Democratising technology

Reclaiming science for sustainable development

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1 Introduction

The great disparities in quality of life between the fully industrialised and less-industrialised countries are mirrored by a 'technology divide'. The lack of access by billions of women and men to the most basic technologies and the resources needed to create sustainable livelihoods helps perpetuate poverty, disease and hunger. The concept of 'technology transfer' has long been presented by the international community as a means to address this great divide.

Those proposing greater investments in scientific research often claim that technology transfer and globalised free trade will close the technology divide, and equalise opportunities among countries. In a report published by the United Nations Conference on Trade and Development, Jörg Mayer recently went so far as to suggest that globalisation would 'ignite a virtuous circle of technological upgrading and skill accumulation in technological latecomers.'

It is easy to see why a consensus exists between most governments that technology transfer contributes to economic growth and poverty reduction. Governments of less-industrialised countries see it as a means to acquire modern, up-to-date technologies, and governments of the more industrialised nations see it as a vehicle for exports. Yet decades of technology-transfer policies have had little visible impact on the daily experience of billions of women and men who are excluded from access to, or control over, old and new technologies alike. Worldwide, one billion people still have no access to safe water, 2.4 billion have no sanitation, and 840 million remain chronically undernourished.

Beyond access

Just providing access to basic technologies is not enough. People also need control, both over the use of existing technologies and the development of new ones. The only way of ensuring that any technology will benefit people is to provide opportunities for them to participate in its development. Such processes should not only draw on their existing knowledge and practices, but also their assessment of particular circumstances in which the technology might be used.

The twentieth century has seen the establishment of democratically accountable systems of governance in many parts of the world, yet science and technology by and large escaped such mechanisms of accountability. The power to generate and apply new knowledge has increasingly become concentrated in the hands of the state and large corporations, able to guide the directions of research and development through their control of funding and dominance in consumer advertising. Yet neither state nor corporations have been democratically accountable for the ways in which the innovations have impacted, often negatively, on people and the environment.

Three snapshots

On both sides of the technology divide there are countless examples of situations where technologies have been introduced without proper democratically accountable safeguards.

- Sanappa is an Indian smallholder farmer. Within a small group of villages where suicide is almost unheard of, twenty-three of his neighbours took their own lives by drinking pesticides in a single year. Seven years on, public outrage over thousands of such deaths contributed to the electoral defeat of the national government; a wave of organised opposition developed in response to the Indian government's refusal to ban the agricultural technologies and corporate malpractice that had prompted the epidemic of suicides.

- Helen Clark worked in a semiconductor manufacturing plant in Scotland. Like the thousands of her fellow Britons who die every year from asbestos-induced cancer, she suffered the effects of long-term exposure to a toxic working environment. Her employer, a transnational corporation, refused to accept her concerns and did nothing to reduce the health risks. Her alliance with other workers and with concerned university researchers succeeded in convincing the UK government's health and safety agency to criticise the conditions in this and similar semiconductor facilities throughout the UK.

- Mrs Mumbengegwi is a Zimbabwean farmer who has been offered genetically modified seeds in a region where malnutrition is widespread. In 2003 she joined a group of smallholder farmers to hear evidence from specialist witnesses about the pros and cons of GM crops. This 'citizens' jury' of rural men and women then decided to reject the proposed GM crops. Its finding was supported by farmers' unions and was subsequently reflected in their government's GM policies.

These three people are positioned at the interface where technological innovation meets burgeoning democratic movement. Each of their experiences, detailed with others later in this document, provides evidence that people's involvement in the development and use of new technologies is a vital way of ensuring the process can be directed in a manner that will benefit them

While many technological innovations have improved the lives of those who could afford them, many others have either directly harmed people's health, livelihoods and environment or led to further polarisations between the haves and have-nots in society. The question of whether citizens should have a greater say in how new technologies are developed and deployed has only relatively recently moved up the political agenda. In the wake of widespread rejection of technologies such as genetically modified crops – and with technologies such as nanotechnology and responses to HIV/AIDS and global warning the focus of new controversy – the democratisation of technology is now being debated by policy-makers in the UK and internationally.

Governmental use of 'science-based' and 'evidence-based' policy in the UK, Europe and USA often conveniently allows politicians whose decisions turn out to be flawed to deflect responsibility for failures onto previous technical assessments. The trend away from politically accountable judgements and towards 'technocratic managerialism' – using scientific explanations to justify policy – has become institutionalised in governments and large corporations. The system of knowledge and its exclusive ownership through patents, which has

been associated with the rise of industrial production, has also imposed an artificial distinction between scientific investigation and analysis on the one side and evaluation by non-specialists on the other.

The democratic technology agenda

There is an emerging consensus among many concerned individuals and organisations that a better balance needs urgently to be achieved between the advantages of many new products and technologies and the insights that women and men bring though their existing know-how.

The basic claim of the new consensus is that technologies only work for people if these people are allowed to play an integral part in the development and application of any new or existing technology. To ensure that environmental sustainability and equal rights for every individual are safeguarded it is essential to combine scientific and technological innovation with democratic processes that encourage the active participation of all groups in society, unrestricted by intellectual property systems. Recent editorials in influential scientific journals and initiatives by senior figures in the scientific profession suggest that scientists are themselves ready for such an approach.

As people and organisations search for solutions to the great challenges of this century – from global hunger and climate change to HIV/AIDS and urban pollution – the need for democratic accountability in scientific research and technological innovation is more urgent than ever before. The speed of technological change, combined with the increasing distance between policy-makers and those on whose behalf they make decisions, creates huge challenges for attempts at democratisation.

Many individuals and organisations are now exploring new initiatives that may succeed in winning citizens a greater say over how and which new technologies are developed. The purpose of this document is threefold: to describe recent attempts to increase public control over science and technology, to highlight some of the difficulties and trade-offs that such initiatives have encountered, and finally to suggest principles and pointers for future efforts in this vital area of social and technological change.

2 Nine experiences of democratising technology

In the diverse experiences described below, different individuals and organisations have adopted a variety of roles to bring about what can broadly be termed the 'democratisation of technology'. Each account begins with a brief summary of these contrasting roles.

2.1 A major UK medical research charity brings non-specialist carers into the decision-making process about how it spends its research funds.

In the early 1990s, the two-million-pound annual research programme of the Alzheimer's Society focused on the puzzles scientists wanted to solve, rather than on the needs of the Society's thousands of members. Lynne Ramsey was one such member. A prison inspector from South London, she cares for someone with dementia. As a fundraiser, she wanted to know whether the money she raised for the Society was producing useful results.

