Knowledge Swaraj: An Indian Manifesto on Science and Technology

Knowledge *Swaraj*:
An Indian Manifesto on Science and Technology

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The Manifesto process

The "Knowledge *Swaraj*" Manifesto is the outcome of efforts spread over two years, starting from a workshop at the Adivasi Academy, Tejgadh, Gujarat (November 2008). "Thought Pieces" and other notes from the Tejgadh workshop helped to make a first draft that was discussed at a second workshop at Hyderabad (March 2009). This second draft was further developed through e-mails and other communications (April-August 2009) and was presented for discussion by an invited audience of knowledgeable persons drawn from all over the country at the University of Hyderabad (September 2009). A more formal publication in 750 printed copies of the next draft of this Manifesto was published in December 2009. Several pilot studies were commissioned around the central tenets of the Knowledge *Swaraj* Manifesto (October 2009-June 2010). There were also focus group discussions and workshops that enable science society dialogues on the pilots (see http://kicsforum.net/kics/setdev/Piloting_Knowledge_*Swaraj*2.pdf). These helped to revise the current and final *Knowledge Swaraj—an Indian Manifesto on Science and Technology.*

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This document has been facilitated by the network "Knowledge In Civil Society" or KICS (http://www.kicsforum.net) that promotes dialogues on issues relating to science and democracy. KICS welcomes comments on the manifesto and invites suggestions on taking further the manifesto process. Please write to science*swaraj*@gmail.com

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Introduction

This is a *HindSwaraj*-inspired document for the 21t Century. It asks what "self-rule *(swaraj)* for India" can mean, one century after Mohandas Gandhi wrote his manifesto for an independent India on board a ship from Europe to Africa. *Swaraj* today in the 21st century has to include the important domain of self-rule in science and technology too. If Mahatma Gandhi gave prominence to science and technology in the form of law, medicine and railways in the original Hind *Swaraj*, for the 21st century we see on centre stage: biotechnologies, tribal knowledge, space technology, handloom, information and communication technologies, and ayurvedic medicine. This Indian Manifesto on Science and Technology argues for Indian self-rule of its science and technology, for a knowledge democracy that draws its agenda for research and technology on the richness of Indian culture and the needs of the Indian people.

This is a pro-science manifesto—but a manifesto that favours a new form of science. This new science will be better rooted in Indian society than the current standard science and technology. This Manifesto argues how that rootedness can be realized by drawing on a broader range of knowledge systems, by proposing that science should assume trusteeship of society and the world, and by foregrounding the values of sustainability, plurality and justice. This then leads to a new ethics of technoscience, and indeed to a science by and for the people - a knowledge *swaraj*.

The world today is facing a multi-faceted crisis: a resource crisis signalling the end of the fossil fuel era and the drying up of most modern resources; a climate crisis which almost reached a point of no return; an institutional crisis with an eroding credibility of the state as well as the market; and an economic-financial crisis that questions the received neo-liberal strategies for development of wealth and health. This Manifesto calls for a critical reflection upon the strengths and weaknesses of Indian society and science, and suggests ways to turn these crises into opportunities. It engages with the original Hind *Swaraj* by recognizing a crisis and the need for personal engagement. It asks questions that need to be asked at this critical juncture. This Manfiesto is meant as a wake-up call to citizens and scientists alike. It seeks to build a framework for moving from short-term individual fixes to longer-term community solutions.

This Manifesto extends the ideas of *swaraj* and *swadeshi* asking what India's own agenda and style of knowledge, science and technology development could be, independent of the dictates of the North and West. This does not imply a plea for isolationism. Just as Gandhi clearly positioned an independent India within the commonwealth of nations, so this Manifesto recognizes the international character of science; but it adds a realization of the (partly negative) effects of globalisation and a celebration of the cultural richness of interconnectedness, albeit on equal terms.

The Manifesto seeks to question a blind faith in technology without being Luddite; to restore cultural identity and pride without being chauvinistic; and to outline an ideal of knowledge democracy without the illusion of concrete policy solutions. Gandhi's

Hind *Swaraj* offers an inspiration in 2011 as much as in 1909 for the need to revalue and legitimise peoples' practices. India, Gandhi believed, needs not only to free itself from colonial rule, but has a responsibility to the world to liberate the West from a developmental mindset that alienates people and is deeply unsustainable. As Gandhi has suggested in 1909, we believe that citizens and civil society today can engage in *swaraj* or self-rule, and inform state processes to reinvent development. In that sense this Manifesto is not just for India, but a modest offering from India to the world.

The Manifesto is written from the perspective of citizens while engaging with science and technology. In doing so, we do not look too much into the past, but try to work towards a normative frame that can help provide a fresher look at India's capabilities and responsibilities. We seek to give the Manifesto an earthy fragrance that draws on concrete experiences of people, and with an innovative spirit that breaks the vicious cycles that many sectors have been trapped in. The Manifesto will present a vision that enthuses those stuck with modest experimentation to paint a wider canvas, and in that process to restore dignity to the majority who are vulnerable victims and yet potential champions of a new and sustainable knowledge society. Indian citizens are thus seen as active contributors in the knowledge society and not as mere recipients of products of science and technology. This Manifesto is about innovation - an innovation that is rooted in communities.

The Manifesto addresses the three key dimensions of justice, sustainability and plurality. Justice is taken - not given - and is conditional on democratisation of governance with the informed participation of all. The Manifesto's understanding of sustainability is long term, with emphasis on universal human rights with access to food, health and education, and focus on reduction of vulnerability of the under-privileged. Recognizing plurality begins by the realization that there are multiple knowledge systems and different kinds of experts as opposed to the conventional division of experts and non-experts. The Manifesto takes cognizance of the existence of a large number of marginalized people who have the capacity to significantly contribute to the development of society, including its science and technology, but are currently excluded from this process.

This Manifesto is intended for three different readerships. First it is written for a general audience of citizens, school children, students, and scholars: a foundational argument about the character of knowledge, science and technology and about the opportunities for self-rule of these. Second, it is meant as a wake-up call for scientists and activists; to scientists it makes a plea to value the social embedding of science and technology in society, and to activists it makes a plea to engage in the social construction of science and technology. Third, this Manifesto speaks to policy-makers and (admittedly rather implicitly) suggests new forms of a pro-active science policy for the people and by the people.

This Manifesto starts by arguing for a plurality of knowledge and expertise. It then seeks to situate some of the debates from social movements that have contributed significantly to shaping the discourse on knowledge and democracy arguing for alternative scientific imaginations rooted in non-violence. It argues for the need to add the notion of trusteeship to the social contract on science in India. Conclusions are drawn to indicate how a *swaraj* of science and technology will yield justice, sustainability and plurality.

Interrogating Expertise

Science and technology have played a crucial role in the development of India. This encompasses centuries-old traditions of agricultural, medical and architectural science, as well as recent investments in science and technology that has moved India to the forefront of international modernisation in the global south and east. The latter has resulted in giving India prominence in the international scientific communities of most natural sciences, engineering and agricultural disciplines, social sciences and humanities. The expertise that these scientific and engineering practitioners have is duly recognized in Indian society and Indian policymaking and politics.

This Manifesto will argue that other forms of expertise— often pejoratively labelled as non-scientific—need to be incorporated into scientific policy making when aiming for a long-term sustainable culture and society. Without such incorporation, societies will develop tensions and schisms that threaten their sustainability. Indian society has a long history of recognizing that there is a spectrum of expertise. One instance of recognition goes back centuries when a broad spectrum of philosophers, mathematicians, astronomers, and ayurvedic doctors built up the body of Indian knowledge. This Manifesto will argue that extending that tradition will strengthen rather than weaken the role of science in Indian society.

Experts versus lay persons?

