

Amid all these concerns, with the pioneering help from Upendra Trivedi, P. N. Chowdhury, Dinesh Abrol, D. Raghunandan, Joginder Walia, M. P. Parmeshwaran, T. Sundraraman, Ajay Khare, S. R. Azad, Satish, Dinesh Pratap, T. P. Raghunath, Gautam Roy and many more, the PSMs were beginning to get involved through the efforts of some of the key members of the All India Peoples Science Network (AIPSN).2 Kerala Sasthra Sahithya Parishad in Kerala and Delhi Science Forum in Delhi, Society for Technology and Development in Himachal Pradesh, Centre for Ecology and Rural Development in Puducherry, Madhya Pradesh Vigyan Sabha, Eklavya in Madhya Pradesh, Society for Promoting Participatory Ecosystem Management (SOPPECOM) in Maharashtra, Jan Vigyan Vedika in Andhra Pradesh, Lok Vigyan Sangthana in Maharashtra, Paschim Bengal Vigyan Manch and Forum of Scientists, Engineers and Technologists in West Bengal and Centre for Social Research in Tripura were beginning their individual journeys of linking their own researchers to the S&T institutions, with a focus on the problems of technological upgrading of the peasant-artisan economies as a system in itself. In order to illustrate and discuss the wider lessons from this work, we first introduce two pioneering examples of PSMs: the Delhi Science Forum (DSF) and the KSSP.

**Delhi Science Forum**

The Delhi Science Forum (DSF) began to formally interact with the Science and Society Division (SSD) of the DST in the development of alternative technologies and forms of organization from 1985 onwards, through specific R&D projects. To date, most of the PSMs retain their distinct place in the programmes of the SSD. Similarly, the schemes started by the S&T leadership for the benefit of the application of science and technology for rural areas during the Sixth Five Year Plan continue to be in place to date within the DST. Even today the PSM interventions continue to be coordinated in the DST, in many cases for India-wide programmes by the Centre for Technology and Development (CTD), an organization set up by the DSF.

The efforts of the DSF were supported by P. N. Haksar (Vice Chairman, Planning Commission), Dr Y. Nayudamma (Director General of the Council of Scientific and Industrial Research [DGCSIR]), A. Rahman (Chief, Planning, CSIR) and Prof. P. N. Chowdhury (Head, Centre for Management and Development, CSIR). The CSIR system was keen to use the space being opened up for the creation of alternative technologies and forms of organization in India. Dr Upendra
Trivedi of DST and Prof. Chowdhury of CSIR helped to forge the collaborative arrangements organized between Central Leather Research Institute scientists and PSM activists. Dr Trivedi, the founder of SSD of the DST was a founder member of the DSF. The first set of DSF projects was stirred by a publication entitled *Gaon Ke Karigar aur [Village Artisans and] Science*, containing the proceedings of a workshop jointly sponsored by the DST and the CSIR. (CSSTD [CMD] and CSIR, 1981). It was organized by the Centre for Studies in Science, Technology and Development (CSSTD) in 1980. In 1981 the CSIR renamed the CSSTD as the National Institute of Science, Technology and Development Studies, where the author worked until his superannuation.

The very first PSM project that the DSF took up, related to the development of vegetable tanning, involved the upgrading of the East India bag tanning method. It focused on the development of carcass utilization for obtaining value-added products from the meat and bones of the carcasses of fallen animals. This project involved implementing the ideas put forward for the development of heuristics (in the form of process flow charts and system designs) at the CSSTD workshop on *Gaon Ke Karigar and Science*, in collaboration with the regional S&T field groups established in Mandi, Dehradun and Rohtak with the help of local PSMs. In this way the DSF started to build its real-world experiment for the creation of an alternative technology system for leather tanning. Development of the S&T field groups, technology-generating groups and a system design group in the form of the CTD was undertaken with the help of the DST. Evidence suggests that these heuristics have had a far-reaching influence on the practice of S&T-focused voluntary organizations across the country. Efforts based on the DSF approach have spread to fruit and vegetable processing, pottery, blacksmithery, economic and medicinal plants, rural energy, non-edible oilseeds, agro-processing, agroecology-based activities in farming and so on.

**Kerala Sasthra Sahithya Parishad**

The KSSP is a leading PSM that has been characterized as the harbinger of ‘ecological Marxism’ by Gadgil and Guha (1994), due to its role in the protection of the Silent Valley forest reserve, threatened by damming in the 1970s. Founded in 1962, KSSP was already a major PSM organization, having a mass base of thousands of activists in Kerala during the early and mid-1980s. At that time it was conducting experiments in alternative forms of rural energy, particularly on smokeless cook stoves (*chullahs*) (see below). The KSSP’s activities around rural S&T linked to other work on the development of Village Science Forums in various parts of Kerala.

In the early days of this rural work, the limitations on spreading ‘scientific temper’ (an approach to life based on scientific thinking, first coined by Nehru) and outlook were being realized in the KSSP. In the battle for liberation of the masses from impoverishment, scientific understanding was not enough. Technical ability was needed. The idea that science should be taken to the people through increased
application of science and technology within the economic activities of society began gaining momentum among the PSMs in the 1980s.

