

Grassroots innovation's framings and their modes of engagement: implications for models of inclusive innovation

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Resumo /Resumen

Grassroots innovation (GI) involves movements and networks of academics, activists and practitioners who seek to experiment with alternative forms of knowledge creation that harnesses local ingenuity directed towards local development. Grassroots innovation can be aimed at fostering inclusion as a process (e.g. fostering participation in the design of technology), as an outcome (e.g. providing services for marginalized groups), or even endeavor to produce structural change (e.g. enabling broad and diverse participation in the shaping and priority-setting of policies and institutions oriented to promoting science, technology and innovation). Often associated with a general aim of 'exercising control over the innovation process' as well as participation in the design of technologies, policies and regulations (Letty et al 2012: 1), it is common to consider GI as distinct from conventional innovation. However, whilst a strict definition casts GI as innovation coming from the 'grassroots' (meaning that it is generally a result of a bottom-up process emanating from communities and users), in practice it can also include actions with and by governments, R&D institutions and aid agencies directed to marginalized groups. In this broader light, grassroots innovation groups can be regarded as initiators or advocates of alternative pathways of socio-technical development which sometimes engage with S&T groups and development agencies in pursuit of technical assistance, funding or other kinds of institutional support; but also including symbolic legitimacy, policy design,

supportive regulatory structures, etc. An important aspect to these encounters between grassroots innovations and formal institutions is the negotiation of meanings and the creation of models of innovation and inclusion. In this paper, we aim to study how GIMs' encounters with mainstream institutions can lead to the development of new models of innovation. We analyze how different framings and interpretations of innovation, social inclusion and participation are negotiated and contested, and what modes of engagement GIs use in order to forge alternative pathways of innovation. In order to do this, we focus on selected encounters experienced by specific grassroots innovation social movements: the Social Technologies Network in Brazil (STN), the People's Science Movements (PSM) and Honey Bee Network (HBN) in India. The approaches, experiences, and encounters with formal institutions are different in each case. We consider some of the events, issues and arenas where encounters with mainstream innovation have been particularly pronounced. Our analysis uses the varied experiences in these cases to explore how policy interest in 'models' relates to the plurality of ideas, approaches and contexts of grassroots movements, which are focused on building locally sensitive alternative pathways for grassroots innovation. Further, the cases highlight that inclusion is not an unproblematic, smooth endeavor; rather, in practice it can also involve uneven, unequal, incomplete, and sometimes antagonistic processes and outcomes. With our cases illustrating the potential of this form of analysis, we argue that the analysis of encounters between GI and formal institutions of R&D and development can offer important lessons for the design of models of innovation and development around the world.

1 INTRODUCTION

Grassroots innovation (GI) involves movements and networks of academics, activists and practitioners who seek to experiment with alternative forms of knowledge creation that harnesses local ingenuity directed towards local development. Grassroots innovation can be aimed at fostering inclusion as a process (e.g. fostering participation in the design of technology), as an outcome (e.g. providing services for marginalized groups), or even endeavor to produce structural change (e.g. enabling broad and diverse participation in the shaping and priority-setting of policies and institutions oriented to promoting science, technology and innovation). Often associated with a general aim of “exercising control over the innovation process” as well as participation in the design of technologies, policies and regulations (Letty et al 2012: 1), it is common to consider GI as distinct from conventional innovation.¹ However, whilst a strict definition casts GI as innovation coming from the “grassroots” (meaning that it is generally a result of a bottom-up process emanating from communities and users), in practice it can also include actions *with* and *by* governments, R&D institutions and aid agencies directed to marginalized groups (see Cozzens and Sutz 2012). In this broader light, grassroots innovation groups can be regarded as initiators or advocates of alternative pathways of socio-technical development which sometimes engage with S&T groups and development agencies in pursuit of technical assistance, funding or other kinds of institutional support; but also including symbolic legitimacy, policy design, supportive regulatory structures, etc. (Ely et al 2013). An important aspect to these encounters between grassroots innovations and formal institutions is the negotiation of meanings and the creation of models of innovation and inclusion.

Development agencies have historically shown interest in alternative models of technological change and social development originating in GIs. For instance, sections of the OECD and International Labour Organization, as well as the World Bank, UNDP, UNEP, FAO and other international institutions, conducted activities around appropriate technology in the 1970s and 1980s. With the impact of the current global economic crisis, new political attention to issues of inequality and social inclusion has drawn institutional attention once more to GIs and varied notions of inclusive innovation. For example, the OECD has started to develop concepts

¹ However, these ‘modes’ may also turn out to be hybrids sometimes. Conventional innovation is often associated with highly centralized, formally organized research institutions, while grassroots innovations are usually thought of as decentralized and locally sensitive. Yet conventional innovation has arguably shifted to include more decentralized modes as well (Chesbrough et al. 2006).

and models of intervention around “inclusive innovation”, “inclusive growth”, and “inclusive development” (see OECD 2012a; de Mello and Dutz 2012; and OECD 2012b respectively). This activity includes recognition of grassroots innovation, as well as ‘bottom of the pyramid’ (Prahalad 2005) and ‘frugal innovation’ (Bound and Thornton 2012) models. Over the past decade, the World Bank has shown increasing interest in inclusive growth (Utz and Dahlman 2007), more recently linked to the green growth agenda central to the Rio+20 conference in 2012 (World Bank 2012). Other examples of interest on the part of international development agencies include programmes by the Canadian International Development Research Centre (IDRC 2012) and the United Nations Development Programme (UNDP 2010; UNDP 2013), among others.