The standard, modern image of expertise makes a distinction between experts and lay persons, and most often equates the expert with the scientists and the layperson with someone without scientific knowledge and expertise. Increasingly this standard image of experts and expertise is producing problems. The problems partly arise because scientific knowledge proves not to be sufficient to solve societal problems, and partly because the general public does not always trust the scientists anymore, even if it continues to respect them as a matter of habit. An important reason for this erosion of trust is an increasing confluence of interests between the experts and commercial interests. This erosion of trust seems to have progressed further in the north and west than in the south and east; we will return to the specific Indian situation below, after sketching the general issue.

Knowledge from the natural and technical sciences is not sufficient to deal with societal problems because every large technological project has many aspects that are beyond the narrow confines of engineering and science. Let us consider the example of water resource management. In addition to technical aspects of design and construction, irrigation systems also have agricultural aspects of matching the irrigation plan to the farming styles, social aspects that may affect relations in the villages, economic aspects that influence the distribution of the benefits, and legal aspects of ownership, compensation and regulation. These aspects call for expertise from the social sciences or humanities to supplement the natural-scientific and technical. There are however, more kinds of knowledge and expertise that need to be included. These are not scientific or scholarly, but can be labelled ‘experience-based.’ Increasingly, for example,

European advisory institutions on health and medicine include representatives from patient organisations on their committees; industries involve users in their design process; and infrastructural projects consult with citizens. So, a variety of forms of knowledge - scientific, scholarly and experience-based - needs to go into the design and implementation of any large scientific-technological projects. These committees do not only exist in Europe. India has similar committees, but somehow the European ones seem to work better. If the members of Indian committees do not listen to each other as well as the members in European committees, this is probably caused by a deeply engrained standard image of expertise that creates a deep divide between scientists and non-scientists, exacerbated further by language barriers that make communication difficult in India between experts and citizens.

The second problem is that increasingly the general public does not trust scientific advice as unhesitatingly as it used to do. Citizens and consumers have more sources of knowledge, also on matters scientific and technological, than the official spokespersons of science and technology: these may come from non-governmental organisations (NGOs), the mass media, or a variety of Internet sources. In Europe Genetically Modified (GM) crops and food were banned when the general public felt that some of the risks associated with GM had been underestimated or misrepresented by the scientists and the industry. At this moment there is hardly any GM food on the European shelves, and scientific statements that argue the safety of GM crops are mistrusted. The Dutch government has now concluded that to avoid a similar chain of events in nanotechnologies, other forms of knowledge and expertise need to be involved early on. Various programmes have been created in Europe and the US to tap the expertise of social scientists, philosophers of ethics, stakeholders, users and citizens in policy making about nanotechnologies and in their implementation in research and development programmes. We will return to some Dutch experience with this, later in this Manifesto.

The situation in India seems different, at least for the time being. The post-independence "priesthood" of specialist engineers and scientists still seems to be held in high esteem. It is too easy to conclude that this implies that the Indian general public has an exceptionally high trust in scientists and scientific knowledge. It is also possible that the trust is primarily in institutions and in the given hierarchical order. The debates on Genetically Modified crops in India indicate how encounters between science and democracy have played out. Requests by citizen groups using the enabling Right To Information (RTI) Act for scientific information on field trials have often been denied under the pretext of citizens lacking expertise in these domains. The scientific establishment and regulatory authorities have had difficulties being independent and have often demanded scientific evidence from these groups. Nuclear power and space technology are totally different categories in India, which seem exempt from normal political or public evaluation. This Manifesto will not follow that line of reasoning: we see no reason why these or any technologies should not be subject to political or democratic governance.

This Manifesto argues for an India that uses science and technology for its own agenda, for a certain style of doing science and technology, and for policies that transcend the dichotomy between experts and non-experts. It will argue for using science and technology for the benefit of the people, and it will argue for including the rich variety of expertise, knowledge and experience available in Indian culture and society in

scientific practice. This immediately raises the question how non-scientific forms of expertise can be given a voice; how expertise from outside the scientific establishment can be given influence inside; how the "citizen" will converse with the "scientist." The larger project of which this Manifesto forms the starting point is specifically aimed at these issues. Reviews of democratization experiences in other parts of the world, and experimentations in India with this Manifesto, will hopefully lead to making better use of the broad spectrum of expertise that exists in Indian society.

Exploring expertise

Expertise has many components and can be evaluated along many dimensions. It is thus not only about competences but also about social status. Having an English education, having a degree, and coming from a high caste and class make an Indian expert in terms of social status. Having inside expertise of a certain domain amounts to expertise in terms of competence.

Such inside expertise can come in different forms. We distinguish two forms: (1) expertise to understand and follow discussions and (2) expertise to actively contribute to the further development of the inside knowledge or to the design of a particular technology. The first is easier to acquire than the second. The first kind of expertise is typically sufficient for interaction with scientists and engineers about policy choices or about balancing risks and benefits of a specific scientific or technical development. The second kind of expertise is needed to actively contribute to the making of scientific or technical knowledge. The mistaken opinion that citizens, users, patients, or stakeholders cannot be consulted on issues scientific and technological results from confusing these two forms of expertise. Since most of the time non-scientists indeed cannot contribute to substantive scientific work, it is erroneously assumed that neither can they interact on choices of priority, policy and ethics.

Taking the multifaceted character of modern science and technology seriously makes it inevitable to adopt the previously introduced broad view of expertise. It does not make sense to talk of "scientific expertise" *per se*. A nuclear physicist does not have expertise in dam building and vice versa. The dam building engineer is in no better a position when discussing a nuclear power station than any other educated citizen. The only sensible way to conceptualize expertise is as a spectrum of different forms of expertise. There is no ground for prioritizing the expertise of a certain domain, at least not in a general fashion. For certain questions you need expertise of physics, for others of sociology. For some questions you need expertise that can actively contribute, for other questions the expertise that allows you to interact is sufficient.

For a "scientific audit" or a peer-review assessment of a project you need contributory expertise in that specific domain. For a "social audit" such expertise would not be enough and perhaps not even necessary. For the latter, you need a variety of interactional forms of expertise. Depending on the precise question of the social audit, you will need citizens, stakeholders, scientists, and/or engineers. And, of course, not just any citizens, stakeholders, scientists or engineers; but those with the specifically required interactional expertise for that particular social audit.

From all experts we expect a form of critical self-reflection, knowing where the limits of

their forms of expertise are and where and when to involve other experts.

Social dimensions of expertise

Once the need to involve other forms of expertise in policymaking on science and technology is recognized, there are more implications than merely pertaining to the set-up of advisory committees and the inclusion of citizens and stakeholders in certain forums. Some of these implications address fundamental characteristics of Indian society. It is one thing to argue for the recognition of the expertise of citizens, in addition to the expertise of scientists. But what about Scheduled Castes and other radically marginalized people, who are in many cases not even recognized as citizens? These are so marginalized that they will not claim, for a considerable time to come, space to be heard unless they are encouraged to do so. Citizens who can speak on their behalf need to swell yet, though a good number are now ready to speak to support them.

Recognizing the spectrum of expertise implies the need to also recognize the spectrum of identities, of peoples; and to recognize that identities are context-dependent. One may be a physicist, or a Brahmin, or a citizen, or stakeholder - and often, some of them may be together. Caste identity, for example, implied a clear structure and guarantee of livelihood. Caste also represented a knowledge hierarchy. Social relations were clearly laid out and social movements were structured; by birth it was determined what you could and could not do. But politics of caste - in terms of questioning the hierarchies of the caste system - was not possible. This is changing to some extent, but much of these characteristics of Indian society are still in place.