With this objective the KSSP started its S&T activities for the transformation of rural areas, setting up ‘rural science forums’ all over the state of Kerala. Attempts in the 1970s to initiate alternative development approaches at the micro level, interventions for self-reliant villages and so forth, had all struggled with a severe dearth of personnel, limited technical capabilities and the formidable nature of the real problems in the field. The KSSP was slowly coming to terms with the reality in the field: the enormous gap between science and society. The necessity for efforts in integration, alternative forms of data and even new methodologies was becoming evident.

As a science movement the KSSP realized the importance of in-house research and development quite early. Like the DSF, which had established the CTD in 1986, the KSSP had also started thinking about establishing an R&D facility of its own (IRTC, 1993, p. 2). The genesis of the KSSP’s R&D efforts can be traced back to its research programme for developing the wood-burning cook stoves. The cook stoves developed by KSSP, widely known as the Parishad chullah, have the highest recorded level of acceptance and functionality among the various chullah models propagated in the country, and the lowest drop in fuel efficiency from the laboratory to the field.

The resounding success of the Parishad chullah is attributed to the unique methodology of participatory technology diffusion adopted by the KSSP, involving extensive field testing of the prototype and design modifications based on feedback from the field. The encouraging results of the chullah development programme inspired the KSSP to undertake a further research programme to develop ashmoh cement, an alternative to ordinary cement. The KSSP also took up the challenge of diffusing biogas generation from kitchen waste, but both these initiatives were a failure in the initial phase. The setback in the programmes of cement and biogas was a key trigger for the KSSP to set up its own central research facility, the Integrated Rural Technology Centre (IRTC). The IRTC, an important in-house R&D organization for the development of alternative technologies and forms of organization, began its work formally in 1987 (IRTC, 2001, p. 1). It was started with core support from the SSD of the DST, Government of India.

**PSM activities multiply with and without government help**

By the mid-1990s the DST was supporting a great number of PSM groups active in the area of alternative technologies, including the CTD and IRTC described above. An overlapping set of PSMs was being supported by the Ministry of Rural Development. Beyond the DST and Ministry of Rural Development support, Bharat Gyan Vigyan Samiti was collaborating with the Ministry of Human Resource Development during this period in the areas of functional literacy, continuing education and science education, and this effort enabled the PSMs to develop into wider social movements working for people’s science and technology during a very
short period of one decade. Other educational networks such as Nav Nirmati, the Society for Promoting Participatory Ecosystem Management (SOPPECOM), Jodo Gyan and the Free Software Foundation, all started in the 1990s and are still active.

The collaboration between the policymakers and the PSMs described above continued actively until the late 1990s, after which the National Democratic Alliance government (led by the Bharatiya Janata Party) took over and the collaboration of PSMs with the Ministry of Human Resource Development declined. This support was revived to some extent after the formation of the United Progressive Alliance government at the centre, following the 2004 general election. In the context of a rightward shift in the polity and the adoption of the strategy of neoliberal global integration of the economy by the mainstream actors today, the PSMs are again in the midst of confronting the challenge of framing their strategies for the diffusion of alternative technologies and forms of organization. Today the AIPS N plans to deepen its collaboration in this sphere, with the help of the wider democratic movement (Thrissur Declaration, 2014).

**Framings of grassroots innovation according to the PSMs**

When the PSMs began their efforts in the mid-1980s for the creation of alternative technologies and forms of organization, two terms were actively under discussion in the discourse on science, technology and society, namely, ‘appropriate technology’ and ‘alternative technology’. The earlier framings of Fritz Schumacher (1973) and Masanobu Fukuoka (1978) come to mind, although Gandhi was clearly a pioneer and ideological inspiration in India. For the followers of these inspiring figures, technologies involving the modern factory production operations evolving in the extant markets were totally inappropriate for the development of underdeveloped countries such as India, on account of their higher intensity of capital and use of non-local resources.

Alternative responses included, for example, the efforts of Professor A. K. N. Reddy, the founder of the Centre for Application of Science and Technology for Rural Areas at the Indian Institute of Science, Bangalore. Attention has been drawn by the author elsewhere to the strengths and weaknesses of the initiatives being undertaken in the Khadi and Village Industries Commission, CSIR, Ministry of Rural Development and Appropriate Technology and Development Cell of the Ministry of Industrial Development (Abrol, 2004). Evolving as a social movement from the 1970s onwards, the appropriate technology framing focused on the creation of grassroots innovations in the context of farm and rural non-farm livelihoods. Appropriate technologies (also famously called ‘intermediate technologies’ by Schumacher, 1973) meant specially designed, context-specific (locational or user) technologies, as opposed to conventional technologies aimed at the usual forms of industrial development.