The research funds, she learnt, were awarded by 'peer review', a standard procedure in scientific research. Applicants submitted their proposals to a panel of experts who assessed only their scientific rationale. The Society was therefore funding research without taking account of the extent to which it would benefit people with dementia and their carers.

In 1998 the Society started to transform the way it funded its medical research. Scientists applying for funds were required to provide a jargon-free description of their proposed research and the possible benefit to people with dementia. The applications were then assessed by Ramsey and her fellow members of the society's Quality Research in Dementia (QRD) network, who rated each project application on a scale of one to ten. Those with the highest scores were then included in the next stage of decision-making.

The citizen-led nature of this research funding process comes from the combination of the QRD's ranking scheme together with an extended peer-review process: formal meetings attended not only by scientists with expertise in the area concerned, but also by carers like Ramsey. Once the scientists applying for money have made their presentation, the 'citizen scientists' ask questions first, before the more technical experts voice their questions.

One benefit of the extended peer-review system is that it has obliged scientists to communicate their science in a way that is accessible to non-specialists. Opposition to this part of the scheme from some scientists was initially fierce, yet today the QRD's success in improving the cost-effectiveness of research in the field has silenced most critics. Now it is the lay members of the QRD network who decide the sorts of medical innovations that are likely to increase the quality of life of patients and carers.

2.2 An Indian indigenous peoples' movement revives a deliberative and participatory process of governance and uses it to tackle the challenges presented by new agricultural technologies.

Girijan Deepika (People of the Forest) is an indigenous peoples' organisation working in East Godavari District of the Indian state of Andhra Pradesh. In 1995 it recruited facilitators from local communities with a view to analysing local problems collectively. They learned that an indigenous system of regular community meetings known as the 'Gotti' was in decline. These meetings allowed issues of concern to the whole community to be addressed, but over the years they had died out or become dominated by a small number of people who did not necessarily represent the diversity of views in the local population. It became clear, however, that these meetings could offer an ideal forum for people to engage in dialogue. The reviving of the Gotti was therefore the first task and was undertaken through a campaign using street theatre, music, dance and painting.

The Gotti is now restored as a vibrant forum for community debate. As an indigenous institution, it offers much greater chances of encouraging sustained participation than discussion and decision-making tools that have been developed by donor agencies in unfamiliar contexts. It is, in the words of participants, a space 'to sit and talk', 'to share our happiness and our sorrows' and 'an opportunity to reflect'.

Agriculture is consistently highlighted as a major concern, particularly where rapid changes have taken place following the introduction of cash crops such as cotton and tobacco. The Gotti offered a space to analyse key agricultural issues with historical maps portraying contrasts in agricultural practice over the previous thirty years.

Crops grown for sale were identified as not offering any livelihood security other than cash, yet having considerable requirements, such as land, plough bullocks, seeds, capital, market, water supply, pesticide and labour. Furthermore, they had led to many negative consequences such as indebtedness, food shortages for people and livestock, no proper market, farmer suicides and health effects such as pesticide poisoning. In contrast, food crops were seen to be useful for encouraging communal work, providing food security and fodder for livestock and poultry, maintaining fertile soil, producing some cash if they were sold, and avoiding debts because the required inputs were so minimal. The disadvantages related to pests and the vulnerability of some crops to heavy rains or winds.

The cumulative analysis over several weeks meant that the resultant actions were often substantial rather than piecemeal, with many communities deciding via a series of Gotti meetings to plant half their land with food crops, reversing the trend towards complete domination of the land by tobacco and cotton. The meetings also initiated a political campaign to make the authorities responsible for most of the decisions in these remote mountainous areas take action on the Gottis' demands, particularly regarding the over-promotion of cash crops.

Local people are clearly in control of what has become a catalyst for social and technological change in this region. At its outset the group received some guidance from urban professionals trained in participatory methodologies, but

decisions about the long-term goals and strategies are made locally. Despite having low levels of literacy, rural people involved in Girijan Deepika have been able to critically assess the new technologies represented by government-promoted packages of seeds, pesticides and fertilisers. They have managed to have their voice heard on this issue as well as other new technologies such as vaccination, GM crops and industrial forestry techniques.

2.3 A top-down agricultural reform programme in Indonesia turns into a bottom-up movement for political accountability and agricultural change.

Integrated pest management (IPM) emerged in Indonesia in the late 1980s as a reaction to the environmental and social consequences of the new agricultural practices that have become known as the Green Revolution. At its height during the 1970s and 80s, the shift from small-scale subsistence farming to cultivation of varieties of food and cash crops requiring expensive inputs such as fertilisers and pesticides, affected rural people all over the industrialising world. Following fifteen years during which pesticides had become subject to annual subsidies of over US$100 million a year, a devastating pest outbreak of the brown plant hopper on the Indonesian rice harvest of 1986 forced the national government to introduce a strategy that moved away from pesticide use towards methods of pest control based on combining external expertise with the farmers' own knowledge of their fields.

A co-operative programme between the United Nations Food and Agriculture Organisation (FAO) and the Indonesian government centred on Farmer Field Schools (FFS). These Schools contained elements of conventional training in methods such as agro-ecosystem analysis, using diagrams generated by smallholder farmers to help them examine different factors affecting their crops. More importantly, however, the Schools also aimed to support and develop farmers' expertise in their own fields, enabling them to replace their reliance on external inputs such as pesticides with indigenous skills, knowledge and resources. Over time the emphasis of the programme shifted towards community organisation and planning of integrated pest management, and became known as Community IPM.

The adoption of Community IPM through Farmer Field Schools has spread to more than one million rice farmers in Indonesia. It might be expected that such 'scaling up' of a successful practice could only occur via a shift in policy by national policy-makers, followed by incentives for farmers to change their practices. However, one of the key lessons from Indonesia, a country with a fragile democratic system that did not allow public meetings of any kind, is the extent to which Schools of 20 and more people were initially allowed and then gradually organised into farmers' unions, which forced a reluctant government to change not only agricultural but other policies related to rural technologies, livelihoods and governance. Community IPM demonstrates that participatory approaches to technology development can be institutionalised by the participants themselves, given an environment that removes political oppression and provides safe spaces for discussion. Farmer groups and associations have now developed their own organisational and advocacy functions, and so are able to bring about pro-farmer policy changes at national and local government level.

There are fears that trends to increase 'corporate farming' will reduce access to markets for smallholder farmers and increase poverty and environmental degradation. There are also market constraints to further enabling IPM. Farmers are currently not permitted to market products as 'pesticide free or low/zero residue', which would facilitate market access. With Farmer Field Schools and their associated political movements having begun to raise the awareness of Indonesian policy-makers about the perspectives of their country's farmers, many have the potential to become a vehicle for broader issues such as corporate accountability.