Enacting expertise

The new view of expertise has far-reaching implications for the politics and management of science, technology and society. The standard image of expertise caused an externalization of all problems, conflicts and dissent: such problems were not considered part of science, but seen to belong to the outside, non-scientific world. If something went wrong - like a chemical plant explosion or an unaccepted irrigation scheme or a lower yield of a crop than promised - this was due to bad management, wrong political decisions, or unprofitable market conditions. With the new view of expertise, the blame cannot be diverted so easily anymore. When things go wrong now, more fundamental characteristics of society, knowledge (including science) and technology need to be addressed. The cosmology of how we see the world in relation to fundamental sense-giving views will inevitably come into play: one cannot, for example, ignore the deeply religious character of Indian society, even though it combines with a secular consumerism of the middle class.

The different forms of expertise affect all stages of scientific and technological development. This is evident and already generally recognized in the stages of production, implementation and evaluation of scientific and technological knowledge and design. But an earlier stage is at least as important: the stage of problem definition. A problem is not intrinsically and a priori technical or economic or scientific or political. During the stage of definition, the problem is given its key characteristics, depending on how the relevant forms of expertise play out. And once a problem has received its main characteristics, these will also determine which types of expertise can best contribute.

Examples abound of how civil society groups have reconstituted expertise and continue to offer informed choices to communities in areas such as sustainable agriculture, water and energy.

In the final chapter of this Manifesto, an example is presented of a Dutch societal dialogue that shows that interactional expertise exists among a wide range of non-scientists, or can be acquired when considered necessary. With such interactional expertise a substantive part of the Dutch citizenry was engaged in dialogue about nanotechnology in its earliest stages of development. It generated a people's agenda for nanotechnology, and it probably helped to embed nanoscience more firmly in Dutch society.

Implications of this new view of expertise

Accepting this new view on expertise has far-reaching implications for an Indian Science and Technology Manifesto.

The first issue is to recognize that science and technology play crucial roles in relation to violence and inequity. They cause violence and inequity—sometimes as the result of strategic use of power to oppress the less powerful and to control the marginalized, sometimes as unintended side-effects, and sometimes as inevitable consequences of the very character of that science and technology. Science and technology are also called upon to harness violence, to provide alternate forms of non-violent intervention, and to redress inequity and lack of justice.

Recognizing not only the existence of a broad spectrum of expertise, but also the roles of science and technology in mitigating violence and inequity, the next question then is: which societal arrangements are needed to make science and technology relevant for the development of India. How is the ownership and management of resources related to commercial markets and democratic governance? To secure a balanced and adequate input of all relevant forms of expertise, new regulatory frameworks need to be developed. In the current dominance of regulatory liberalism and market economy, the state seems to be in retreat. This leaves a gap in balancing the various interests and stakes—a gap that is often occupied by private corporations. New institutional frameworks should better guarantee a balanced input of all forms of relevant expertise. Such frameworks will also pay explicit attention to ethical issues, and in a broader and more explicitly political sense than mere research ethics or medical ethics.

In this chapter the plea for citizens' participation in the regular science and technology process was explained. This, however, is only a first step towards recognizing the plurality of knowledge systems and the implications for justice and sustainability. The following chapter will make this next step in the argument and outline the need for a new form of knowledge democracy.

From Contract to Trusteeship: a New Role for Science

Nation states today, irrespective of their political systems, see science and technology as important vehicles for the development of a country. Increasingly, however, citizens have raised voices questioning claims made by science and are suspicious of some of the scientists' work. In India, environmental minister Jairam Ramesh in 2010 was led by public consultations to declare a moratorium on Bt Brinjal that he argued was 'both responsive to science and responsible to society'. In Germany the opposition against nuclear power reached a new high around the same time and in 2009 in The Netherlands a vaccination campaign against cervical cancer became a failure when the majority of 12-16 year old girls, for whom the campaign was designed, refused vaccination against the almost unanimous advice by scientists. Citizens today, the world over, are increasingly arguing for newer forms of public engagement of science that go beyond its current public understanding. The social contract between science and society as it has existed since the times of Wilhelm von Humboldt's (1767-1835) autonomous university for the *Bildung* of citizens or Vannevar Bush's pure science that could be trusted to deliver the goods is increasingly being seen as inadequate (Science: the endless frontier, Report to US President, 1945).

Science policies in India in the past, irrespective of the government in power, have predominantly seen the contract of science with society as the remit of the experts, and a domain where it was up to the 'scientific elites' to vision the future of science and technology for India's development. These elite groups are narrowly constituted, and are not even representative of the large scientific manpower that India has. The only experiment with a participatory process of informing science and technology planning involving over 2000 scientists, the National Council for Science and Technology (NCST) Plan as part of India's Fifth Five Year Plan (1974-79) was short-lived. Internationally today India seeks to promote itself as the 'world's fastest growing democracy' at events such as the Davos economic summit of 2006. The Manifesto questions the tenuous link between knowledge and democracy in India. If science was widely debated during the freedom movement, the absence of democratic discussions on science and technology post-independence is an aberration that needs to be re-examined.

This Manifesto proposes to rethink science's contract with Indian society by arguing that India can draw upon its rich and diverse traditions of understanding the relation between science and society, both from within and outside the scientific establishment. This, the Manifesto suggests, requires openness to critiques of science by scientists, social scientists, citizens, activists, and industrialists—not to demonize science and technology, but to inform future scientific and democratic practices. This is examined at two levels. First by considering the contribution of social movements to the debates on knowledge, and second by exploring the often unspoken, but nevertheless important, relations between science, violence and inequity.

Science and social movements in India

Science and technology have seen several debates during the Indian national movement. Gandhi, Tagore, Ananda Coomaraswamy, P C Ray, Meghnad Saha and Jawaharlal Nehru all contributed to the rich discussions on both the nature and content of science, technology and development. Ever since the rise of the nation-state in India, society has been dominated by state, bureaucracy and partisan unions. There were a whole set of issues that never got articulated and innumerable voices of protest which were ignored or never heard.

The science-society contract was one where the nation state was committed to science, security and (technological and economic models of linear and western) development. The struggles of Telengana, Naxalbari, and the North-East of the late 1960s and early 1970s and even the peaceful efforts of Bhoodan in the first few decades after independence reflected what was deeply wrong with the body politic. India had created more refugees from development than from all the wars it fought. By the 1980s, there were one million troops of paramilitary control for the maintenance of internal order.

History has not recorded all movements that sprang up in India in the 1970's and 1980's offering alternatives to mainstream politics, science, technology and development. One can immediately recollect, however, the forest and ecological movements of *Chipko* in the Himalayas and Appiko in the Western Ghats, the movement against the IRMBs (Intermediate Range Ballistic Missiles) in Baliapal, the struggles against development at Koel-Karo, and the anti-nuclear struggles at Rawat Bhata. Apart from the explosions at the community level, this period also saw the rise of NGOs—not as extension counters of the state but as separate voices of political protest. One thinks in particular of the People's Union for Civil Liberties (PUCL), the Kerala Sastra Sahitya Parishad (KSSP), the People's Science Movements (PSMs), the Patriotic and People Oriented Science and Technology (PPST), and the various voices of the non-party political process articulated by groups like the *Lokayan.*

In the 1980's, almost as an act outside history and political scripts, these movements mushroomed in India. They collectively made three separate arguments. First, the party, the union and the electoral process could no longer exhaust the possibilities of the political. Second, while Gandhian struggles might have ended, these social movements began to invent new styles of *Swaraj*. Third, they multiplied the possibilities between the real presence of the naxalite movements and the nostalgic memory of the Gandhian movements. They formulated and staged a variety of alternatives that were not available to the technocratic imagination of the state.