The term ‘alternative technology’ also came into use in the environmental context of reducing resource use and waste, with a major thrust towards renewable energy and energy conservation, and promoting social forms in harmony with
People’s Science Movements

nature – more specifically moving towards ‘environment-friendly development’ and ‘ecological agriculture’. Although there was a growing realization that (apart from the expected economic gains) positive values of environment-friendliness and poverty reduction would have to be realized through the development of alternative technologies and forms of organization, the debate focused on how, through the mere adoption of these technological options, their social carriers would be able to achieve desirable and alternative social relations within society. It was clear that the appropriate and alternative technology movements urgently needed to reconsider their framings.

The distinctive origins of the PSM framings need to be traced to the experiments initiated by the DSF and the KSSP during the 1980s, with their focus on the co-evolution of ‘alternative technologies and organizational forms’.

**Delhi Science Forum**

The DSF began its efforts with a focus on how to get small producers to strengthen their interlinkages (which were already present in rudimentary form within the bounds of traditional manufacturing). To this day, the DSF continues to concentrate on the challenge of upgrading traditional techniques, and targets all those sectors where the small, informal producers and labour are able to obtain access to improved technologies relatively easily. The framing underlying its approach remains that, under competitive conditions, the self-employed small producers not only have to come together for access to resources, but also have to emerge as a multi-sectoral collective of producers, cooperating in production, because economies of scale are required in order to overcome adverse competition. The DSF solution is that the rural poor should raise the scale and scope of their collective production by cooperating across interrelated sectors of traditional manufacturing. Change in scale and scope is considered a key requirement to allow the participating members of the PSM to lower the barriers that the small producer faces.

The framings of the DSF remain in its efforts and experiments focused on how to avoid mutual competition among small producers. As cooperation on a large scale occurs only infrequently on its own (and even when it does, it seldom sustains on its own), the DSF experiments posit that, in order to upgrade, the poor must first develop local markets that are accessible to them and where they are themselves both producers and consumers. Only then should they diversify to non-local markets. The planned scope of DSF experiments has rested on the premise that the rudiments of local economy exist as a taluk-wide (sub-district), multi-sectoral network system of production, and that these rudimentary systems can be strengthened through upgrading the collective production of small producers and workers. Improvement in productivity, increase in incomes and reduction of drudgery require a radical, qualitative shift from household modes of production to science-based industrial forms of productive organization – that is, involving collective production with the organized division of productive activities. Collective industrial forms require managerial and supervisory skills for which local, educated youth (from artisanal or
linked agricultural labourer and peasant families) are a potentially sound and available human resource. Artisans and rural labour have been the pivots of small-scale production. They have the potential to develop as the human resource/skills base for science-based industrial forms of organization.

Since, according to this approach, the initial leadership capability requirements are high, the envisaged shift is a big leap for artisans, peasants and agricultural labour. Under the framings of the DSF, S&T-focused voluntary agencies have to take the initiative to build the local teams of leaders that are to be selected from among the small producers and workers. According to the heuristics described above, the DSF’s experiments have consciously focused on the establishment of the following organizational structures at local levels: (a) S&T field groups; (b) S&T system design group; and (c) technology generators. The formation of the S&T field group is seen as a critical organizational requirement because it performs the crucial role of interaction with artisans, landless labour and small farmers at the grassroots. The S&T field group participates in production to ensure continuity in these interactions and to foster the development of innovation capabilities. The S&T field group interacts with technology-generating institutions to support the upgrading of the skills of producers in new, improved technologies. It also helps to upgrade their organizational and management capabilities and requires the involvement of activists with formal S&T training, work experience in production, and master craftsmen, artisans, technicians, skilled workers and others who are able to convene and mobilize.

In all its experiments the DSF consciously targets the existing traditional occupations to become the social carriers in the experiments for grassroots innovation.

**Kerala Sasthra Sahithya Parishad**

As outlined by K. P. Kannan, one of the founders of KSSP, the framings of the organization explicitly give attention to the environment and indigenous knowledge, within the PSM approach to technology development. In *Towards a People’s Science Movement*, K. P. Kannan wrote:

> Technology should incorporate in its use the use of indigenous resources including the abundant supply of human labour power and the knowledge that have been accumulated over a period of time. If the human race as a whole is seriously interested in its survival, it can no longer neglect the issues which affect environment, of the land, of the water and of the air. Danger to the environment as a result of indiscriminate use of technology could arise in a society where decisions are signalled through the horse-eyed working of the market mechanism or where decisions are taken by a few in the name of majority. Therefore, the concept of Appropriate Technology cannot but take into account the need for protecting the environment.

*(Kannan, 1979, pp. 132–133)*
The KSSP framings emphasized that an understanding of the ‘alternative’ demands a clearer understanding of ‘alternative to what’ in the case of development. In the report of the workshop organized at Palakkad during 1–4 March 1996 entitled, ‘Integrating Alternative Development Efforts in Asia (IADEA)’, the KSSP/IRTC team articulated its view on the alternative. It stated,

it is self-evident that with the demise of centrally planned socialist approaches to development, the dominant form is that of aggressively pursued capitalism at global levels . . . [It] is an intricately integrated enterprise of modes of production, production relations, goods and services, legal, educational and cultural structures, values and lifestyles situated within an appropriate philosophical thought, and has evolved over a period of three centuries. Ideally, seeking an alternative would imply an alternative to this integrated dominant [model of development].