Interactions between GI and formal institutions of R&D, policy and development arise through mutual interests that contain an uneasy mix of cooperation and competition for ideas and models of innovation for development. Encounters with formal institutions are often important for the survival and expansion of grassroots innovation, for example by providing resources and/or scaling up experiences. But such encounters can also be controversial since mainstream systems of innovation usually rely on science and technology-centric frameworks which have struggled to engage with the less formal and apparently unstructured forms of community innovation, leading to a neglect of some of the empowerment, ingenuity and transformational potential. Thus, within the context of increasing interest in inclusive models of innovation in mainstream policy, it is important to realize that though inclusion is a fashionable word at the moment, it can be seen as a black box that involves a lot of different interpretations and ways of framing what gets included, and what remains excluded. Therefore, it is important to analyze how policies and programmes at national and international levels are engaging with ongoing, vibrant grassroots innovation movements (GIMs) around the world.

In this paper, we aim to study how GIMs’ encounters with mainstream institutions can lead to the development of new models of innovation. We analyze how different framings and interpretations of innovation, social inclusion and participation are negotiated and contested, and what modes of engagement GIs use in order to forge alternative pathways of innovation (Hess 2007; Smith 2007). In order to do this, we focus on selected encounters experienced by specific grassroots innovation social movements: the Social Technologies Network in Brazil (STN), the People’s Science Movements (PSM) and Honey Bee Network (HBN) in India. The approaches, experiences, and encounters with formal institutions are different in each case. We consider some of the events, issues and arenas where encounters with mainstream innovation have been particularly pronounced.

Our analysis uses the varied experiences in these cases to explore how policy interest in ‘models’ relates to the plurality of ideas, approaches and contexts of grassroots movements, which are focused on building locally sensitive alternative pathways for grassroots innovation. Further, the cases highlight that inclusion is not an unproblematic, smooth endeavor; rather, in practice it can also involve uneven, unequal, incomplete, and sometimes antagonistic processes and outcomes. With our cases illustrating the potential of this form of analysis, we argue that the analysis of encounters between GI and formal institutions of R&D and development can offer important lessons for the design of models of innovation and development around the world.

The paper is structured as follows. The following section briefly interrogates the notion of models, and builds on prior work on social movement framings of grassroots innovation to discuss models of grassroots or inclusive innovation. Section 3 presents the three cases and their ‘encounters’ with mainstream innovation and development institutions and policies. Section 4 presents some analysis of the three cases’ experiences, and related discussion. The Conclusion offers some lessons for policymakers intent on building models of inclusive innovation.

1. Models, Framings and Encounters: Insertion & Mobilisation

Designing, building and operating ‘models’ is a tricky endeavor. Whether business models, economic models, geographic models, ecosystem models, policy models or conceptual models – each of these implies some level of abstraction and establishment of some discrete set of variables, defined set of rules or acknowledged logic to explain or predict functional processes within the ‘model’. Models sometimes emerge to fit what is more easily measurable, i.e. existing statistical data, such as R&D data, while the task of developing models that reflect and respond to more complex realities may be in tension with efforts toward standardization (Arond & Bell 2010; Letty et al 2012: 10-11).² Designing models of innovation for inclusion and development imply that there exist ways to formalize, abstract, define variables or principles, and establish logical processes to develop effective and inclusive innovation (and thus policies can be designed following such models). At the same time, models can be pursued as a means to an end (e.g. the provision of basic services to large parts of the population or participation in the

² Letty et al (2012: 14) discuss this issue in detail in relation to grassroots agricultural innovation and the development of agricultural innovation indicators: “One kind of limitation cuts across these indicators of inputs, actors and outputs: apart from the execution of formally organized R&D by large farming enterprises, these parts of the system of indicators take virtually no account of farmers as actors in the innovation system, either as suppliers of inputs to innovation or as producers of innovation outputs. Instead, farmers (especially smallholder farmers) only come into the picture as ‘adopters’ of ready-to- use technologies after they have been developed by non-farmer actors.”

innovation process), but also models might be regarded as an end in itself (see Sennet 2008). The latter generally occurs when a technological intervention is regarded as a universal, technological fix for social problems (Weinberg 1991; Schön 1983). This is sometimes attractive to policymakers and practitioners, though as we shall see, such reductionism may not fit well with the diverse realities and framings of grassroots innovation. Thus, even when mainstream stakeholders can agree with GIMs about the need to foster social inclusion through technological development or innovation, they might still clash over their framings of 'inclusion' and the forms of knowledge production that count in the process.