2.4 An ITDG Zimbabwe initiative draws on farmers' knowledge to work towards the restoration of local food security.

Chivi, in Masvingo province, is one of the poorest districts in Zimbabwe. During a drought in 1992, people survived only by receiving famine relief. Around that time, a project initiated by ITDG began working to enhance the availability of food in the district's households by supporting activities that local people felt were effective, and building new approaches based on local farming skills and experiences.

Before the ITDG project, state extension workers had a top-down approach which generally failed to consider whether the farming methods they promoted would fit the needs of local farmers. Farmers, in turn, tended to wait for external help to change their lives. Their traditional knowledge of land management had been eroded in both the colonial and post-colonial periods and was further eroded by this situation.

When the ITDG programme started, Chivi had farmers' clubs, but these were mainly dominated by men, even though women performed the bulk of the agricultural work. During the 1992 drought, small gardens were abandoned and 90 per cent of arable land suffered crop failure. More than thirty thousand cattle died in the province, leaving most families without draught animals.

By setting priorities through participatory meetings with the local community, especially its women, the project drew on farmers' existing knowledge and researchers' and other projects' experiences to introduce cropping methods that minimised the need for pesticides and fertilisers and enhanced soil and water management.

One project participant, Mrs Muteuri, had become dependent on food aid to feed her family of three children following the 1992 drought. Having participated in the project, she became far more self-reliant. During the 1997 crop season, Muteuri harvested 600 kg of sunflowers, 900 kg of millet and 500 kg of sorghum and shelled maize,– enough food to see her family through to the next harvest and with a surplus to sell. Being able to feed her family and sell the surplus meant that food aid dependence syndrome, which had long characterised the people of Chivi, became for her a thing of the past.

Most important of all was the way the project enabled its participants to reclaim the knowledge that had been ignored or discredited by the Government's

agricultural advisory system or that it had failed to disseminate. ‘Our villagers were seen as knowing nothing, because we are poor – so we just got handed out drought relief,’ commented an ITDG project participant. ‘We now realised that there are many good things we knew as Africans before colonialism and we realised that we are indeed clever’.

2.5 A landless workers’ movement in Brazil supports low cost agro-ecological technologies and challenges the introduction of GM crops by transnational corporations.

The Movimento dos Trabalhadores Rurais Sem Terra (MST – Landless Workers Movement) is the largest organised group of rural poor in Latin America. The MST grew from a small land occupation in the district of Rio Grande do Sul to a movement of over a million of the poorest people in the country. During the past twenty years, it has taken control of fifty thousand square kilometres of land – about the size of the US State of Ohio or three quarters of the Republic of Ireland.

In a country where, until 1988, the illiterate were not allowed to vote, the MST has promoted social justice. One hundred thousand children study in MST schools, and adults gather in tens of thousands of literacy circles across Brazil, so building the capacity of the movement to grow.

While the MST movement has been spreading over rural Brazil, the country’s agricultural sector has become far more integrated into the globalised world food industry. By 1999 seventeen transnational corporations handled around half of all Brazil’s agricultural exports. The emerging global food system transforms previously self-reliant farmers in effect into hired hands on their own lands. This change often leaves such people far more vulnerable to periods of hunger than before. In March 2000, one of the Brazilian government’s advisers pointed out that farmers could not afford to risk the technological packages of high-yielding seeds, fertilisers and pesticides that were needed to enter competitive export markets. He estimated that around three million family farms in Brazil have very little income and are therefore ‘sick’. About half the migration into cities in Brazil, around four and a half million people between 1996 and 1999, comes from agricultural families.

The MST believes that the programme of rural land reform it has started, together with the move towards the localisation of economies, can reverse this trend. Once people own their land and have organised themselves into a powerful economic and political unit, they will be better able to choose the seed varieties and other agro-ecological practices and sustainable technologies that promote their long-term welfare.

In the mid 1990s, the MST began promoting a model of low-input agriculture – agro-ecology – that prioritises crops that can be eaten, consumed and marketed locally, rather than sugar-cane and soya that are subject to the vagaries of export markets. People who are returning to work the land from the city slums have often lost their families’ experience of farming, agronomist Jose da Silva has found. ‘They’ve never used chemical fertilisers or pesticides on food crops, so

they don't miss them and can move directly onto organic methods without going through the problems caused by chemical farming.'

More important for wider issues of bottom-up democratisation in Brazil, the powerful political force represented by the MST has played a role along with other people-power movements in coalitions that have led to major set-backs for Monsanto as it attempts to introduce GM crops into Brazil. Those MST farmers practising organic and other agro-ecological methods were particularly under threat. After a series of conferences and votes by regional representatives, they decided to reject currently available GM crops. By contrast, neighbouring Argentina became the world's second largest cultivator of GM soya in 2000 and its farmers are now impoverished.

The Brazilian experience of democratising the control of agricultural land – the most basic resource for rural people – over the past two decades has broader lessons for democratising agricultural technologies and the promotion of agro-ecological farming. Brazil's MST began with a regional focus in the south of the country, but built up a movement that is now prominent throughout Brazil and which has influenced other people's movements through the World Social Forum movement.

2.6 An ITDG project in Sudan combines external with local knowledge to improve brick-making technologies and enlarge markets for co-operatives using the new techniques.

If it were not for the harsh arid climate prevalent in the Kassala region of eastern Sudan where Osman Hummed and Mohammed Ali Abu-Amna live, they would probably farm for a living like many millions of others across the continent. Instead they do something else to survive. They are brick makers for the Shambob Brick Producers Co-operative.

Brick making is one of the main rural alternatives to farming, employing 5000 people around Kassala. But most are kept in real poverty because they produce bricks which are bought by middlemen on behalf of wealthy merchants. Shambob village, where 80 per cent of the families derived their living from brick making, was so poor in 1998 that many of the men could not afford to marry, while the village had no services.

ITDG helped the villagers to form and legally register a co-operative, and trained them in the necessary management skills. Women as well as men are accepted as co-operative members, each of whom makes a basic cash contribution. Throughout the process ITDG representatives deferred to the indigenous knowledge of the workers to help them find the most appropriate way forward.

Local brick makers learned more about brick production processes and techniques from ITDG staff and then began managing their own production and marketing. They started to experiment with new moulding and drying methods, so improving brick quality. The brick makers' incomes rose by 20 per cent in the first year and 67 per cent in the second. They now produce one million bricks a year, and demand is still rising. The improved Shambob bricks have helped set new

national standards in Sudan, and to influence brick makers and consumers across the Kassala region.