(Raina, 1997, p. 15)

Experiments prioritized by the KSSP continue to consciously pursue the challenge of establishing alternatives to a market-based approach to development. Experiments for the advancement of decentralized people’s planning, solid waste management through decentralized urban governance, initiatives for self-sufficiency in vegetable production, total literacy, reorientation of science education, palliative healthcare for the elderly on their doorstep, and so on, reflect the influence of the framings developed, with the aim to explore the values of integrated models of human development. The concept of appropriate technology was linked by the KSSP to premises such as a search for a new life, a search for a new philosophy and a value system.

Under these framings, alternative technology development is radically different from the existing forms of technological development based on the assumption of an infinite reservoir of natural resources, of unlimited capacity of environments to absorb effluents and of the capacity of societies to adjust to any technological changes. Instead, the IRTC calls for the following: (i) industries based on rural raw materials specially agro-waste and untapped forest resources; (ii) technologies which are energy saving; (iii) preference for labour intensive and capital saving technologies; (iv) reorientation of west oriented technological approach in India to Research and Development (R&D) set up; and (v) a system of management of appropriate technologies which will ensure redistribution of wealth in favour of poorer sections of society.

(Kannan, 1979, pp. 132–133)

**Grassroots innovation and common elements of PSM framings**

What distinguishes the PSM initiatives from the efforts of all the other grassroots innovation networks is its distinctive framing that, as the market economy
is adversely integrating the small producer, the small producer is at a disadvantage, particularly when trying to compete individually against large enterprises. Alternative technologies and forms of organization need to aim for the organization of unorganized small producers, without which they will not succeed. Small producers need to be made powerful. The ideas of cooperation and local area planning played a critical role in the development of the PSM heuristics, with their focus on upgrading the capabilities of the poor. While the PSMs started their interventions in the sphere of production by focusing on the organization of the rural poor, which includes poor peasants, landless labour and artisans, their experiments have subsequently included workers in urban areas.3

The PSMs realized that grassroots innovation for structural transformation needed the organization of a new type of social carrier to provide entrepreneurial leadership that helps the poor to directly develop their own access to markets, capabilities and resources. The PSMs recognized the critical role of S&T voluntary organizations and have treated them as a crucial element of enterprise and group development. This organizational feature is a common element in the experiments of the S&T-based voluntary organizations supported by the DST. In the DST SSD schemes, the S&T voluntary agencies collaborate as intermediaries with the formal sector S&T institutions to incubate entrepreneurial leadership among the poor.

Spaces and strategies

The PSMs have followed the strategy of seeking returns from the technologies developed by multiplying the number of social carriers of grassroots innovation as rapidly as possible and fostering organized leadership to compete in the market place. Their revenue model involves the use of project grants and the earnings that the PSMs have been able to realize via the sale of products and by charging customers for the provision of knowledge-intensive business services. The CTD, IRTC, STD, CERD, MPVS, Jodogyan, SOPPECOM and many other PSM entities have sustained their set-ups by means of this strategy.

Alternatives to a stronger system of IPRs as an innovation incentive

The PSM strategies have assumed that the S&T community and the grassroots innovators do not seek exclusive intellectual property rights as an incentive, and have occupied this space throughout their history. Open dissemination of the contributions created by the S&T voluntary organizations (in collaboration with the formal sector S&T institutions) is regarded as an important and developing policy space for the benefit of grassroots innovation in India. Recently Dr Samir Bramachari, Director General, CSIR, offered the rural technologies of the CSIR to interested parties as an open resource (Abrol, 2014a).

The PSMs are in favour of keeping the mechanisms of intellectual property out of the field of grassroots innovation. The interventions of the PSMs began
by organizing artisans for the upgrading of rural non-farm systems and related occupations. Grassroots innovations do not need intellectual property rights as an incentive. Technology-implementing organizations can sustain themselves in the case of grassroots innovations by developing the competence for know-how generation and providing services required for technology implementation.

**Formation of S&T voluntary groups under the SSD schemes**

Today the core support programme of DST’s SSD involves more than 200 S&T voluntary groups. About twenty-five of these organizations receive DST support as core groups. An assessment of the initiatives underway on behalf of the DST core groups suggests the emergence of an enormous diversity of perspective. This is illustrated by the varied responses of diverse groups to the wide assortment of problems thrown up by local populations. Evidence exists of a wider impact of the PSMs’ approach to innovation on the activities of organizations such as Vigyan Ashram in Pune, the Society for Rural Industrialisation in Ranchi and Technology Informatics Design Endeavour in Bangalore, none of which is formally a member of the AIPSN. An even wider impact is visible through the diverse contributions of the voluntary organizations supported by the SSD Core Group Support Scheme of DST. Not all of these S&T-based voluntary organizations (which, as discussed above, focus on upgrading capabilities) are capable of supporting the diffusion of innovation. The SSD trusts the capabilities and outreach of PSMs and continues to use these organizations as reliable partners in the implementation of its developmental programmes, especially in a large number of states where the state governments lack the appropriate capabilities. Most of the SSD programmes are still implemented by the S&T voluntary organizations, an institutional mechanism that is known to have yielded rich dividends in terms of location-specific solutions to problems, generic technologies and, above all, a methodology for technology innovation and dissemination.