These protest movements are important for the reaction of the state and for the memory and nostalgia they still inspire for alternative social, institutional and scientific imaginations for *swaraj*. Three of these struggles stand out for local movements that drew national and international attention:firstly the fisher folk struggles in Kerala, secondly the anti-dam movement, and thirdly the struggle of the survivors of Bhopal. The fisher folk's struggle, which initially began as a battle between traditional fishermen and motorised trawlers, began as a set of local contestations and transformed into the most globalized of struggles articulating the role of marginal fisher people everywhere. It raised questions of equality and justice giving newer meanings to exploitation and

suffering. The anti-dam struggles on the Narmada dam issue forcefully articulated and forged a wider umbrella of alliances questioning the nature of development inspiring similar movements across India and involving several dissenting scientists and technologists to pursue alternative pathways to development. The struggle in Bhopal following the world's largest industrial disaster could also not assure genuine rehabilitation or any sense of justice to its victims. It brought to the fore the inability of the state and its scientific apparatus to be with its people even as it claimed to represent them in the legal case against Union Carbide.

The real contribution of these movements was not to the politics of civil society but to the politics of knowledge. The NGOs showed the insufficiency of technical and natural sciences. They emphasised the importance of design and construction of technology as a socio-cultural system, and the need for a cost-benefit analysis that goes beyond technical assessments to the wider requirements of justice and sustainability. They called for a world-view where a humanistic and social science imagination would supplement a scientific and technocratic perspective. They demanded a diversity of knowledge systems that were both cognitive and experiential. They also demanded an emphasis on participation and representation, and a systemic connection to health, education and ecology, while linking tradition to future. These movements brought a new meaning to the Gandhian vision of oceanic circles by showing how Indian students pursuing higher studies in science and technology abroad often played important roles in taking the struggles to a wider audience through the Internet. They connected the worlds of subsistence and sustainability long before the Brundtland report and the Rio summit. Unfortunately, they were caught by the twin processes of globalisation and liberalisation. Liberalisation gave the state an excuse to retreat from key responsibilities within India, while globalisation undermined the state's regulatory role from without. The NGOs, as dissidents, suddenly did not have a credible opponent anymore to argue against, but neither did they have a positive alternative ready.

The first decade of the 21st century has led to a rethinking amongst people's movements. The sites of protest had multiplied. Several Indian states now compete with each other to attract foreign investments displacing people's lives and livelihoods in large numbers. The strains of unbridled growth of mining projects, automobile manufacturing, power and chemical plants, and the spread of Special Economic Zones have raised the question of *swaraj*. How can science and technology contribute to the *swaraj* of the Indian people instead of becoming vehicles of oppression and destruction?

The broad acceptance of an ideology of urbanisation, globalisation and progress shows that the victims of violence—whether of riots or development—are not part of stakeholder democracy. The Manifesto urges us to re-examine some of these linkages between science, development and violence.

Science, (non-)violence, and knowledge democracy

Hind *Swaraj* was a manifesto that aimed to promote love and non-violence. It was no naive call for peace but based on a deep understanding and even personal experience of violence and its origins by Gandhi in Europe, South Africa and India. This fundamental understanding needs to be updated since Gandhi's times, as societies have enhanced the capacity for violence manifold. There is an obvious, monolithic and technocratic

side to violence in the form of war and genocide; but violence also appears in an unexpected everydayness—less obvious, more dispersed, and less centrally controlled. Violence today is no longer confined to the holocaust camps, but also to the realms of development, globalisation and modernity.

Every large-scale innovation has its underside by creating obsolescence, waste and erasure. Knowledge societies, like those in India, that have a continuing tradition of several parallel indigenous knowledge systems, have to contend with this underside. Otherwise, science and technology could lead to large-scale societal and cultural damage by further pushing these parallel knowledge systems into obsolescence. Such damage may have huge negative consequences for society since especially these parallel knowledge systems may have ideas and hopes of human survival when trying to find new ways to cope with a radically new problem such as climate change. This Manifesto recommends that answers be sought broadly—not just from modern science and technology, but also from these hitherto parallel and 'defeated' knowledge systems. This can offer new ways of coping with the inherent violence in standard science and technology.

Recognising violence in standard science is not to vilify science, but to suggest that science needs a theory of culture in which it should be located. Meghnad Saha significantly captured this connection through the naming of the journal he founded in 1935 "Science and Culture" that later led to the unequivocal celebration by Nehru in his famous address to the Indian Science Congress in 1937 where he proclaimed the Congress to represent science and the future as belonging to those who made friends with science. There was indeed more to the culture of science that Saha and Nehru were asking India to pursue—India was, for example, one of the first states in the British commonwealth to accept the metric system. An alternate view explored science's separation from culture, suggesting that science could become violent if such separation happened. Ananda Coomaraswamy was one of the first who articulated this during the debates of the national movements when he claimed that a proletarian is a man who is disconnected from his culture. Coomaraswamy argued to revisit India's craft traditions that, to him, offered alternate notions of time and ways of being. He seemed to suggest that once culture reconnects to science it would be possible to retrieve its complexity, its sustainability, its playfulness and that one thus could move away from the reductionism fetishized by years of state politics and industrialisation. Gandhi's opposition to western civilisation in Hind *Swaraj* had this notion of science being embedded in a theory of culture that later found expression through the *Khadi* movement.

Coomaraswamy and Gandhi were critical of the linear notions of time embedded in the western ideas of progress, rationality and the scientific method. Rationality helps to order, discriminate and choose; but those rational choices can easily result in a triage that excludes some from science's benefits or makes others the victims of unintended negative consequences. The scientific method helps to generate new information, but it can also be violent—especially when the experiment is not carried out on the 'self' but on the 'other'. The social movements of protest challenged this notion of the scientific experiment of progress on tribals, farmers and nature. In this modernization project the pursuit of science becomes a movement of victorious discoveries and leaves no place for "defeated" knowledge systems. The mono-logic, linear notion of progressive science regards other forms of knowledge as non-knowledge and locks them away in a museum. Rather, marginalized people should be recognized as bearers of valuable knowledge in

their own right, and producers of new knowledge and sustainable practices of dealing with the world. Their expertise in domains such as agriculture, animal husbandry, food processing, handloom, and conservation of biodiversity makes them valuable partners in the new knowledge society.

If societies do not learn to assimilate modern 'western' science in their own, culture-specific ways, the negative aspects of science will overtake the positive, and the violent character of science will prevail over the beneficial. The political project of democracy is thus clear: democratisation of institutions without the democratisation of knowledge and science is futile. Here again the insights of Gandhi merit attention—both in understanding the violence in the scientific method and in working out alternative scientific imaginations through his work on, for example, khadi and village industries. The All India Spinners Association (AISA) and its sister All India Village Industries Association (AIVIA) can be seen as experiments in creating alternative institutions of science, democracy and culture, and not just as economic experiments or as vehicles for India's freedom.

Science in India today can be seen as a site for various struggles. Extending the argument in the previous chapter, the opposition of crowd and expert needs to be challenged, and the idea of the citizen needs to be renewed as a person of knowledge. It is by re-working the idea of the citizen as possessing a repertoire of knowledge and expertise, that we can open up secluded spaces which modern science has hitherto forbidden to the nomad, the tribal and the informal economy. This will liberate and enable their craft consciousness as a method of survival, their tacit knowledge as a source of improvisation, their ecologies of memory and technology as repositories of useful knowledge. The rationality, methodology and modernity of science and technology can only be beneficial and constructive when complemented by the playfulness, creativity and improvisation of the tinkerer.