By the year 2000 the Shambob brick makers' incomes had risen dramatically, and they were able to improve health services and establish a local school. As part of its shelter programme, ITDG started working with brick makers like Osman, Mohammed and their 113 co-workers to set up a commercially viable and sustainable co-operative which would provide a better income and improve their quality of life.

A big part of Shambob's success was to cut out the middlemen and enable the villagers to run their own business. Equally important was the energy efficiency resulting from the co-operative's successful experiments with alternative fuels to replace expensive wood.

2.7 IT manufacturing workers in Scotland and Thailand forge research alliances to challenge the lack of corporate and government accountability with regard to workers' health.

Part I: United Kingdom

During the 1990s, the growth of the semiconductor industry fuelled the worldwide spread of computer technologies at the same time as government scrutiny of employers' health and safety practices became substantially weaker. Alliances with local rights workers and academic researchers forged by factory workers at National Semiconductor in Scotland have done much to make computer manufacturers more accountable to their employees. At the same time, these alliances have highlighted the challenges of integrating technical data with evidence based on individuals' personal experience.

More than ten thousand people are employed in the semiconductor industry in Scotland, which now accounts for a third of all European personal computer production.

Semiconductor manufacturers portray the industry as free of pollution. Workers, who are mainly women, wear head-to-toe white suits and work in sterile 'clean rooms' where air is filtered to remove minute particles. Industry representatives claim that these rooms are cleaner than operating theatres. Yet, while protecting the production line from sweat or dust particles from humans, such measures do nothing to protect workers from exposure to hazardous chemicals and solvents, some of which are known to have harmful effects on human reproduction.

A former employee of one such firm, National Semiconductor, Helen Clark recalls:

> *'During my interview with the company I was asked if I was affiliated to any trade union and was strongly urged not to contact any previous union. My job training was only for 10 minutes, and it did not include anything about safety procedures or hazards from chemicals. The hazardous gas monitor was never taken seriously, especially when the workload was high, and managers often told us to ignore the danger warning, claiming it to be just a*

malfunction of the monitor, and to continue to work. I worked for six years, from 1979 to 1985, and one day I just collapsed on the floor. The company doctor told me that I should consider retiring, but I was only 36. Further diagnostic tests showed that I had developed stomach cancer and the doctor told me that my stomach had the look of an 80-year-old woman's. Many workers died of different cancers. I tried to fight back and demand compensation from the company. I commissioned a report and even hired a lawyer. Managers would openly say that it is very difficult to fight with multinationals.'

Injured and ill workers did not receive any compensation beyond standard sick pay from the company. The company was not willing to acknowledge that these illnesses had any link with the manufacturing process. The sick women, with a local activist, formed an organisation called Phase II (People for Health and Safety in Electronics), which then formed a partnership with Californian occupational physicians and Stirling University's Occupational and Environmental Health Research Group. The researchers helped Phase II members publish evidence of the effects of the toxic chemicals and build a case for the factories to be visited by inspectors from the government's Health and Safety Executive (HSE). However, during their early inspections, the HSE did not take any samples to check the concentrations of hazardous chemicals, including several carcinogens, in the air or on work surfaces, and received no such data from the companies. Soon, Phase II had gathered enough evidence to launch a lawsuit against the plant, demanding compensation for cancer, birth defects in their children, miscarriages and other illnesses.

In response to the legal pressure from ex-workers and growing media coverage, the HSE conducted a new study into spontaneous abortion rates at six semiconductor plants in the UK. In 1998 it announced that, despite evidence from large studies in the USA, there was no sign of increased miscarriage rates. The university and Phase II co-researchers pointed to the statistical unreliability of the HSE's results, and the fact that the government researchers had ignored employees' knowledge of symptoms and their history. In 2001 the HSE conducted another small study on cancer in the company and found excesses of some diseases that have led to further investigations. Phase II and its supporters indicate that only large-scale studies of the industry will glean the epidemiological data needed to establish accurately the health status of past and present workers in the industry. National Semiconductor still employs over five hundred workers at Greenock.

In a joint paper in the International Journal of Occupational Environmental Health, in 2003, Phase II and the Stirling researchers suggested that assessments of occupational safety were all too often 'exercises that followed paper trails', allowing inspectors to be deceived. The HSE, they concluded, suffered from 'apathy, complacency, underfunding', and was inspecting an industry that was 'fairly secure in the belief that it will not be regularly and rigorously inspected.'

In November 2003, the company, which had experienced a 79 per cent rise in profits that year, announced a further investment of around £11 million to

'significantly increase production capacity' at its Scottish facility. Organisations like Phase II, working together with unions and international coalitions of workers facing similar risks, are continuing to challenge the lack of corporate and government accountability in the industry.

Part II: Thailand

Thailand's IT manufacturing sector accounted for a fifth of Thailand's total exports in 2001. It is characterised by an overwhelmingly female workforce with minimal union representation and weak government oversight. Regulatory capacity is fragmented and overshadowed by the Board of Investment (BOI), which has a mandate to attract foreign investment. The BOI has previously used high-level government contacts to seriously disable the Ministry of Health's only occupational health clinic after it investigated questionable production activities.

In 1988 and 1989, a Californian computer manufacturer called Seagate opened two plants in Thailand. By 1991, worker health problems began to surface and there were four deaths. According to their co-workers, the four who died had all experienced headaches, fatigue, muscle aches and fainting. As a result, Seagate found itself facing strong calls for unionisation. In reaction, Seagate laid off 708 employees who were demonstrating in front of the US Embassy for union action. Seagate's director strongly resisted calls for unionisation, and in firing 708 people ensured that union leaders could not secure the 20 per cent of employees required to officially represent the workforce. When it became clear that the company would not recognise a union, most of the fired workers asked to return to their former posts, but were denied the opportunity to do so.

In response to the abuses of worker rights and the poor health conditions at Seagate, Dr Orapan Metadilogkul, the country's foremost practitioner of occupational health, was asked by a coalition of civil society organisations (CSOs) to investigate the deaths. Dr Metadilogkul concluded that more than two hundred members of the workforce had blood lead levels which suggested chronic poisoning, possibly aggravated by solvent exposure. Seagate disputed the evidence on the grounds that job applicants already had high levels of lead in their blood due to exposure to the high levels of leaded petroleum in local urban areas.