**S&T voluntary organizations take up challenges not addressed by the mainstream**

The PSMs have engaged with S&T policymakers around R&D for sustainable livelihoods in rural areas by undertaking ‘S&T not done in the mainstream’, to be understood as ‘undone S&T’ (Hess, 2005). Within the space of ‘undone S&T’ that is undertaken by the PSMs, their in-house R&D establishments have worked in collaboration with the S&T institutions of the public sector R&D system in India. Grassroots activities of technology implementation, development of models for the creation of alternative technologies and establishment of group enterprises of artisans, workers and peasants are all alive because the PSMs as a social movement are interested in continuing them. Significant lessons exist specifically in respect of the implementation of the strategy of developing social carriers of grassroots innovations.
Given below are brief descriptions of the policy spaces in which various PSMs have engaged in producing technological alternatives and forms of organization, focusing on the cases of Delhi Science Forum/CTD and KSSP/IRTC.

**Centre for Technology and Development of Delhi Science Forum**

The Centre for Technology and Development has often played the role of a nodal organization for the DST in its several All India Coordinated Programmes, namely leather tanning, carcass recovery, fruit and vegetable processing and non-edible oilseed processing. The CTD has been recognized for the development of expertise in a wide range of squashes, spices, pickles, preserved fruit products, murraba and massage oil. It has been marketing this range of products under the Farmers brand. The DST recommends this brand to user groups when they receive support and technical assistance from the DST via the CTD.

The success of the CTD’s work in this area has been derived from the fact that it addresses several major problems faced in the horticulture sector. The technology package has been designed for the maximum involvement of women in all its operations. A processing unit catering for a cluster of about 15–20 villages networks women from small growers and landless households. The unit, conforming to the national Fruit Products Order quality assurance standards and methods, uses suitably scaled and adapted equipment and innovative technologies to make a wide range of processed products from produce available at different seasons. Wherever appropriate, pre-processing is also undertaken at home, village or satellite-unit and nodal taluk levels to add value locally. Packaging and marketing are undertaken centrally, adopting a suitable brand name with appropriate labelling. Products are mostly marketed in local and nearby villages, towns and cities, thus minimizing transportation and other marketing overheads, while tapping into the demand for processed products. Local PSM organizations perform the necessary technical and managerial functions, including motivation and networking of growers, training of women in processing and preservation and so on.

The technology package described above was first demonstrated through an All India Coordinated Programme at the DST under the leadership of CTD during the period 1994–97. This involved setting up such units in eleven locations in different states covering a wide range of raw produce. In subsequent phases of the programme, more units were set up in the north-east, and in western and southern India. Most of these units are running successfully and are self-sustaining. The package has also been taken up for dissemination by other diverse developmental agencies, including the Council for Advancement of People’s Action and Rural Technology, District Rural and Development Agency under different state governments and Asia and Pacific Centre for Transfer of Technology. In all, forty-three such units have been set up covering practically all the states of India.
Integrated Rural Technology Centre (IRTC) of KSSP

Thanks to the wider social movement in Kerala, which is strong and supportive of the PSM efforts and their hands-on contribution to grassroots innovation activities in the field, the KSSP has succeeded better with regard to the diffusion of alternative technologies and forms of organization. Its contribution in the difficult areas of renewable energy, solid waste management, horticulture and agriculture, and construction confirms this point very well. In search of alternative technologies that would bridge the gap with solutions that are affordable and sustainable, the KSSP activists have been successful in diffusing the alternatives of biomass-based cooking stoves, micro-hydro, solar lighting and many other energy-saving devices.

The IRTC pioneered the programme of panchayath (village-level) resource mapping with people’s participation, undertaken in collaboration with the Centre for Earth Science Studies. The Kalliasseri Development Programme and Kalliasseri Total Energy Planning came as logical follow-ons, leading to the Participatory Panchayath Level Development Planning project sponsored by the Kerala Research Programme of CDS Trivandrum. This effort was followed up in the preparation of master plans for watershed-based development for various panchayaths in Kerala. All these efforts became the basis of the people’s planning programme of the state government formed under the left-wing administration in Kerala, where the state government implemented the devolution of 40 per cent of the state budget for the management of development processes at the level of the district, block and village panchayaths.

In the states of Kerala and Tripura, where left-wing and democratic groups have given much attention to the promotion of alternative technologies and forms of organization, momentum is growing in the area of agriculture. Larger successes are due to the introduction and acceptance of technologies that are explicitly beneficial to women, such as paddy transplanters, winnowers, weeders, threshers and seeders, and which have reduced labour drudgery. In the area of agriculture, new forms of organization developed in collaboration with the local PSMs include women’s collectives, labour cooperatives and associations of water users that ensure rights to dalits (previously known within the caste system as ‘untouchables’) and other marginal communities. Alternatives in agriculture, led by peasant organizations and PSMs, have matured only over the last decade.