Also time needs to be pluralized. Both history and progress have become deeply problematic for a nation state that is so committed to industrialisation. Development, as Mahashweta Devi once said, becomes the rape of the countryside, justified in the name of history. To pluralise time is to pluralise the possibilities of life and living for parallel cultures that do not follow modern calendars. If time is narrowly taken as linear and historical, the tribe will remain only as an oral memory and its crafts will only survive in a museum. The beauty of modern science also lies in the multiplicity of time that it offers. We only need to assure that our societies, democracies and policy-making systems recognize and exploit this opportunity.

The brutality of scientific violence goes beyond physical violence. It might impinge on the body but the long-term violence lies in the logic of its world-views and its concepts. This Manifesto proposes an anthropology that will help world-views that were stored away by science to re-enter a dialogue. Part of the violence of science is its also being the vehicle of the nation-state. Hence, a non-violent (or at least less violent) future of science lies in celebrating alternative imaginations and broad spectra of expertise. Such alternative and complementary imaginations also need to restore a gender balance. Science and technology have erected the myth of masculinity and of an impersonal machismo. Since wars began in the minds of men, the defences of peace must be reconstructed in the minds of women and children (to rephrase a UNESCO manifesto).

Unindicated hysterectomies in Andhra Pradesh: Science, Violence and ethics

A doctor couple with the Life Health Reinforcement Group (Life – HRG) working in rural India not too far from Hyderabad projected as the medical capital of India found a number of young rural women undergoing hysterectomy operations (along with the removal of ovaries) as a solution recommended by qualified and certified allopathic medical practitioners for often basic gynaecological problems. This practice usually recommended as a solution of last resort after several other tests and remedies including pap smear tests and informed consent of patients was being practiced as a normal activity without any rigorous examination. This 'surgical menopause' has been possible due to the ease of operative procedures made possible through modern science and technology even as the imprecise nature of the intervention and the effects on the female body are relatively unknown. In the absence of an ethical framework and guidelines for intervention, there is violence caused to women who are poor and who are not informed of possible longer term effects on their bodies. The silence and helplessness of the medical community to examine this phenomenon when the doctor couple brought this to their notice indicates the absence of *swaraj* of the medical fraternity with their profession that is increasingly controlled by finance capital as also the complex relation between the possible violence of science without an ethical frame of action and precaution. The pilot on medical ethics also shows the importance of technological responsibility of scientists as demonstrated by the doctor couple who sought to carry societal concerns to the scientific community.

Towards trusteeship as a new relation between science and society

This Manifesto proposes to reconsider the social contract between Indian science and society. Rather than thinking about the relation between them only in terms of a contract, it makes a plea for reinvigorating the ideals of gift giving and hospitality. With such a form of trusteeship we can hope for a socialisation of research and technology as called for by the larger project of which this Manifesto forms a part. In translating the vision of a non-violent science as articulated in Hind *Swaraj* through khadi, Gandhi built on the idea of science for sacrifice. The members of the Ashram and of the khadi service spun khadi for sacrifice and to create a 'charkha atmosphere' that would encourage experimentation and innovation. While the khadi movement created incentives for innovators through well-advertised prizes such as the Charkha Prize for an improved spinning wheel, citizens were encouraged to see themselves as trustees of their products and innovations and were encouraged to share them for use by institutions such as the AISA. The design of the charkha prize itself was a case of socialisation of science where the design criteria incorporated the conditions of the poor user in the village. Rooting social needs within a politics of alternate imaginations has been the contribution of various social movements. Dissenting views, rather than being silenced or ignored, need to be engaged with in a dialogue aiming at a greater democratisation of science. Carrying out this challenge not only needs a fundamental reworking of the very idea of expertise as elaborated earlier, but also a new idea of the relationship between science and society.

This Manifesto proposes to add the idea of trusteeship to that of social contract, in order to reshape the relationship between science and society. The vocabulary of contracts typically implies that the contract partners see themselves as opposing parties. This

oppositional perspective then includes the possibilities of mistrust and cheating, and a need for checking and control. Such a perspective belies the mutual dependence between science and society. No scientific institutions can exist without support of society (as captured by the 'socialisation' concept) and current societies are thoroughly constituted by science and technology. This Manifesto invites the scientists to regard themselves as trustees for those on whom they depend for the making, the distribution and the use of knowledge. And, building on the previous chapter's generalisation of expertise and knowledge, also others—who have knowledge of a different kind than scientific—are asked to behave like trustees holding their riches of knowledge on behalf those who do not have the expertise.

All current holders of knowledge—whether labelled 'scientific', 'experiential', 'alternative', or 'modern'—will have to make their choice between fighting wars over knowledge or being trustees of knowledge. All will retain the stewardship of their knowledge and increase and use it, not primarily for their own sakes, but for the sake of the nation. This would need to be backed by new regulations of intellectual property rights, as well as those that protect the environment and people against misuse and exploitation of knowledge. It would also require new ways of giving shape to this idea of trusteeship, complementing the contractual relationship between science and society. Public debates and other new forms of democratisation of science and technology need to be experimented with. An agreement on central values, shared within a society and the foundation for such trusteeship and stewardship, is needed too.

A good example of how this vision of trusteeship in science can be put into practice is the *swaraj* that farmers have experienced in several parts of India through the System of Rice Intensification (SRI). SRI is a set of practices that involves a combination of principles of traditional farming such as alternate wetting and drying, single seed transplantation, use of organic inputs, with principles derived from close observation and understanding of novel practices such as wider spacing of much younger seedlings. This civil society innovation originated in Madagascar in Africa by a Jesuit priest Henri de Launlanie who offered it to African farmers as a gift that has since been offered repeatedly by others in the spirit of trusteeship. In a short span of over a decade SRI was introduced to the rest of the world through Norman Uphoff who placed the knowledge on SRI in public domain and treated it as an open source innovation. SRI has been accepted by farmers and researchers in 42 countries. In India, several thousand small and marginal farmers have adapted this innovation in their rice fields to improve farm incomes and soil health, and have started to use the principles of SRI in other crops. The SRI movement in India, and the rest of the world, has seen several alliances of farmers, civil society organisations and researchers who are keen to look at themselves as trustees of knowledge. The internet has enabled knowledge dialogues between different kinds of knowledge creating spaces for meeting different forms of expertise.

Sustainability, Plurality and Justice

Scientists, policy makers and citizens need to renew their responsibility in decision-making about India and the role for science and technology in its further development. A new form of trusteeship by scientists for society will take into account the marginalised people who have not benefited enough and in fact suffered from science and technology which have unthinkingly caused violence and amplified existing inequities through a mindless pursuit of progress and economic growth. This Manifesto argues for learning from India's own history, from the strength of its local institutions and dissenting science movements.

What should be the implications this new trusteeship? How to move forward? What is the role for science and technology in shaping the future of India? Firstly, an understanding of sustainability is needed that goes beyond functionality by including diverse forms of subsistence and survival. Secondly, a democratic politics of science and technology is needed that understands how a society becomes unduly vulnerable when it does not celebrate its plurality of knowledge systems. We imagine new citizens who carry within themselves a confidence of identity and of diverse forms of expertise, craft and knowledge. Thirdly, this Manifesto makes a plea for cognitive justice—for a justice that builds on and gives shape to knowledge democracy.

Redefining sustainability

The world today, this Manifesto argues, is facing multi-faceted crises: a resource crisis, a climate crisis, an institutional crisis, and an economic-financial crisis. Speaking from the margins of this crisis, this Manifesto urges the new commons to turn these crises into opportunities. It is time to re-visit our definition of sustainability to include survival and subsistence. A new conception of sustainability will plan for everyone's needs and for strengthening local institutions. This re-conceptualisation will question the blind faith in technocratic institutions and the use of economic instruments to evaluate sustainability.