In a recent review article, Smith et al (2013) identified three broad framings of inclusion and knowledge production for GI: *grassroots ingenuity*, emphasizing grassroots knowledge and products to cater for the needs of their communities, and which are not provisioned through existing markets and state processes; *grassroots empowerment*, concerning the prospects for transforming local situations, framing innovation as empowering the grassroots to have great control over their futures; and *structural transformation*, which lays emphasis on raising awareness about structural impediments – e.g. from mainstream regimes of production and industrial elites – to alternative pathways of innovation.³ So, behind the abstraction of models, there is usually a negotiation and compromise between different actors over resources, aims and frames of inclusion. How these different frames are translated into models of innovation will depend on the political strength and creative capacity of GI to negotiate with policy makers and mainstream institutions.

Some research has tried to characterize how encounters between GI and mainstream institutions can lead to the construction of alternative pathways of innovation and development (Hess 2007; Smith 2006). Following these authors, we acknowledge that encounters can be shaped by at least two modes of engagement. Firstly, there is *insertion* of GI models of alternative innovation (or at least some of its elements) into wider mainstream policies of innovation and development. The *insertion* mode of institutional engagement proposes to read grassroots creative capacities in ways that make it legible and useful for innovation systems and product markets. Thus, from the point of view of GI, insertion means fitting into existing spaces of innovation and playing by or adapting to the rules of dominant institutions, technologies, regulations, etc. The other side of the same movement may happen at the locus of top-down engagement, where mainstream institutions seek to insert and *capture* ideas, elements and even models from GI, adapting them to their own agendas and practices.

³ For a detailed discussion of these frames see Smith et al 2013.

These dynamics depend on many different aspects, such as policy framework and policy culture, level of community organization, forms of resistance to an imposed technological conformity and the innovators' capacity to generate interest among policy makers. Either moving from grassroots up to policy, or from policy down to grassroots, encounters may generate some kind of adjustment and transformation of aims and strategies, leading in some cases to processes of co-construction of models; or they may also lead to appropriation of ideas and products without necessarily being models for alternative pathways of inclusion and development (see Smith 2006; Hess 2007).

If the latter occurs,, giving way to policy disagreements or if formal institutions are impenetrable to GIM proposals, a second mode of engagement can arise. This happens when there is *mobilization* or resistance of grassroots to incumbent regimes, with the aim of developing pathways toward alternative innovation systems. As this mode sometimes arises in response to attempts at *capture*, it can even question whether 'models' and policies can really accommodate different forms of and reasons for mobilization. In this way, mobilization implies direct attempts to transform the spaces of innovation by challenging the dominant practices, technologies, power relations and discourses. Though mobilization is not a model of grassroots innovation, this perspective is important since it may eventually force the incumbent regimes to change and/or lead to autonomous experimentation with new socio-technical arrangements.

Thus, as grassroots innovation movements interact with mainstream S&T agendas, negotiating with conventional innovation institutions to enact change (either through engagement or opposition) they face the challenge of having their goals captured and integrated and/or realizing the need to resist and mobilize in order to transform mainstream systems of innovation and technological change.

In this context, choosing between strategies of insertion and mobilization is necessarily related with the capacities of GIMs and the conditions of incumbent regimes of innovation and technological change. As we discuss below in section 3, all three cases attempt a variety of different strategies of insertion and mobilization in order to build pathways of inclusion; but the context and resistances they face are different, and thus outcomes are very different. In the subsequent section we analyze how GIMs insert and mobilize as a result of encounters with mainstream regimes of innovation. We argue that this analysis has implications for the construction of models for inclusive innovation, and in particular what kind of inclusion (inclusion as outcome, inclusion as empowerment or inclusion as structural change) these models tend to foster.

2. Three grassroots innovation movements

India and Brazil are currently the sites for notable and internationally visible attempts at developing grassroots innovation. The Social Technologies movement in Brazil involved activists and communities seeking innovation agendas and arenas that develop solutions to the problems of those on the margins of economic growth, or who suffer the negative consequences of mainstream growth patterns. In India, the Honey Bee Network has a twenty-plus year history, while the People's Science Movements offer a longer historical trajectory, originating in the 1980s and with even earlier roots.⁴ All three cases presented here indicate attempts to engage with mainstream regimes of innovation and development.

In this section we study how the respective framings of GI encounters with mainstream innovation regimes and what strategies of insertion/mobilization GIM apply. Hopefully, the analysis of these cases will provide some clues on who and what is being included in innovation models, and under what circumstances, in order that the challenges, limitations and possibilities posed for development can be debated.

*Honey Bee Network (HBN)*⁵

The Honey Bee Network emerged in 1989 among a group of scientists, farmers, academics and others interested in documenting and disseminating traditional knowledge and local innovation in local languages, with a focus on ensuring the individual innovators would receive benefit. This was born in part as a response to the Green Revolution of the 1960s and its associated challenges, such as further marginalization of small-scale farmers.