Thai laws exacerbate the lack of access to reliable health and safety data. Employees have no right to know about occupational hazards, nor do they have the right to refuse to undertake certain tasks. The law requires that employees are medically examined, but they have no right to choose the doctor or define the level of examination, or to see the results. Each labour inspector monitors, on average, over a thousand sites. Meanwhile, third party organisations are helpless to assist in monitoring conditions due to the same lack of information that workers face.

While IT firms in Thailand claim continuous improvements in working standards and employee health records, they do not disclose their information, making any attempt to evaluate the claimed improvements impossible. Moreover, there is a basic lack of baseline information, such as historical blood lead levels. However,

the incidence of workplace accidents at Seagate has encouraged Thai CSOs to organise and demand improvements, campaigning for legislation to set up a national institute for occupational health, safety and environment that is financed independently from the state.

Both Scottish and Thai experiences demonstrate that it is important to have democratic input not only into the sorts of technologies that are developed, but also to the conditions under which they are used.

2.8 Indian community groups form alliances with UK research institutes to create an accountability forum for Indian scientists and policy-makers on future agricultural technologies.

Initiatives aimed at bringing new developments in biotechnology under a greater degree of control by non-elites have demonstrated that there are widespread and well-founded misgivings about genetically modified crops among the very people the technology is supposed to lift out of hunger. Between 2000 and 2003 five separate citizens' juries were organised by broad-based coalitions, in Karnataka and Andhra Pradesh, two of India's largest states, in Zimbabwe, and in the states of Ceará and Maranhão, Brazil. Closely involving the UK-based International Institute for Environment and Development, and funded by the Dutch government and the Rockefeller Foundation, the event in Andhra Pradesh has had the most widespread international impact and is described here.

Anjamma, one of the jurors in Andhra Pradesh, is the female head of an extended family of 17 people who survive on just four acres of land, only two of which can be irrigated. She joined 18 other farmers of small and marginal holdings in perhaps the largest-ever event to allow the poor to assess the potential advantages and risks of GM crops. She had not known about such technologies before joining the citizens' jury.

Called Prajateerpu, meaning 'people's verdict' in Telegu, Anjamma's jury sat over five days and heard from thirteen witnesses on a huge range of topics. The witnesses included representatives of the authors of 'Vision 2020', a plan to transform the state's agriculture to one based on GM crops and mechanised farming methods, which was devised by the US management consultants, McKinsey and Co, in collaboration with the state government and funders at the World Bank and the UK's Department for International Development.

As in other areas, the proposed introduction of GM in Andhra Pradesh would come within an industrialised system of agribusiness, grouping small farms into larger units, and the introduction of contract farming whereby a large proportion of the state's land would be run by large corporations rather than by small-scale farmers. It would see the number of people working on the land being reduced from 70 to 40 per cent, equal to a loss of livelihood for around 20 million people with no plans for alternative livelihoods for these people.

Having listened to the witnesses and discussed the issue among themselves, the Prajateerpu jury found that the policy and technical package of Vision 2020 was unacceptable to them. But neither their verdict nor those of the other jury

processes that took place between 2001 and 2003 – one in Zimbabwe and two in Brazil – was a simple 'no'. In most cases jurors were provided with the opportunity to put forward their own carefully considered vision of the future of food and farming, with a wide-ranging list of demands detailing action to be taken by the government, civil society organisations and foreign aid agencies to implement their recommendations.

As for Vision 2020, Anjamma could not understand how any responsible government could knowingly take part in a scheme that would drive her, and millions of smallholder farmers like her, from their land. 'You are talking about the removal of a third of the population. Where will the farmers go? If you throw them away, what will they do with their lives? You have introduced hybrid varieties and also chemical agriculture, and we are now in debt. Now we are talking about GM crops. Again the small and marginal farmers will be losers. The big farmers will walk away with all the returns.'

The citizens' juries conducted on GM in Zimbabwe, Brazil and India differed from many previous attempts at allowing farmers to assess new technologies because the process allowed jurors to analyse the proposed introduction of new agricultural technologies in the context of broader social, economic and political questions. Rather than concentrating merely on specific issues such as land consolidation, GM crops and forest produce, the witnesses' evidence and the resulting discussions ranged across aspects of rural livelihoods that jurors, rather than the organisers or witnesses, thought were important.

2.9 Two citizens' jury initiatives on GM crops – one overseen by a multi-stakeholder consortium and the other carried out by a government agency – provide contrasting qualities of input into the UK government's GM debate.

Following a widespread boycott of GM foods by UK consumers, the UK government launched the 'GM Nation' debate during 2003, which claimed it would inform its policy-making as to whether, and if so how, GM crops would be planted commercially in the UK. In July and August 2003, citizens' juries funded equally by four different organisations – Unilever, Co-op Supermarkets, Greenpeace and the Consumers Association – met to discuss the issues. Having heard a wide range of evidence, a GM Jury in Tyneside and a parallel jury in Hertfordshire agreed with the Indian farmers of the Prajateerpu process – that GM crops should not yet be introduced.

Despite hearing from the same witnesses, each GM Jury reached its verdict independently of the other. The two verdicts broadly agree, in that both juries called for a halt to the sale of GM foods currently available, and to the proposed commercial growing of GM crops. They based this conclusion on the lack of evidence of benefit and an application of the precautionary principle. Both juries also called for long-term research into the real risks of damage to the environment and the potential for harm. One jury particularly asked for an end to blanket assertions that GM crops are necessary to feed the starving in the Third World, given the complex social and economic factors that lie behind such hunger.

As another contribution to the 2003 GM Nation debate, the UK Food Standards Agency commissioned a citizens' jury from a division of the public relations firm Bell Pottinger plc. In contravention of standard practice for citizens' juries, no panel of stakeholders was assembled to oversee balance and fairness in the jury process. Senior staff at the FSA stated that it was itself an 'independent' agency and had been advised by Bell Pottinger that no such oversight panel would be necessary.

A major disadvantage of not having drawn on a broad range of interest groups for oversight of the jury process became apparent when the question was set for the jury to consider. This was announced by the FSA as 'Should GM Food be Available to Buy in the UK?' One of the witnesses to the jury immediately objected to this question, commenting: 'With a question like that I can predict a "yes" verdict without even needing to give evidence'. Not only was this question open to the accusation of being skewed, like some opinion poll surveys, towards getting a particular answer, but it is likely to have severely limited the scope the jurors had to discuss a range of issues relating to the links between GM technologies, the food system and farming that they – rather than the FSA – might have thought were pertinent.