When talking of growth or scale, sustainability is seen as a function of productivity and efficiency. It is a reductive term that does not challenge market economics and which sees nature as a resource to be exploited. This Manifesto proposes that for a society to be sustainable in the long term, the concept of sustainability needs to be broadened by looking at nature, by going beyond industrial factory time, and by incorporating diversity. Societies that traverse through time in a linear fashion have different realities along a timeline. In India such realities exist alongside each other. The linear timeline splits into multiple realities that exist simultaneously. The reality of that part of society that benefits from science and from the "progress" it offers exists parallel to the reality of other groups of people who are marginalized and excluded from this "progress."

The margins have helped us understand risk better and have shown how subsistence economies often improve conditions through risk minimization rather than profit maximization. Over a million famers in Andhra Pradesh have, for instance, moved away from a distress causing strategy of reliance on external inputs that promise maximum

profits and adapted principles of Non-Pesticidal Management (NPM) to increase farm incomes by minimizing risks.

New notions of sustainability that redefine livelihood force us to define the problem of our society's margins differently. People living in the margins, pushed away from mainstream discourses, emerge with strength from this re-definition. What do we learn from our margins when we recognize how large they are? In what way do our margins survive? Can we use science to benefit marginalised people and to stop creating new forms of violence and exclusion? To be sustainable is thus to have a theory of non-violence.

To see how science and technology can help re-define sustainability, the question of energy, which has been central to so much scientific enquiry as well as social developmental policies, we offer an example (see text box below). Science and technology are pre-occupied with large electricity systems, with fuels, and with production and distribution. Electricity companies largely work from a supply perspective, catering to economic needs that are easy to quantify. A more decentralized perspective that looks at use in the context of social needs will necessarily include long-term benefits to balance the older notions of economics. As opposed to the current supply-centric growth-oriented paradigm, an alternative perspective would advocate an end-use centric, development-oriented paradigm. Prevention and end-use efficiency are central criteria, rather than cure and consumption. Promoting equity and democratic institutions then necessarily becomes high priority and education should support initiatives to achieve these goals. Such a perspective would work simultaneously towards catalyzing a societal transformation.

Reconstructing Sustainability in the Built Environment

It is estimated that the construction industry accounts for 22% of carbon emissions and is thus a significant contributor to climate change. Disasters are sites where reconstruction of the built environment occurs at an accelerated space.

A study on piloting knowledge *swaraj* that looks at the issue of reconstruction in three recent disasters in India – the Gujarat earthquake, the Tsunami in Tamil Nadu and the Bihar floods on the Kosi river - has shown how in the absence of processes to involve communities on issues of habitat choices, the reconstructed colonies end up forcing standardized living spaces with choices of material that have a high carbon footprint. There are however examples of sustainable reconstruction, such as the dwellings designed by Laurie Baker, that are organized around design principles that value the client's knowledge and build on it through an appropriate choice of building material that incorporates sustainability and is not costly too. These choices indicate possibilities of a *swaraj* in the built environment and are worthy of renewed interests by professionals and public policy experts in the light of newer challenges of sustainability. The case study also suggests that these choices are not typically either only traditional or only modern but are mediated and socially constructed by the communities and that the professional scientists or technologists can play an important role in shaping and co-creating alternatives with communities.

Plurality and democracy: experiments from civil society

Plurality of knowledge is an engagement across differences, especially when it is acknowledged that there are different experts.. When we include notions of survival and economy of subsistence into sustainability, we recognize plurality in different ways of living such as in the existence of craft and tribal communities. When we understand multiple and often oppositional realities—of rural and urban, of agricultural and industrial, of traditional and modern—that push large sections of our society into the margins, we can re-examine the linear notion of time and recognize the parallel realities that this Manifesto wants to celebrate.

But what benefits are to be expected from the co-existence of diverse realities that seem to exclude each other? Whether through

traditional occupational and social classifications such as caste or through more modern segmentations through class and scale—differences exist in our society. Every society has a structure through which it defines an optimum scale and builds logic of governance. Traditionally the caste system worked on socio-economic transactions, with no space to negotiate the political system. One was born into a lifestyle, or an occupational choice, and the structure and hierarchies enforced by these became the foundations for Indian society. Any movement out of this structure became impossible and thus oppressive. The modern state tries to address this imbalance through giving equal political rights to every citizen. But how can Indian society ensure this equality, given the diversity that exists within it?

To define equality without falling into a bland language of homogeneity, a new language of heterogeneity is needed. . Is it possible to move beyond a slogan of "unity in diversity" that makes the Indian plural identity disappear? What does being different mean: being diverse, or alternative, or dissenting? Diversity can come from isolation of ways of living and across geographies. When these alternatives engage with each other in a modern context, this will typically happen within some kind of constitutional space in which secularism facilitates their interaction through erasing their identities.

Does science create alternatives? Does it allow for cultural alternatives? When tribals in the Narmada valley are displaced in the name of scientific and technological development and are offered work in the factories, can this offer be considered a cultural alternative? When cultures built during centuries are destroyed for someone else's irrigation and electricity, as in the case of displacement of communities living close to the river, this seems more a case of denying plurality than creating alternatives. For a society to be sustainable it is imperative that people participate in the choices that will impact them, and that there is recognition of knowledge plurality. This is the best guarantee that there will always be alternative solutions available in a society. Democracy as a theory gives voice and as a practice it allows for participation; but it is still incomplete if it does not allow for alternatives that challenge the status quo and celebrate the margins.

Cognitive justice

There have been various dissenting peoples' movements in recent history that challenged science policy. These asked for reform and change against the violence that dominant forms of knowledge and politics cause to other forms of knowledge and science. These dissenting movements were strongest where the survival of a marginalized few was being eschewed for the sustainability of the so-called greater common good. Does science as it is being practised today allow for different ways of knowing how to co-exist? Can science become more tolerant to allow for plurality of ways of knowing? Can science reflect the violence it engenders and amplifies by creating a dominant paradigm that marginalizes people through centralizing of wealth and resources, while privileging its own ways of knowing over others' so-called "non-scientific" forms of knowledge? What are the implications of this Manifesto's plea for plurality for today's science policy? If we have to reduce the vulnerability of our technological choices, it can only be done with a multiplicity of expressions that exist on an equal basis, valued by Indian society for their contribution to reduce the risks of the dominant paradigm over time.

It is this diversity of scientific imagination that Indian knowledge society needs to take seriously. Such diversity has been made possible by the co-existence of plural knowledge systems in health, textiles and many other sectors in India. Rather than mimicking ideas of universal science, Indian scientists need to recognise and be empowered to engage with plurality, in order to create and celebrate the diversity of knowledge based on a nuanced understanding of expertise outlined in the second chapter of this Manifesto.

Taking such knowledge democracy seriously implies a new form of justice—cognitive justice. Cognitive justice recognizes the right of different forms of knowledge to co-exist but adds that this plurality goes beyond tolerance or liberalism to an active recognition of the need for diversity. It demands recognition of knowledge: not just as method, but also as a culture and a way of life. This pre-supposes everything this Manifesto has argued for: that we need a pluralistic view of expertise, of science and technology, of knowledge and craft; that we recognize that knowledge is embedded in culture, that every knowledge has its own cosmology; that we need to add trusteeship to the social contract between science and Indian society to own up to India's rich plurality of parallel knowledge systems; that we need new engagement of civil society to build a social democracy with the knowledge democracy. The plurality that cognitive justice pre-supposes and builds on demands the diversity of time that this Manifesto mentioned previously. Current citizenship is built on the instant time of global financial markets and local industrial manufacturing plants; other varieties of time such as tribal time, body time, and festival time need their place on the timetables of new citizenship to allow for cognitive justice.