Technology implementation model developed by the PSMs

Today the PSM continues to occupy the space of social movements undertaking S&T not done by the mainstream. The PSM strategy has consciously used the building of in-house capacity for research, development and design, while creating local S&T field groups and system design groups. These carry out intermediation for technology implementation at the level of the grassroots and diffuse alternative technologies and forms of organization, with the sole aim of upgrading the access of socially and economically weaker sections of society to new S&T capabilities, markets and resources. The PSM heuristic continues to focus on development of
S&T voluntary organizations, helping the social carriers of multi-sectoral interventions to emerge and contribute to the establishment of group enterprises in different parts of the country. PSM-linked R&D institutions have worked in collaboration with mainstream S&T institutions towards this end.

The PSM initiatives now extend to the implementation of agroecological approaches for rural development in India. For example, the PSMs are implementing the All India Coordinated Programme of the DST on Biological Integration of Farming Activities and Resource Management (BIOFARM), a distinct approach in the sphere of implementation of agroecological approaches, with the aim to create a viable and appropriate model in India for agrarian transition to sustainable agriculture (DST, 2012). The University of Kolkata is starting a six-month course in agroecology with the help of the Society of Agro-ecology, India, in which the PSM leadership is actively involved.

The PSM technology-implementation model is supportive of the formation of more equitable social relations. For example, gender relations are better in the enterprises that are being set up for fruit and vegetable processing, due to forms of organization that promote equity and dignity. The model of worker-owned group entrepreneurship can be seen in operation in Mandi, Dehradun, Puducherry, Patalkot and elsewhere. In India, within the resource-constrained conditions of the agro-industrial environments where even today modern forms of management are quite scarce in large-scale operations, the PSM model of technology implementation represents a real advance in frugal engineering and inclusive innovation. Although most of the alternative technologies and associated forms of organization that the PSMs have been able to develop practically have until now been only at the district level, the PSM models are now slowly beginning to get wider attention from practitioners of social development (Thrissur Declaration, 2014).

**National and international agencies support the efforts of PSM**

The United Nations Development Programme is also now supporting the fruit-processing model that the PSM-linked S&T voluntary agencies have developed. The Central Leather Research Institute promotes the leather-technology package developed by the PSMs to those parties interested in commercializing the technology. The Council for Advancement of People’s Action and Rural Technology promotes the packages and supported technology resource centres based on PSM technologies for STD and CTD. Technologies for fruit and vegetable processing developed by the PSMs have been duly supported by the Small Industries Development Bank of India and other such financial institutions. Green natural products are on the way to gaining acceptance in the competitive, non-elite markets. In the fruit-processing sector, the PSMs have been able to launch green, healthy products very rapidly at competitive prices. In almost all these cases, both the technology system and the business system are transforming the relations of rural labour, peasants and artisans in production.
Pathways

The achievements and limitations of the PSM framings can be better understood from the scale and scope of the activities of core groups that are funded by the SSD of the DST. The development of organizational capabilities for successful technology implementation and the multiplication of S&T field groups is a key challenge facing not only the AIPSN but also the DST. Documentation of the technology models and descriptions of the work of core groups supported by the SSD describe well both the achievements and the limitations of the spaces occupied by the S&T voluntary organizations. The space created by the PSMs is now occupied by even those S&T voluntary agencies that do not wish to get into entrepreneurship and are limiting their efforts to the development of technological alternatives (DST, 2008).

Although the PSM-initiated S&T voluntary organizations differ from the SSD-supported core organizations in their ethos with regard to dissemination of technology, the challenge of attracting younger members exists for all the S&T voluntary organizations working in the sphere of development action. The problem of how to retain the S&T volunteers is an important challenge because of the PSMs’ insufficient access to financial resources. PSM organizations are clearly unable to offer remuneration at a reasonable level. As far as the PSMs are concerned, they are still trying to prove to the wider social movements that this experimental space is important and needs to be expanded through their intervention (Abrol, 2005). The PSMs are trying to consciously involve the wider social movements, the S&T community and interested policymakers in order to construct a broader pathway for inclusive innovation. In the PSM approach, the role of S&T-based voluntary organizations is critical to the nucleation and sustained functioning of the S&T field groups.

The PSM challenge is how to enrol more S&T personnel with appropriate thinking and commitment. Lessons from the experiments described above suggest that the S&T voluntary organizations need to have a mix of full-time and floating staff. Full-time staff normally include S&T activists with a background in system design, documentation, electronic data processing and information networking. Floating staff include visiting scientists and technologists, innovative technicians/artisans, legal experts, social scientists and science popularizers. Activists should provide leadership to the programme of knowledge production, organizational development and diffusion of innovations from one area to other. They should provide an interface between different field groups and technology generators and undertake the task of training and orienting other activists for networked forms of group entrepreneurship and participative management.