Though both GM Jury and the FSA citizens' jury were on the subject of GM crops, the lack of fairness and competence in the latter jury process, as well as a failure to safeguard against it being used to legitimise the pre-formed agenda of an already avowedly pro-GM government agency, leaves the motivations of those who initiated it open to question.

3 Lessons from the experiences

The nine experiences demonstrate the different roles that individuals and organisations can have when attempting, or claiming to attempt, to democratise technology. The so-called 'bottom-up' initiatives that arise from people's movements, such as Brazil's Landless Workers Movement or India's People of the Forest, inevitably produce very different opportunities for people to articulate their views compared to 'top-down' processes run by governments, private foundations or international development agencies.

Whoever initiates it, any process that attempts to increase the democratic control of technology must include common-sense safeguards to ensure that the process is procedurally fair, and seen to be so. Such safeguards should ensure, for example, that no single participant dominates the discussion. Practices must also achieve certain basic levels of procedural competence, in that participants are able to undertake an informed discussion that allows them to reflect on their own views together with those of others. The democratic nature of such initiatives can further be enhanced by considering the following five issues.

Is the objective to give participants opportunities to take control of issues that concern them fundamentally?

All the experiences contained strategies for helping marginalised people wrest some of the control from decision-makers who had previously evaded accountability. The ventures which involved agricultural extension work (Farmer Field Schools and Chivi), working conditions in technology manufacture (Phase II and Seagate), brick making (Shambob), forest resource extraction (Girijan Deepika), foreign aid policies (Prajateerpu), medical research funding (Quality Research in Dementia) and land reform (Landless Workers Movement) all stand in sharp contrast to conventional social research which typically aims merely to provide data for researchers and policy-making elites.

In assembling the members of the citizens' juries, organisers of such initiatives are increasingly aware of the need to allow the jurors to create their own political space that they then might use independently of the jury process. Consequently, participants in the Indian, Brazilian and Zimbabwean juries were not plucked off the street or from voter records, as in most opinion poll, focus group and conventional citizens' jury processes. Instead they all have had some involvement with, or membership of, some kind of community group. Consequently, most have some baseline knowledge which helps them to participate. Working together with existing groups and identifying participants who are in contact with these groups means that if people want to pursue further the issues raised in the jury, they are more likely to have the opportunity, and support, to do so.

Is the initiative under collective rather than hierarchical control?

Approaches vary in the extent to which non-specialists, as opposed to scientific or administrative elites, are able to control the political space that is represented by an initiative to democratise technology.

An indication of the amount of control non-specialists can exert over a process is the extent to which they are allowed to interrogate their sources of information, rather than being merely the passive recipients of briefings and specialist testimonies. In a jury process an easy measure of this is the proportion of time that is devoted to the presentation of witness evidence versus the amount of time allowed for the interrogation of witnesses by the jurors. In Prajateerpu the ratio was roughly half and half, which appeared to be enough for the jurors to inform themselves about the factors pertinent to their deliberations. Although applications for dementia research funding came from scientists, the Quality Research in Dementia programme ensured that non-specialists had their questions answered in non-technical language before other scientists cross-questioned research applicants.

The development process for most new technologies still uses a model unchanged since the nineteenth century – first, optimise the technology, then check user acceptance, and finally examine any regulations governing its use. Given the investments made in the earlier stages, it becomes difficult to re-design a technology even when potentially harmful social effects have been subsequently identified. Hence, when faced with opposition to a new technology, policy-makers are forced into defending the technology, a technocratic managerial response in which potential social and environmental impacts, identified outside the narrow design process, are regarded as problems of user acceptance.

A refusal to involve non-specialists in research funding priorities and the technology design process – often called ‘upstream’ engagement – is a common failing in most systems of government. In some instances, however, such as the QRD network, systems have been designed to allow non-specialists to influence how research and technology development is funded, thereby allowing the priorities of non-specialists to shape the future of science and technology in this area.

In the case of a controversial technology such as genetic modification, a wider understanding of the interlinkages between biotechnology, corporate control, and local power structures is more likely to be achieved by taking a scenario approach than by merely asking a jury to say yes or no to a particular technology. In Prajateerpu, for example, the jury was able to compare and evaluate three contrasting scenarios, each being the product of a series of interdependent values, assumptions and predictions. GM crops were thus not judged in isolation – they were evaluated as an integral part of a wider system or development model. For example, the jurors used their experience of high-yielding varieties to critique GM crops when they were told that GM technology allows farmers to do away with pesticides. ‘If that really is the case, why would the pesticide companies allow GM to come in?’ one juror responded, disbelievingly.

The assessment of any initiative must include an examination of the extent to which its focus is on generating technologies that address future societal needs, rather than the ‘end of pipe’ assessment of an already-designed technology. However, democratically organised campaigns such as Phase II also have an

important role in ensuring that the conditions under which existing technologies are applied are those with the greatest benefit, and the minimum risk, to workers and the rest of society.

Is adult literacy necessarily a pre-condition in the short term?

Local circumstances will determine the extent to which adult literacy is a necessary pre-condition in any process of democratising technology. The Landless Workers Movement and People of the Forest (Girijan Deepika) used adult literacy programmes over several years to help thousands of people from marginalised groups to influence the forces that impact on their lives. Aimed at a particular policy time-frame, the Prajateerpu hearings occurred over a few days and were explicitly focused on fostering deliberation among nineteen largely non-literate marginalised rural people, using a range of information providers who were critically interrogated by the jurors.

Often marginalised communities find that longer-term processes of building their capacity to use basic techniques of alphabetical and numerical literacy are an important part of achieving lasting policy changes and holding decision-makers to account. Rather than being a decision taken by outsiders, it should be for those people who have been excluded from power to assess whether their interests will best be served by a short-term interrogation of new external knowledge followed by advocacy. At a larger scale, societies need information and knowledge to be made available to a wide range of groups in order for them to be able to assess potential new technologies from varying perspectives.

Is there sensitivity to gender and other inequalities within the process?

Marginalised groups such as women, those living in poverty and minority ethnic groups may be excluded if it is assumed that participants all have the same capacity to articulate their views and the same opportunities to attend meetings. There are many ways in which gender and social class can be taken into account.

For the Indian, Zimbabwean and Brazilian citizens' juries a space was provided in which people who might otherwise have felt threatened by sharing their knowledge and experience with others could do so. Within these environments of mutual support and empathy, perspectives from the social and natural sciences as well as the knowledge of farmers and local resource users could be confronted, negotiated and combined to develop policy recommendations.