Ethics and Technoscience

It would be a strange juxtaposition if science surrounds itself with immaculate innocence while technology holds the burden of guilt, irresponsibility and irony. The modern praxis is completely different and conceptually demands a new integration of science and technology, and a nuanced harmony of theory and practice that goes beyond the current standard linear view of science -> innovation -> technology transfer. The concept of techno-science has been coined to capture this. This techno-science is a hybrid entity, and quite different from technology and from science as we normally conceive these. Yet, technoscience constitutes both technology and science.

One of the key characteristics of technoscience is the increased interaction, if not seamless transition, between the spaces occupied by science and technology. This is clear in the industry-university relations. Values and norms of industry and academia are changing as a result of actors moving from one space to the other and back. That different sets of norms are emerging is not disputed. Which new norms are replacing the old ones and whether that is desirable is an issue for dispute. One example of this is the evolution of the IPR norms and the accompanying discussions.

An efficient system is often viewed from supply-side considerations. Efficiency is typically interpreted as technically and/or economically efficient. The demand side—the people who "receive" the system and its output—is inadequately represented here. Often, the only representation at the demand side (i.e. the user side, or societal side) resides in utilitarian calculations and arguments, often—ironically—provided by the supply side. The standard argument then becomes that the system's output serves the greatest good to the greatest number.

From a Gandhian perspective, such utilitarian ethics may not be the best way to conceptualize the wishes of the people, or the efficiency on the demand side. Remembering Gandhi's adage for pursuing any activity—that the activity should ameliorate the condition of the weakest and the neediest individual—the utilitarian view becomes ethically disputable. Gandhi's critique in Hind *Swaraj* of railways, hospitals, and the legal profession, was that all these institutions might help some, but could also increase the probability of wrong-doing. And this was unacceptable to Gandhi.

Energy Swaraj

One important example of techno-science, and a good example of how a new ethical approach might work out, is energy generation and distribution. What would an "energy *swaraj*" look like? The quest for Energy *Swaraj* could begin by revisiting the pioneering work of Amulya KN Reddy and others on energy for sustainable development. In the mid 1990's, they advocated a paradigm shift in energy from the current GROSSCON (Growth Oriented Supply Sided Consumption directed) paradigm to the DEFENDUS (Development Focused End Use oriented Service directed) paradigm. They attributed seven sins to GROSSCON: unwise (having a consumption emphasis), unfair (bypassing the poor), unclear (not being transparent), un-frugal (ignoring efficiency improvements),

unbalanced (having too much of a supply emphasis), uneconomic (with an exorbitant capital requirement), and unsustainable (having a negative environmental and societal impact).

This critique of GROSSCON could indeed be a starting point for formulating an energy *swaraj*, but the framework needs to be adapted to today's changed context. This context is marked by a high impact of liberalisation-privatisation-globalisation policies, an increasing neglect of the poor, a weakening of institutions, over-straining of natural resources and the impending fuel-climate crisis. An energy *swaraj* framework should be based on integrated resource planning, which maximises the area of intersection of the three E's—economy, equity and ecology. Including economic growth is necessary to support income-generating activities and increase purchasing power. Equity implies an explicit focus on access, targeting of subsidy, fairness in quality of service. And ecology focus implies an internalisation of environmental and livelihood impacts, of promoting end use efficiency and renewable energy sources, as well as ensuring climate justice. This approach would mark a shift from the current energy policies, which largely have a short-term focus on the energy utilities (minimising cost and maximising profits), to a paradigm of trusteeship with a long-term focus on all actors—energy utilities, consumers and society at large. Examples of this include efficient wood stoves; solar water heaters, cookers and lighting systems; afforestation; support for public transport; promoting energy efficiency; innovations for renewable energy etc.

What would the components of such an energy *swaraj* be? *Swaraj*, or self-rule, has to address the concerns of all. This implies an emphasis not just on energy service and energy supply, but also on democratic processes of decision making and energy governance. This Manifesto will thus elaborate this example of energy *swaraj* under three broad headings: energy service, energy supply and energy governance.

Energy service

Energy service is to be the central aim, rather than energy supply. Let us identify the major energy service areas that have a transforming impact on the majority of people, and focus on improving them: in countries like India, for example, this would include cooking, lighting, drinking water pumping, irrigation pumping, etc.

The first priority then is to provide such energy service to meet the basic social needs (household lighting, cooking, community drinking water supply etc), which may require small quantities of energy, but would result in a significant improvement in the quality of life for many. The next priority would be to meet economic needs (irrigation pumping, cottage industry etc), which enhance the purchasing power and help overcome factors that keep people poor. While planning for transport, the priority would be to encourage public transport options, and towards minimising travel needs through better planning. Buildings should be constructed (and managed) to minimise artificial lighting and climate conditioning. Water use for agriculture should be optimised through a natural resource management approach, which takes land use, cropping pattern, efficient irrigation techniques and community water resource management into consideration.

Energy supply

The idea of trusteeship implies internalising livelihood and, social and environmental impacts while planning large centralised energy supply options (coal, gas, large hydro, and nuclear). This might lead to different choices about a balance between centralised and decentralised energy systems. An equal treatment of both these systems should be guaranteed, so as to give people the highest benefits with the smallest risks; it is likely that this will result in much higher allocation of resources to decentralised systems. Additionally, and in the light of current climate change threats, it is crucial to promote renewable energy sources such as solar, wind, small hydro, and bio-mass.

Energy governance

Planning, implementation and monitoring of energy systems should be democratised by an informed participation of citizens and users.

It will help to internalise and strengthen the linkages to other questions—including livelihood issues, fuel and climate constraints, and gender dimensions of energy. To counter the recent withdrawal of the State from service delivery sectors and to support an increasing role of de-centralised energy systems, participatory regulatory mechanisms need to be developed at national, state and local levels.

Towards a Knowledge Swaraj

The high profile 'India everywhere' campaign at the Davos economic summit of 2006, the recent launch of *Chandrayaan* (India's mission to the moon), the recognition that India has the second largest consumer market in the world and that it has more degree-holders than the population of France—are all indicators of India's scientific and technological prowess. This celebration, however, is tempered by the embarrassing Human Development Indicators of India and the evident disconnect of large sections of the Indian population from science and technology. What do the Indian people get from science and technology? What are their priorities? Do policy makers of today have the capability and patience to engage in a dialogue with citizens to find answers to this? Should Indian people only be seen as passive recipients of the "blessings" of science and technology; be grateful for its short term mercies; silently bear the damages it inflicts in the name of social development?

Democratising Knowledge: Societal Dialogues on Nanotechnology

On January 27, 2011, the Dutch public's agenda on nanotechnologies, titled "Responsibly forward with nanotechnologies", was presented to the Government of The Netherlands. This resulted from the Societal Dialogue on Nanotechnologies in 2010 wherein Dutch citizens spoke out about their research priorities: what to do and what not to do, what they fear, and a hope for balancing the risks and benefits.

Nanoscience and nanotechnology deal with the very small and have wide ranging applications but potential hazards with scientific evidence of some toxicological risks that is still not known. Following the Societal Dialogue the general public in The Netherlands is more aware of the risks of nanotechnologies, and at the same time more supportive of further nanotechnology development. This is surprising and is in contrast to the long-held views on the relation between the public and science. The standard view on "public's understanding of science" argues for better "risk communication" as the general public does not understand science and technology sufficiently to appreciate its benefits, and due to lack of knowledge irrationally fears new science. The view that emerges though is that Dutch people are more fearful of a government that hides potential risks of nanotechnologies than the risks themselves—when monitored and researched well. Parallel to the process of the dialogue, the knowledge and opinions of a representative sample of the Dutch population was surveyed. "Having heard of nanotechnologies" increased during the societal dialogue from 54% to 64% of the Dutch population; "knowing the meaning of nanotechnology" increased from 30% to 36%.