The PSM approach envisages the involvement of technology generators selected from the mainstream S&T institutions by PSM activists. The mainstream S&T institutions get involved in the activity at the point of field investigation and opportunity analysis. The technology generators get involved in the field work and help to guide the design of manuals, assistance in start-up and trouble-shooting,
prototype design, pilot-scale demonstration, adaptive research and so forth. The process of technology implementation needs to begin at the stage of choice of technology itself, that is, the identification of existing technologies that can be transferred, either directly or by adaptation, and the identification of requirements for new technologies based on needs. Close collaboration exists between the technology-generating groups and the S&T field group working at the grassroots.

PSM activists have collaborated to establish – in the form of IRTC, CTD, COSTFORD, STD and CERD – their own system design groups to steer and involve the group enterprises formed by the S&T field groups and the technology-generating groups in efforts to formulate technology generation and implementation plans. The S&T field group, system design group and the technology-generating group jointly perform the functions of need specification, field-testing and demonstration, production and replication. Promotion of the activities of value addition, by-product utilization and co-product development has been an integral part of PSM activities, and the S&T intermediaries have been required to focus on the use of local resources, capabilities and markets to develop the local economic system.

The interventions of the PSMs focus on the simultaneous development of technological know-how and group enterprise formation. Thus, PSMs have targeted not only the cultivation of research and development activities but also feasibility studies, system design and development of prototypes of systems, processes and products, demonstration of technology models, establishment of pro-poor, environment-friendly business models and so on. In some places they have deliberately pursued the organization of labour collectives and women’s self-help groups. As system design groups, the CTD, IRTC, COSTFORD, CERD, STD, MPVS, Nav Nirmati, Jodogyan and SOPPECOM are now known for the competences that they have developed for the establishment of technological alternatives and forms of organization.

The practitioners of AT assumed that appropriate technologies are readily transferrable on account of their associated positive values. Although this weakness of the AT movement is being intentionally overcome by the PSMs, their struggle to find appropriate partners has become far more difficult following the onset of neoliberal policy reforms. The challenges that are involved in the realization of the values of ecological and social justice are not easily overcome when the alternatives need to compete within the environment of a deregulated and open market economy. Debate within the PSMs continues as to what the strategy should be in respect of the creation of alternative technologies and what it means to be the alternative at the grassroots. The PSMs hold the view that there is no escape from the ups and downs, and that the closing and opening of spaces has its own dynamics.

Technologies capable of generating enhanced employment incomes and for shifting the small producers towards industrial forms and creating economically viable groups need directed efforts and the collaboration of PSMs with the wider movement. Alternative technologies are not and cannot be generated through a passive mode. Alternative forms of organization need the active collaboration of the grassroots with the PSMs and the publicly funded R&D organizations.
Further, as their transfer and implementation will require the establishment of production networks, efforts at network development on the ground have to integrate the production intra-sectorally and inter-sectorally into ever-widening economic organizations.

Solutions have to be identified, developed and implemented in a systemic way with the help of policymakers, local communities and wider social movements. The PSMs have been focused on the need to scale up the organizational apparatus for the implementation of technology models that are competitive, as well as embodying the values of ecological and social justice. The PSMs have tried dealing with the challenge of scaling up and of stretching the grassroots innovations for their wider diffusion by undertaking the challenge of development of a new type of S&T voluntary organization. While the PSMs understand that the construction of pathways in the local economic systems can be undertaken only with the help of wider social movements, the challenge of PSMs is how to continue to forge the necessary conditions for the development of a new set of social carriers of techniques.

Greater participation of wider social movements in the processes of local self-governance and planning is evident as a key factor in the state-wide reach of the KSSP. The ability to establish alternative forms of organization is a key factor in success at the area level. Dilemmas faced on how to scale up by simultaneously fitting and stretching the alternative technologies and forms of organization into the market economy pose the challenge of how to create democratic business organizations and networks of small producers and workers that are capable of competing with big business, which has deep pockets and the benefit of greater state support.

The PSMs have used their ability to undertake need assessment and develop viable technology implementation models. They have been trying to nurture a new set of alternative technologies that connect with the resources, capabilities and markets accessible to the poor, fulfill basic needs and sustainably support the livelihoods of the poor. The techniques involved have been capital saving and have helped to develop traditional occupations in an interlinked manner so as to allow them to collectively achieve economies of scale and scope.

The PSMs view their interventions for the development of alternative technologies and forms of organization as socio-technical experiments, which broader social and political movements need to use in order to convince the public that these alternatives, when widely diffused, would bring about structural transformation in rural areas and so should be given larger support (Abrol, 1998). Realization of the enormous diversity of perspectives and approaches used in practice, capabilities, areas of strength, technologies developed for rural areas and even methods of utilizing the DST’s support grants have been seen by some as the strength and by others as also the limitation of the methodologies under development by the respective PSM constituents.