The Honey Bee Network – an informal network that acts as an umbrella for various others -takes a very precise position on the meaning of 'grassroots innovation': as invention and innovation coming from the grassroots, often amongst people with little formal training and reliant on local, traditional or indigenous knowledge (Honey Bee Network website). The network's main activity is the scouting and documentation of innovations and traditional knowledge based on different actions such as visiting communities, interviews, awards and competitions. A second step is related to the exploration of the commercial potential of products and processes identified during scouting. This involves supporting local grassroots innovators in

⁴ In South America the historical antecedents to social technologies are not quite as clear, though appropriate technology initiatives in the 1980s, as well as the dynamic efforts of other grassroots social movements offer some background to contemporary experience (Smith et al 2013).

⁵ This section draws on a draft paper by Dinesh Abrol (Abrol 2013b).

the process of patenting, but also offering further assistance in terms of prototyping, incubation and seed funding in order to assure commercial viability (Sone 2012).

As just described, the HBN aims to foster creativity and recognition of the capabilities of people to develop their own solutions through their interaction with other innovators, entrepreneurs and supporting governmental institutions, thus we characterize its initial framing of knowledge production as a mixture between grassroots ingenuity and grassroots empowerment.

With regards to the engagement of the HBN with mainstream institutions, in its early stages this was intentionally limited, as to a large extent a “no external funding” model was adopted over the periods of establishment of the Honeybee Network (1986-87), and its related organizations, SRISTI (1993) and GIAN (1997).⁶ Turning down some offers of financial support, and relying instead on voluntarism and good will, the networks at the same time built a strong, values-led mobilized group of members that ensured their sustainability through the 1990s (when they ran with a skeleton staff of 8). One of the key mobilization elements are the *shodh yatras* – traveling on foot for up to 15 days to explore the grassroots innovation in villages in different parts of India. This and other similar activities have allowed the HBN to connect formal institutions with traditional knowledge holders, making it possible to map around 100,000 ideas, forms of traditional knowledge and innovations. The sheer amount of ideas surveyed does not allow support for every project or innovation. Almost 200 innovations have been given awards by the National Innovation Foundation (NIF), an autonomous institution of the Department of Science and Technology, between 2001 and 2005. Additionally, NIF and GIAN have filled patents for 405 innovations. Examples include: electronic gadgets, agriculture machinery & farm implement, auto components, agro based food processing machinery, energy conservation and generation technologies, herbal formulation, and others.

The mode of engagement of the Honeybee Network could be described as mainly based in a strategy of mobilization and cautious insertion. As the Honeybee Network and associated institutions gained in reputation over the years, encounters with formal/mainstream policy has increased. The HBN benefited from the fact that several governmental and non-government bodies were already engaged with similar initiatives of innovation activity based on traditional knowledge in India. Initial support for the HBN from mainstream policy came when the National Innovation Foundation was established in 2000 to strengthen grassroots technological innovations and outstanding traditional knowledge, with Dr R A Mashelkar, former Director

⁶ SRISTI is the Society for Research and Initiatives for Sustainable Technology and Institutions; the GIAN is the Grassroots Innovations Augmentation Network.

General of the Council of Scientific and Industrial Research (CSIR) as its chair. At that point and from 2000-2010, the annual budget came from an initial endowment provided by the Ministry of Finance approximately US\$3.7 million. Since 2010 NIF has worked with an annual budget of around \$1.1 million as an autonomous body of the Department of Science and Technology (Gupta interview, 2011).

Thus, based on their previous mobilization, the insertion approach has been successful in facilitating further expansion of the HBN networks – already very broad prior to the initiation of the National Innovation Foundation. They have since spread yet wider to link to state-level and national-level government, banks, firms, research laboratories and civil society organizations. These and the huge networks of volunteers across the country perform the bulk of the work, supported by the staff of around 40.

According to Anil Gupta, a deliberate effort has been made to retain control of the ethics and philosophy of the Honeybee Network by insisting on a level of operational independence from government. The National Innovation Foundation, is now, founded in the HBN philosophy, as an autonomous organization within the Indian government's Department of Science and Technology, and works to scout, document, validate and add value to, develop and help commercialize innovations developed in rural areas of India in order to benefit the masses in India and elsewhere (with a proposal for a global network drawing on the Honeybee philosophy) (Gupta 2012). This cautious strategy of insertion was only possible due to the political capital generated over decades of the movement's development. Thus, by mobilizing supporters and collaborators widely, HBN enabled control over insertion into policy models. By doing this, the HBN seems to have avoided losing control of its value-driven focus on searching and recognition of grassroots ingenuity.

One example of the National Innovation Foundation model is the Mitticool fridge, constructed out of clay and working without electricity on the principle of evaporative cooling. Water from the upper chambers drips down the side and evaporates, leaving the chambers cool. This keeps food fresh for days, including vegetables and even milk. After a number of years of entrepreneurial activity related to his traditional clay crafts, the inventor - Mansukhbhai Prajapati from Gujarat – benefitted from GIAN's support in product development until he launched the Mitticool fridge in 2005. He was awarded a National Award in its Fifth National Competition for Grassroots Innovations and Traditional Knowledge in 2009. The invention was granted Indian patent No. 240633 and is currently on sale (including through the National Innovation Foundation website) for Rs3440 (National Innovation Foundation website). An emblematic

success story, Prajapati was also celebrated in national and international media, including *The Economic Times* and *Forbes'* list of Top 7 Rural Entrepreneurs in 2010.⁷

Social Technologies Network (STN)

Originating in Brazil in the early 2000s, the now defunct Social Technologies Network (STN) involved a range of participants, from academics to activists, unions, government representatives, funding agencies and, specially ,NGOs and community groups. The STN had as its main aim fostering a more democratic and inclusive processes of technology and innovation development (Miranda et al 2011).