Compared to the jurors, specialist witnesses are generally wealthier and better educated, and often represent powerful organisations or social classes. Despite these asymmetrical relationships, interactions between specialist witnesses and the jurors can be made balanced and mutually respectful by sensitive facilitation. At times, however, jurors in Prajateerpu reported feeling undermined by what some specialist witnesses said or implied. Power relationships between the more technocratic witnesses and the largely illiterate yet highly knowledgeable farmers were played out repeatedly during some of the hearings.

Table 1 Areas of **stronger** and *weaker* performance in democratising technology

Criteria / Experiences	Linking knowledge and power	Fairness and competence	Creating alliances for change
1: Quality Research in Dementia network (Alzheimer's Society, UK)	**Needs focused.** *Little attempt to address issues of social class within the network.*	**Multi-perspective. Deliberative.**	**Significant national impact on research practice.** *Limited local impact.*
2: People of the Forest (Girijan Deepika, India)	**Focus on marginalised groups of indigenous peoples.**	**Grassroots control. Deliberative.**	**Major local impacts.** *National policy impact limited by lack of capacity for coalition-building.*
3: Farmer Field Schools (Indonesia)	**Change focused.** *Weak gender focus.*	**Multi-perspective. Deliberative.**	**Major national impact.**
4: ITDG's Chivi project (Zimbabwe)	**Focus on validating women's agricultural knowledge.**	**Multi-perspective. Deliberative.**	**Local and regional impact.** *Limited national and long-term impact due to ongoing political crises.*
5: Landless Workers Movement (MST, Brazil)	**Focus on the livelihood needs of the poorest. Change orientated.** *Hierarchically organised. Initially weak gender focus.*	**Landless controlled. Adult education methods used.**	**Major local, national and international impact.**
6: ITDG's Shambob Brick Producers Co-operative (Sudan)	**Focus on the livelihood needs of the poorest. Change orientated.**	**Worker controlled. Multi-perspective.**	**Major national impact.** *Brick makers remain politically vulnerable and marginalised.*
7: Phase II, UK	**Women's knowledge validated by university researchers.**	**A co-inquiry of workers, unions and researchers.**	**Local and national impacts arise from coalitions.** *National and global impact limited by lack of wider support.*
7: Seagate workers, Thailand.	**Worker's knowledge validated by university researchers.**	**A co-inquiry of workers, CSOs and researchers.** *Unions banned from organising.*	*National and global impact limited by political restrictions on coalition-building.*
8: The People's Verdict (Prajateerpu, India)	**Focus on validating women and oppressed castes' agricultural knowledge and assessments of GM.**	**Safeguards against single stakeholder dominance. Deliberative.**	**International impact.** *Limited local impact due to the lack of capacity for coalition-building.*
9: GM Jury, UK.	*Participants treated as homogeneous. Focus on a single technology on a timetable dictated by the government.*	**Safeguards against single stakeholder dominance. Deliberative.** *Limited participant control.*	*Low impact due to lack of institutional support within funding bodies.*
9: FSA Jury, UK.	*Most participants disempowered by process. Institutional requirement is merely to be seen to consult.*	**Multi-perspective.** *No safeguards against single stakeholder dominance. No participant control.*	*Low credibility and impact.*

Despite their tremendous achievements in changing power relations, the Landless Workers Movement and the Indonesian Farmer Field Schools have acted with little regard for gender hierarchies within local groups. Both organisations are now attempting to tackle the tendency for male domination in group settings.

Are there safeguards against domination by the agendas of a single stakeholder?

In any attempt to democratise technology it is important to ensure that a variety of different interest groups – including both people's movements and government policy-makers – have joint oversight of the process and that a diversity of perspectives is available to participants. This aspect is often neglected, especially by government-funded processes. Diverse control of a process can be ensured by drawing on several sources of funding. The selection of at least two funding sources which have vested interests in visions that appear to be in conflict with each other can be a good way of ensuring balance.

On issues where there is a high level of controversy it is particularly important to ensure the quality and validity of the knowledge generated. These have been central concerns for those coalitions organising citizens' juries on GM. It is vital for such groups to recognise that their subjectivity and world view could potentially influence their actions as researchers and their interpretations of events. Four primary safeguards were therefore built into the Indian, Zimbabwean and Brazilian processes, with the explicit aim of promoting diverse control and transparency: a broadly-based 'oversight panel', a range of media observers and reporters, and a comprehensive set of video archives.

Table 1 summarises a provisional assessment of the relative performance of the initiatives described in this document, based on the extent to which the processes were able to:

- link knowledge and power;
- ensure the competence of the process; and
- create alliances for change.

These three broad criteria can be used to assess the democratic credentials of the initiatives discussed.

4 Issues for the future

There are many areas of future research that demand attempts to inform current practices with the principles outlined in this document. Three of the most urgent – HIV/AIDS, climate change and nanotechnology – are highlighted here. Also important is also the issue of intellectual property rights, which affects those with HIV/AIDS and exacerbates the problem of global hunger.

HIV/AIDS

The current HIV/AIDS pandemic kills six thousand people every day. Women, especially pregnant women, make up a substantial and growing proportion of those with the virus. In sub-Saharan Africa, women account for more than half of those infected. Yet, of the drugs that have been developed to tackle the symptoms of HIV/AIDS, very few have been tested systematically on women. There is some evidence that the side effects when women take the drugs are very different from those displayed by men. There is also evidence that HIV treatments are far more available to men than women, because men are more likely to be mobile, to have higher levels of literacy and to afford not only the drugs themselves but also the costs of obtaining them.

HIV drug treatments often need to be administered alongside support and care, which again is generally less available to women than to men. Cervical cancer is an extremely common side-effect of HIV infection among women, yet few in poorer countries have access to testing schemes. Women are forced to access HIV services via ante-natal clinics, which means that women's lives are only being valued by the health system around the time of giving birth. Older women, who also suffer high HIV prevalence, find it particularly hard to access treatments.

Issues of gender have been central to the development of both democracy and technology, but have been little discussed until the last two decades. Assumptions about the differences between men and women in the development of new technologies often mirror presumed differences between Western technoscience and local traditions. Men are presented as technological innovators and producers, whereas women are seen as practitioners of ancestral cultural practices that need to be changed. Whereas men design new stoves with Western engineers, women's fuel conservation techniques are considered a 'cultural practice'. Ecofeminism, which in some formulations identifies women as 'mother nature' and suggests that science and technology oppress women in their role as nurturers of the natural world, can reinforce assumptions that women are keepers of traditions, rather than agents of innovation or experiment.