Attempts by the DST to restructure the schemes of the SSD (as well as shifting contexts that have made it more difficult for S&T voluntary organizations to take the model forward) have also led the PSMs to debate and reflect on how well the
model of innovation has actually been implemented and replicated in practice. The DST report on *Technology for Rural Development* explicitly suggests that the PSM technology implementation model of grassroots innovation is an important model for funding rural innovation in India (DST, 2008). However, the new S&T policy leaders in the DST are now under pressure to allow the S&T institutions to directly submit proposals to the SSD, rather than the S&T voluntary organizations choosing the partners and technologies for implementation of the projects. This poses a new challenge for the PSM strategy of S&T voluntary organizations choosing the technologies, partners and sites for real-world experiments.

Most of the alternative technologies involve the establishment of ‘disruptive’ social relations among the poor. Strategies require the social carriers of grassroots innovation to practise user-capability development, continuous technology improvement and network development within the local economy. The positive role of both the capabilities of the PSM members and the nature of the support being provided by the wider social movements remains critical to the emergence of the PSMs’ desired pathways. This is well illustrated by the evidence gathered from the experience of several states. Experience of the wider adoption of alternative technologies developed for use in the states of Kerala (KSSP) and Himachal Pradesh (STD) confirms the role of these two factors very well. Contrary experience in some other states also lends support to the critical role of the capabilities of the PSM members and the nature of support being provided to their efforts by wider social movements.

In particular, when the practical challenges of enterprise-system building had to be addressed without the support of wider social movements, and instead with the help of entrepreneurial leaders who had only limited capabilities, important weaknesses of the S&T voluntary organizations became evident. Lessons exist from the experience of PSM work around leather processing in Haryana on how the roles of both PSM and wider social movements can guard against the challenges facing local S&T field groups.

Development of the knowledge base that the PSMs have been able to foster by collaborating with the mainstream S&T institutions is certainly indicative of the wider significance of the PSM technology-implementation model. Through the efforts of PSMs, this model has enabled the rural poor to pursue the upgrading of rural non-farm systems, involving diverse sectors and regions in collaboration with the DST. Technology adaptation involving the PSM approach of systemic development of local resources, capabilities and markets has now been successfully undertaken in a number of areas of traditional manufacturing.

But more recent changes to DST policy (for example, routing funds to the projects through the mainstream S&T institutions, requiring core groups to have a critical number of trained S&T personnel on the staff and directing funds for national-level programmes on the basis of non-local priorities) are also playing a critical role in the diffusion of technological alternatives.

However, it also needs to be acknowledged that how well developed the capabilities of S&T voluntary agencies remains a critical contributory factor in the
diffusion of technological alternatives. Experience of uneven results obtaining from
the states of Kerala, Tamil Nadu, Uttarakhand, Andhra Pradesh, Maharashtra,
Orissa, Karnataka, West Bengal, Madhya Pradesh, Himachal Pradesh and Haryana
confirms the importance of this factor.

The wider impacts of the efforts undertaken in technology implementation by
the S&T-based voluntary organizations in the evolving political economy context
are a moot point within the PSM. After the mid-1990s the collaboration of the
PSMs with the national and state administration and all the other national-level
agencies experienced a weakening of support. PSMs have had to rely far more on
their own self-generated resources. During the 2000s they recalibrated the scale
of their nation- and state-wide campaigns and had to choose their district sites far
more realistically. Although the PSM efforts continue to flourish, it is at a slower
pace. This is also due to reductions in the scale of national public investment in
the spheres of economy, education and health. In respect of people’s technology
experiments, the breadth and depth of the PSM activity is certainly in need of
wider support for increasing the pace of scaling up the efforts of PSMs.

While the importance of support from PSMs, voluntary organizations and wider
civil society is evident from the numerous examples described above, a clear lesson
is that the continued support of and positive engagement by the mainstream S&T
institutions is required for the construction of alternative pathways. To achieve
a wider structural transformation of the economy, experiments that can deliver
desired system change at local levels require the continued support of both social
movements and the state. While the wider left and democratic movement has been
broadly supportive from outside its partnership with the PSMs, its direct support
and efforts are still a key factor in the pace of the process of diffusing technological
alternatives and forms of organization.

Notes

1 The state of Orissa was renamed Odisha in 2011.
2 The All India Peoples Science Network came into existence in 1987 at Kannur in the
state of Kerala, after a year-long campaign undertaken for the campaign on ‘Science for
People’, as a network of over forty member organizations now working in more than
twenty states across India.
3 These groups also included the Society for Technology and Development (STD), Centre of
Science and Technology of Rural Development (COSTFORD), Centre for Ecology and
Rural Development (CERD), Forum of Scientists, Engineers and Technologists, Madhya
Pradesh Vigyan Sabha (MPVS), Paschim Bengal Vigyan Manch and Haryana Vigyan Manch.
4 This included the Centre for Technology and Development (CTD), Society for Technology
and Development (STD), Centre of Science and Technology of Rural Development
(COSTFORD), Integrated Rural Technology Centre (IRTC), Centre for Ecology and
Rural Development (CERD), Forum of Scientists, Engineers and Technologists, Lok
Vigyan Sangthan and MPVS.
5 In Kerala the PSMs have also focused on the organization of urban poor and industrial workers.