Individuals and organizations involved with the STN conceived innovation as a tool or catalyst for local development with particular emphasis on empowerment as part of the goal of the interaction between communities and technology developers (Fressoli et al 2011). A key aspect for the Brazilian STN was that for a more socially just relationship to be built between technologists and local communities, the community must have some control both of the process of innovation and the distribution of outcomes. Local groups may not directly be the innovators, but developers make sure they are fully included in adopting and benefiting from technology. In other cases, the technology is deliberately developed by local groups, selected by the STN and then scaled up (or re-applied) in engagements between developers and the community in manufacture, maintenance and operation. Thus, the question of empowerment (more than ingenuity) was from the beginning the key frame for inclusion by the STN. Although, in the long term, some actors of the network also saw participation in a local ingenuity frame in developing knowledge solutions as a possible pathway to further social transformation (see Smith et al 2013).

From early on, there have been significant encounters with mainstream institutions. From 2001, the Banco do Brasil Foundation has organized an annual award for Social Technology initiatives (which serves as an invitation to a certification process) and a database which includes hundreds of examples of grassroots innovation including agroecological schemes, water sanitation programs, water recollectors, ecological bricks, oil seed production technologies,

⁷ "Mansukhbhai Prajapati's Mitti Cool Clay Creations brings clay back in fashion" from *The Economic Times* (3 Dec 2012), and Prajapati chosen for *Forbes'* Top 7 Rural Entrepreneurs list in August 2010 http://www.mitticool.in/news_detail.php and http://www.forbes.com/2010/11/01/honeybee-network-anil-gupta-opinions-power-10-indian-entrepreneurs_slide.html

fisheries, etc. But only a few of these examples have been selected for reapplication and scaling up, in this way being granted access to funding and support from formal institutions.

An illustrative example of an encounter between the STN and the state is the One Million Cisterns Program (P1MC). P1MC, as it became widely known, aims to build a massive number of water cisterns in a large semi-arid region in Northeast Brazil with a population of around 25 million. The region is characterized by low rainfall and scarce groundwater sources.

The cistern programme was originally devised by the Semi-Arid Association, a network of more than 700 institutions, social movements, NGOs and farmers groups, which later became an important actor of the STN. The Brazilian Ministry of Environment was also initially involved, although the Programme was later embraced by the Ministry of Social Development. The Semi-Arid Association itself has its origins in the popular mobilization against dominant paternalistic schemes of aid in the region, known as the "industry of drought" (*indústria da seca*). Instead of relying on water supplied by water tanks provided by local political patrons, the Semi-Arid Association proposed to build simple cement-layered containers that collect rainwater from the roof, with a capacity of around 16,000 litres, enough to sustain a family's needs through the region's drought season. With the arrival of the center-left government of Lula da Silva in 2003, the Semi-Arid Association found space to insert this programme into national development policies to be funded by the Ministry of Social Development. Later, in 2005, the Cisterna Programme also became part of the re-applied technologies of the Social Technology Network. Since its start in 2003, over 549,000 water cisterns were built and put in place by local inhabitants with the support of the STN and the Ministry of Social Development (MSD 2013). The main feature of the technology is that it is built by its "users" (farmers/masons, a common archetype of the Brazilian semi-arid). The building of the cisterns self-build aspect, which fosters relationship-building in the community, through the process of learning to build, use and modify the technology, indicating a grassroots empowerment framing. The water system empowers local people in the building process while also providing autonomy from local governments and water suppliers.

However, the insertion of this model into a government programme became problematic in early 2012, when the Brazilian government announced a plan to speed up the implementation of the programme through the purchase of 300,000 plastic water cisterns at almost twice the price of the original cement scheme. Focused on outcomes, this policy change disregarded the process of participation and empowerment that was central to the design of the program. Also, some private companies saw a business opportunity in the proposal (see Dias 2012).

Furthermore, early attempts to introduce the plastic cisterns showed design problems, as the plastic cisterns bent and folded due to the intense heat of the region.

The reduction of the model by the National government led to a public rally of 10,000 farmers, marching against the plastic cistern initiative. Protestors claimed that changes in management disempowered people from participation in the construction. Another element of the controversy included concern that introduction of the plastic cisterns would enable the local political elites to regain power over controlling water, by controlling the market in water cisterns. By the time when this occurred, however, the seed of empowerment had already been planted: banners waved at the rally contained phrases such as "We do not want water at any price. We want to participate". While the government's approach was built around the artifact and the accomplishment of policy goals, the user's approach was mostly concerned with the process and the inclusive dynamics it generated. At the end, access to clean water seemed to be less important than empowerment and the strengthening of community bonds.