Four elements were crucial in the set-up of the Societal Dialogue on Nanotechnologies above. (1) An independent committee was responsible for the organisation of the dialogue. (2) The committee created a three-step process of providing information, raising awareness and having the dialogue. (3) Most of the substantive work was outsourced, to keep the organising committee credibly independent. A broad variety of scientists, NGOs, firms, and individuals were responsible for these projects. (4) The use of a broad spectrum of media (from TV and Internet to science cafés, theatre plays and teaching materials) and the participation of a wide range of people (from children to scientists, from religious organsiations and groups, patient organizations to industrialists) contributed to the solidity of the resulting public's agenda (see www.nanopodium.nl).

The need for democratic experiments

This Manifesto is grounded in the firm belief that it is possible to develop new forms of trusteeship, new forms of people's engagement with science and technology, new forms of science and technology for the democratic development of Indian society. One example that illustrates this is an experiment with civic engagement during the earliest stages of nanotechnology in The Netherlands.

The democratic experiment and dialogue on nanotechnologies shows that it was especially the heterogeneity of means that proved successful. Rather than a naïve belief in the Internet as a "global panchayat," the committee used a combination of small-scale but specifically targeted activities,

with large-scale broadcasting and publishing via TV, printed media, and Internet. This dialogue yielded an interesting result that is potentially farther reaching in terms of its societal importance than the regulatory governance of nanotechnologies. The general attitude certainly is not anti-science; but the public is not prepared, as in the 1950's, to give scientists a blank cheque either. Instead, a continuous critical appraisal of risks and benefits of science seems to be called for: a new form of democratic risk governance.

The mechanisms to provide such a risk governance of science and technology are not readily available. Countries need to experiment with such innovations of democracy, as much as scientists experiment with the new technologies that shape our world. It is unlikely that what worked in The Netherlands will work in India, and vice versa: the difference between the proverbial consensus-oriented Dutch and the equally iconic diversity-celebrating Indians may be too large. But the democratic issues remain just as pressing. Can The Netherlands find ways of democratically coping with the opposition around nuclear power: the 'new' benefits of lower CO2 emissions versus the 'old' risks of nuclear waste storage, the 'old' benefits of energy autonomy versus the 'new' risks of international terrorism? Can India find ways of democratically reaching a well-informed and broadly shared policy on Bt Brinjal by moving the current moratorium to a next phase?

Elements of a science and technology policy

This Manifesto is not anti-science or anti-technology, but it does imply a change of the dominant paradigms of science and technology and challenges liberal democracy by using a language of *swaraj* and swadeshi of the Indian people, leading to a fundamental renewal of societal institutions and the role of knowledge therein.

The change of paradigms, call for innovative ways of celebrating the rich variety of parallel knowledge cultures in India and of renewing the relevance of "traditional" knowledge and craft. The inevitable consequence is that space will be given—within this science and technology policy—to religion and multiple cultural identities.

Ethical dilemmas now reappear in a new form. Whether intellectual property rights, patients' consent, or the ethics of displacing people for the common good—how can we include the Gandhian option of non-violence in the gamut of strategies that techno-sciences employ for the development of the world? Sustainability takes the form of inter-generational and cultural trusteeship, making the original Gandhian trusteeship concept contemporary.

Socialising Science in India: Kisan Swaraj Yatra

In 2010, starting on the birth anniversary of Gandhi from the Ashram on the banks of the Sabarmati river in Ahmedabad, members of a large, informal pan-India network called ASHA set off on a "Kisan *Swaraj* Yatra" to draw attention to the plight of farmers in this country, the continuing agrarian distress in the countryside and to also highlight sustainable solutions. This Kisan *Swaraj* Yatra travelled for 71 days, meeting thousands of Indians in villages and cities to initiate a debate and knowledge dialogue on issues pertaining to "Food, Farmers and Freedom", or Kisan *Swaraj*. The Yatra questioned the existing economic model of development that has led to distress in Indian farming, with many policy makers believing that displacing farmers from agriculture and shifting them to urban centres is the only way out. The Kisan *Swaraj* Yatra tried to point out that our Indian vision of development need not be borrowed from the West, and that rural livelihoods can indeed be improved and made viable without causing concomitant environmental destruction. These solutions lie with communities and their own positive innovations. The Yatra, with its emphasis on *Swaraj* and Swadeshi, found large resonance with the people that it met over its 16,000 kilometres journey and has come up with a Kisan *Swaraj* Policy for discussion by scientists, researchers, farmers, consumers, political parties and policy makers.

Practicing Sustainability through Knowledge Swaraj

Farming in many parts of Andhra Pradesh is dependent on ground water. The use of borewell technology in recent times has led to an explosion of private wells and the conversion of a common property resource such as ground water into a private resource. This situation has led to heightened competition amongst farmers leading to a tragedy of the commons and the government responding by banning new borewells with a view to prevent unsustainable use. The Centre for World Solidarity (CWS), a civil society organization, followed an alternate approach to mitigate the problem. It combined existing traditional knowledge and practices of sharing surface water (known as Gonchi) with simple tools for water literacy and budgeting, to initiate knowledge dialogues amongst farmers to find ways out of the problem.

A pilot project on 'community based governance systems of ground water' with local partners enabled farmers to cooperate rather than compete, by creating a situation of sharing ground water and providing social regulation to prevent excessive mining of natural resources. The successful pilot was expanded from 2004-2010 with the formation of over 300 'sharing groups' in 19 villages in 5 districts of Andhra Pradesh. The law that failed in most parts of the state was implemented voluntarily by the community that created new institutions and mechanisms for equitable access, even as the communities agreed to augment groundwater resources through conservation, recharge and demand-side management. CWS' work was expanded by WASSAN (Watershed Support Services and Activities Network), another civil society organisation, that extended this model through a network of pipes to ensure protective irrigation in the main cropping season for a large number of farmers rather than assured irrigation for a small patch of irrigated crops. The work of CWS shows how sustainability can be practised by ensuring justice and equity for farmers by combining plural knowledge systems through dialogues with communities.

A new science and technology policy needs to be as down-to-earth and rooted in the Indian experience as this Manifesto is. That implies the need for a transparent discussion of the economies of science and technology. Globalisation exists, but it is also continuously remade by the accumulated efforts of a multitude of actors, individual and institutional. Economic and financial relations are important, and sometimes even violent, but not unchangeable. A new Indian policy for science and technology will aspire to quality rather than to quantity, and will invest in infrastructure and process rather than events and products. For instance prevention and service delivery will be prioritised in health care; and value and self-esteem become central goals of education, rather than producing a willing and unreflective work-force in deceptively value-neutral institutions.

Elements of a people's policy

As important as a science and technology policy for India, is the self-rule by Indian people of their science and technology. That not only implies an effort to think from the perspectives of the peoples of India when drafting the policy document, but also an effort to create the necessary accompanying measures by reinventing Indian democracy and its social institutions. The challenge is to dream beyond the boundaries of state politics.

Taking seriously the arguments in this Manifesto reinstalls the citizen as an expert, as an inventor. It not only reinstalls the richness of parallel knowledge systems, but also celebrates the morality of the weak and marginalized. It challenges the current moral base of science and technology as validated by the state, which creates second-class citizens without rights to their way of life and knowledge cultures. A new science and technology policy, for and by the people, needs cognitive justice. It gives, following Gandhi, an identity of strength to the weak.

This Manifesto set out to rewrite Hind *Swaraj* and explore the meaning of Indian self-rule of its science and technology. As Gandhi reinvented Europe while outlining an independent India in Hind *Swaraj*, this Manifesto argues for reinvestigating the relations between India and the world, while developing science and technology into a plurality of knowledge and crafts to create cognitive justice and a sustainable future for India and its people.


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