The cistern example shows how the Semi-Arid Association and the STN managed to draw power from mobilization in order to negotiate a model of innovation and social inclusion. For almost a decade, this model was very successful in building more than 500,000 cisterns and empowering the population of the Semi-Arid region. However, as the government attempted to strip the program of its empowerment element and focus instead on inclusion as outcome, the mobilizations by the movement pushed the government to reinstate the self-build cistern programme, though they also continue to install some plastic cisterns (Semi-Arid Association, 2013).

People's Science Movement (PSM)

The People's Science Movement began in India in the early 1980s, encompassing a range of grassroots networks, organizations and associations, varying in size, history, focus and strategy, some of which trace roots back decades earlier, all sharing concern for leveraging the relationship between science and social needs (Jaffy et al 1983; Varma 2001). Some of these groups focused on promoting and popularizing science, including through local language education initiatives, to "reduce disparities in scientific knowledge," while others were more concerned with "promoting an alternative development model, based on local Indian science and technology" (Varma 2001: 4796).⁸

⁸ Various factors influenced the emergence of PSM groups, including political-economic changes and mainstream developments, and shaped the motivations, framings, enrolment processes and strategies of PSM mobilization (Abrol 2012). PSM groups arose at least partly in response to diverse post-colonial nation-building arguments (both Gandhian and Nehruvian), as well as taking inspiration from Mao Tse Tung's concept of "walking on two legs", to draw on both small-scale labour-intensive industry as well as larger scale

The PSMs began their contribution to the area of grassroots innovation making by picking up first on the interventions to be made in the rural non-farm sector. Interventions began during the period of the late 1980s with a view to work with the artisans active in occupations such as leather tanning, flaying of carcasses and supply of hides and skins, pottery, blacksmithy, carpentry, processing of oilseeds and pulses, non timber forest produce, honey, plant-based health system, non-edible oilseeds, fruits and vegetables, milk and milk products, to improve their own access to new capabilities, markets and resources in a competitive way in the local economies. Since the mid 1990s the PSMs have also become active in the farm sector; the PSM initiatives have been more recently extended to the implementation of agro-ecological approaches in rural development.

While being focused on the upgrading of traditional knowledge and techniques, the PSM grassroots innovation approach has sought to involve the institutions of formal S&T in the improvement and commercialization of traditional techniques, and the harnessing of technical improvements in the systems of local production, by building on grassroots ingenuity. This aimed to make artisans, workers and peasants competitive against non-local businesses that threatened their livelihoods. In other words, the PSM grassroots innovation approach enabled artisans, workers and peasants to function as inter-linked social carriers, to organize themselves cooperatively and acquire capabilities for industrial and technological upgrading of local production as “systems in themselves”. In this approach, they also collaborated with laboratory scientists in the creation of new techniques with the help of PSM organizations playing the role and function of intermediaries. An important feature of the model has been the *open participation of the potential social carriers* in the assessment of technology implementation needs. The PSM grassroots innovation approach has thus included aspects of participatory development of technologies, enhancement of “user capability”, and application of heuristics of “pro-poor” business models (Abrol 2013a). Further, the PSM approach is embedded in a systemic understanding of the local rural and peri-urban economies, recognising that a) all these occupations are inter-linked and should be suitably upgraded as a system in order to enhance their collective competitiveness and b) when upgraded they should be able to serve the local rural markets and also meet needs of the urban poor not yet addressed by the modern industrial sector (Abrol 2013a).

industry for Chinese rural development (Abrol 2013a). This framing, toward self-reliance and national development, with attention to the rural context, shaped the ‘model’ of PSM grassroots innovation.

Thus, the PSM framing of knowledge production has focused on the empowerment of rural poor as the social carriers of traditional techniques, which, in combination with modern science, could result in industrial upgrading (indicating a grassroots empowerment framing). However, like the STN, the PSMs indicate a dual focus; both on enabling concrete outcomes for marginalized people in India, but also consciousness about the structural barriers to deeper change. The PSMs apparently also judge progress toward building capabilities for technology development and implementation as well as toward this larger purpose of structural change (Abrol 2013a). In this sense, the PSMs are also part of a wider democratic movement motivated by a larger framing of “structural transformation”.

In terms of engagement with mainstream institutions, the PSM in India has based its strategy in both mobilization to transform mainstream schemes and the insertion of its own model into S&T institutions. The PSMs’ early collaboration with the Department of Science and Technology (DST) expanded to include schemes across India such as the S&T Application for Weaker Sections, S&T Application for Rural Development, Tribal Sub-Plan, Special Component Plan for Scheduled Castes, and S&T for Women and Young Scientists Programme. All these schemes draw on the various characteristics of the PSM approach: a multi-sectoral approach focused on local markets, capabilities and resources, linkages with S&T institutions and participation of beneficiary groups in all stages of the innovation process. These have developed through significant involvement by regional PSMs, which positioned themselves as bridging organisations, voluntary organisations, as well as through continuous engagement with national and state S&T institutions.

An emblematic success of the PSMs was the development of successful group enterprises and broader sectors around cleaner vegetable-based techniques for leather processes, involving people involved in tanning, carcass processing and flaying, and more. The core leather tanning technology itself was originally developed in the 1950s by the Central Leather Research Institute, but remained filed on a shelf, unimplemented in practice. The PSMs drew on their knowledge of local economies as area-based production networks, and instead of focusing on a technology artefact, focused on developing a systemic approach, developing cooperative enterprises and improving local supplier relationships (Abrol2013a).

In this systemic approach tanners were grouped into group enterprises, and unit level co-operation in production was introduced. Tanneries were accordingly designed to suit these scales and operationalised at the kasba (municipal) level locations in places like Mandi (Himachal Pradesh), Rohtak (Haryana), Dehradun (Uttar Pradesh), Bastar (Madhya Pradesh), Pondicherry, and Islampur (West Bengal).

But even then there was a problem of supply of hides and skins at quite a few locations. This happened because flayers were still linked to the source of raw material for their tanneries through the market. Large traders could prevent the supplies from reaching these tanneries, by controlling the markets for supply of hides and skins. Work had to be started on the development of carcass recovery systems to bring the flayers into the production net of the technology system for leather processing under development for the small producers. The issue of how to engineer the choice of scales of various sub-systems comprising the carcass recovery system, which would not eliminate the flayers but involve them in the network of production, has proven to be a major challenge.

Experimental development is continuing even today. Nonetheless, the installation of carcass digesters under the control of flayers enabled tanners to win flayers over to the production net in these areas. There was a radical change in the flayers' attitude to the tanneries, and their social identity changed. They were now willing to co-operate with the tanners. As a part of the network, they did not have to be linked through the market. It was also possible for the tanneries to plan for the utilisation of full capacity. Today, work continues on the development of machines for leather cutting, wrinkle removal, pressing and leather finishing. Without these machines some of the units are yet not viable. Local markets are available for exploitation but to tap them complete system designs for technology and business are needed.

One of challenges of 'success' in attracting government attention that the PSMs is currently discussing is how to replicate a PSM 'model' of grassroots innovation, given the diversity of perspectives, approaches, capabilities, technologies and even methodologies for using government DST support grants. There is some merit to the view that the realization of enormous diversity should be treated as one of the great strengths of the model of innovation, because the process of innovation is not only fully circumscribed by the devices or processes of the technologies concerned, but also involves socio-economic relations, in procurement of raw materials, organization of production, marketing, and so on.

Nonetheless, while the DST suggests the PSM approach to grassroots innovation should be treated as a general purpose model for funding rural innovation by government agencies in India (DST 2008), there is debate within the PSMs about how to retain the original PSM aims toward structural transformation, and how to absorb and nourish the area-specific processes needed for implementing rural innovation across diverse situations (Abrol 2013a).

3. DISCUSSION

As we have seen in the previous section, models of innovation are not exclusive to formal S&T institutions. GIMs are prepared to put forward their own framings of inclusion and knowledge production through the devising of their own approaches to innovation. As a result, grassroots innovation movements are open to interacting with mainstream S&T agendas, and negotiating with conventional innovation institutions to enact change (either through engagement or opposition). At the same time, grassroots innovation initiatives are of interest to policy-makers as a means to reach below the radar and bring communities into view, but without necessarily altering broader innovation agendas, institutions and practices. As interest in models of innovation and social inclusion grows among aid agencies and S&T institutions (see introduction), encounters between GIs and formal institutions are coming forward. Based on the analysis of the three GIM cases, we see two related challenges to the construction of new models for innovation and social inclusion.

One challenge for GIMs is when their goals are captured and integrated into mainstream systems of innovation and technological change without recognizing the more complex and challenging aspects of their framings. A framing of the activity coming from conventional innovation institutions overlooks the alternative frames that have originally motivated grassroots activity. This can happen when top-down approaches attempt to provide technologies and products as a solution to social problems disregarding the original aims and heuristics of grassroots models. In this case, formal institutions frame inclusion as an outcome where people are seen as passive end users without attention to empowerment in the process. Paradoxically, this top-down capture can exclude at the same time as it seeks to include. In the cases above, attempts at capture from entrepreneurial approaches have resulted in cautious insertion (like the case in HBN) or in overt resistance and mobilization like in the STN Cistern case.

It might be seen as strange then that, despite the different emphasis in framing found in each case, the three GI movements have used insertion and mobilization dynamically according to the level of openness and capture that formal innovation institutions have shown. In this way, the capacity of GIMs to switch from mobilization to insertion and vice versa, or even combinations, may be regarded not only as a response to the context, but as a deliberate attempt to retain autonomy. In this sense, social movements are also actants with certain types of power and capacity for reflexive learning, as evident for instance in PSMs' development of a new approach to grassroots innovation building on lessons gained from prior approaches. In those

cases, GIMs may make instrumental use of models, as tools to shield their activities and nurture mobilization and alternative ways of knowledge production (See Smith et al 2012).

The second related challenge is the constriction of models in terms of resources, extent, aims or space for experimentation, all of which can result in difficult dilemmas for GIs (See Smith et al 2013). As we have seen in the cases, the 'successful' operation of both models of *insertion* and alternative pathways of *mobilization* for grassroots innovation proves elusive. All suffer implementation 'deficits' on their own terms. In the case of grassroots *insertion*, this is because representations of grassroots initiative will always be imperfect. Whereas grassroots initiatives seek context-sensitive solutions, policy pressures to scale-up lead to decontextualized models whose abstractions lose sight of the generative context and alienate those who were involved (such as inattention to local power relations, and the fear by communities of goals being subsumed by political patronage in the Brazilian case). Arguably, there can be no definitive reduction of grassroots initiative into objective knowledge for inclusion in universal innovation processes. Indeed, decisions about how to represent, and which representations to include – decisions taken by those with more powerful influence over innovation processes – can effectively disempower and exclude some grassroots perspectives. Inevitably, not everything can be included in participatory design, prototyping and innovation development; something will be overlooked or communicated poorly in the process, to return disruptively in, say, processes of implementation and commercialisation (Asaro 2000). As the cases show, even when GI movements have a strong mobilized base and good insertion in the S&T agenda, the sheer diversity of grassroots experimentation and the complexity of their framings will probably overwhelm the capacity or the willingness of mainstream institutions to accommodate alternative pathways of innovation.

Ultimately, these challenges point to a very different and maybe more complex understanding of models of innovation and social inclusion. On one side, there is a construction of models as an end in itself where the heuristic is regarded as a solution to a certain social problem. This can be very tempting to policy makers, formal institutions and even to practitioners in grassroots groups. However, a fixed heuristic will easily overlook the broader framings and ideas of GI movements. Regarding models as an end also puts extra pressure on the success or failure of the implementation process, undermining any learning process that might develop. Furthermore, devising models of innovation and social inclusion as an end in itself could help to solve emergency situations or provide basic services but hardly will attend to ideas and ways of cultivating deeper forms of grassroots innovation.

On the other side, models can be built as means to broader goals and visions of social development and structural transformation. Seen as part of a pathway, models can be translated as constituting spaces of experimentation for different approaches, networks and socio-technical arrangements. Instead of regarding a model as a silver bullet solution, they become an element among other strategies of engagement and pathway construction. Processes are provided for reflecting on the operations of the model in practice, and for voicing dissent, so that the model reveals different framings rather than excluding some. This perspective requires stakeholders and policy makers to become aware of difficulties and resistance that models of inclusive innovation face.

The latter option might call for policies to be put into context, and to be honest about the wider power and framings of relations that shape their operation. The issues at stake here are whether models of innovation and social inclusion will frame inclusion as an outcome or can be supported as a wider and longer-term process of empowerment and transformation that might challenge established institutions.

4. CONCLUSIONS

Models are a necessary step in building up pathways to alternative knowledge production and sustainable development. But they are also subject to tensions between different strategies and visions of inclusion (i.e. outcomes vs. process) from networks/movements, politicians, funding agencies and stakeholders.

The three case study encounters described earlier show a combination of framings (ingenuity/empowerment/transformation) and modes of engagement (insertion/mobilization). We discussed the challenges of retaining control over framings and how they materialize in support for innovation, the risks of capture, and the complexities of representation. Interestingly, all three GI networks have used insertion and mobilization dynamically according to the level of openness and capture that formal innovation institutions have showed. In the case of HBN, for example, mobilization carefully cultivated legitimacy and cemented grassroots values in order that they might be retained in subsequent insertion into policy support. In the case of RTS, a reduction in the framing of Cisterna as it was inserted into a revised policy programme prompted mobilization in order to re-assert the empowerment framing. Finally, the PSM negotiated a complex combination of popular mobilization and policy insertion from the outset, and whilst a more rounded model for rural development resulted, the depth of its implementation (or not)

remains controversial. It is important to be aware and open to these dynamics as models develop over time.

The renewed concern with models of inclusive innovation seems to be a propitious moment for GIMs to propose models and ideas in order to get funding and support. However, negotiations between different framings and practices are not always easy and encounters with mainstream institutions can lead to tensions, controversies or may vary over time. We emphasize the fact that strategies vary and take a long time to develop, and movements constantly face setbacks and tension between their frames and the need to negotiate models. Thus, we argue that it is key to regard models not as a definitive solution to inclusive innovation but as spaces for experimentation, empowerment and alternative ways of knowledge production. In sum, talk of models needs to avoid discussing them as arrangements for best practice or devices for scaling-up. Experience with PSM, HBN, and STN suggest it is better to talk about plural spaces for grassroots encounters and engagements in innovation that are decentred, and provide context-rich experiments in practising technological democracy, as much as they are testing grounds for novel goods and services. Cultivating spaces for engagement and empowerment is perhaps a better policy goal, where the constantly contested and emergent forms of inclusion/exclusion can be explored and new forms of innovation practice developed in parallel across different sites and at different scales.

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