In technology, as with other realms of social and economic study, gender analysis is seen by most organisations as something that should be done by women for women, rather than something that both men and women should address. NGOs that are effective at promoting equality in other areas of their work still often marginalise the status of gender analysis within their organisation, thus re-establishing a social order within which men are continually re-created as the dominant class – while, as one woman activist commented, 'women make tea and organise the logistics'.

The International Community of Women Living with HIV/AIDS, which has compiled much of the evidence relating to these trends, has organised workshops at which women with HIV are able to engage with policy-makers on improving the access of women to HIV diagnosis and treatments such as cervical smear tests and anti-retro-viral drugs. However, the neglect of gender by most HIV/AIDS initiatives – and particularly the need for women's participation – means that they are joining a long list of technological interventions where women's lives are increasingly threatened more than those of men.

Information feudalism?

The global system of intellectual property rights (IPRs), called by some 'information feudalism', is a potential threat that limits access to knowledge and technology. Their proponents claim that patents and other IPRs produce globally-distributed economic and social benefits such as vaccines for diseases and improved medicines, but many patient, farmer and other grassroots organisations have accused large corporations of operating a legalised system of biopiracy, laying claim to knowledge from indigenous peoples and marginalised groups.

The system of patents was established to protect the interests of individual developers of mechanical inventions. However, by the early twentieth century corporations had developed massive research capacities in the chemical, electrical, pharmaceutical and rubber industries. Patents were then used as a means of limiting competition and allowing large companies to fix prices and control production. Corporations also used intellectual property rights and licences to enforce global knowledge cartels that divided up global markets among their members. Any attack on a patent-based cartel was difficult because it could be construed as an interference with the use of private property.

An engagement in IPR-based cartels by the largest pharmaceutical companies from the 1950s onwards fixed the prices of antibiotics at artificially high levels, leading to thousands of unnecessary deaths among those who were unable to afford them. During the 1970s countries such as India, Brazil, Argentina and Mexico built indigenous pharmaceutical industries by establishing less restrictive patent regimes than those that existed in the USA and Europe. However, in 2004, nearly 150 countries are members of the World Trade Organisation and thus have to abide by its Agreement on Trade-Related aspects of Intellectual Property Rights (TRIPs), which formalises a legally enforceable IPR regime, largely designed by supporters of corporate cartels.

The threat posed by IPRs is exacerbated by the spread of GM crops and other modern crop varieties. Whether they are inserted gene sequences as in the case of GM crops, or new crop varieties, such novelty is protected by IPRs. Under TRIPs, all member nations are obliged to implement plant variety protection measures on behalf of the owners of the genes and plant varieties, either through patents or other recognised means. These measures are better termed monopoly privileges than property rights andare designed to restrict access to crop varieties and associated knowledge. However, the genetic resources contained in crop varieties and the knowledge of how to use them have been developed over millennia, mainly by poorer rural communities of farmers and indigenous peoples

who should have continued rights of access. It is open access to, and the free sharing of, these genetic resources and the agricultural biodiversity of which they are part that has allowed the development of the great diversity of crops and livestock which underpins global food security.

Climate change

In January 2004, Britain's government chief scientist announced that 'climate change is the most severe problem we are facing today' and thus presented the growing crisis as an even greater potential threat collectively faced by humanity than global terrorism. Yet addressing the issue poses unprecedented challenges for the international community.

A consensus of scientists from a majority of the world's nations now emphasises the urgent need to take action on climate change. Governments in Europe have expressed potential support for a levy on aviation, the fastest rising contributor to global climate change. However, it is up to environmental and development groups to use the kind of deliberative processes described here to provide support for what they believe to be socially and environmentally sound initiatives: how women and men might organise themselves to make and implement decisions to act to tackle the crisis.

Democratic initiatives should also ensure a bigger voice in debates for marginalised communities who, whether in Bangladesh or Haiti, are already suffering the effects of human-induced climate change. Participatory projects launched by groups such as Rising Tide and the Global Commons Institute have already produced agendas for social and environmental justice that have major implications for the high-carbon lifestyles of citizens of industrialised nations. Without such initiatives, governments may continue to be beholden to corporate lobbyists who use market research techniques such as focus groups to argue that people do not care enough about climate change to agree to such policy changes.

Nanotechnology

Nanotechnology– the frontier technology that enables atomic scale construction, rearrangement and design of materials – has quickened the debate over global regulation of new technologies in the twenty-first century. Governments in the industrialised world recognise the 'transformative' potential of nanotechnologies and have reacted by channelling billions into national research programmes – without creating the regulatory institutions to monitor the health, social or environmental impacts.

NGOs such as Greenpeace and the Action Group on Erosion, Technology and Concentration (ETC Group) have advocated a moratorium on the commercial production of new nano-materials and a 'transparent global process for evaluating the social, health and environmental implications of the new technology'. One specific proposal is the formation of an International Commission for the Evaluation of New Technologies (ICENT). An ICENT would give governments a way to gauge the scientific, social and economic effects of all emerging technologies, the ETC Group argues. The concept of an ICENT has

been taken up and supported by the European Parliament's Committee on Development and Cooperation, which considers that 'new technologies should also be assessed for their impact on sustainable development' via such a mechanism.

However, social movements need to become powerful enough to challenge the decisions of technocrats and to institutionalise the principles of accountability briefly described in this document. The success of such initiatives will determine the extent to which conventions such as ICENT lead to long-term improvements in how new technologies impact on people's lives.

5 Principles of democratising technology

The issues of HIV/AIDS, climate change and nanotechnology all highlight the global imbalance of power between those who are affected by the applications of technology and those who, until now, have possessed almost completely unaccountable power to develop those technologies. The nine experiences described here suggest that, even if large organisations such as transnational corporations, governments or civil society organisations decide to begin to redress this balance by providing spaces for those they have previously marginalised to have a voice, turning an intention into a reality requires them to face up to numerous new challenges.

The magic bullet myth

A common assumption made by those trained in scientific or bureaucratic cultures is that there will be a particular participatory methodology – a 'magic bullet' – that can be devised to facilitate dialogue between scientists, technologists and citizens at large. In reality, participatory initiatives are most effective when they acknowledge that each situation will require a different design, using a new combination of tools as part of a continuous cycle of action and reflection.

Because any participatory initiative contains a unique mix of people and institutions, each process will necessarily include elements from a range of approaches and methodologies. Misguided attempts to strictly standardise and replicate protocols, in line with conventional scientific practice, can only undermine the participatory process.

An analogy from natural science

Scientists might find the following explanation valuable: when describing a scientific experiment, it is vital to explain the context in which that experiment takes place. Were the plants in test tubes or in a farmer's field? Were the rats well fed or starving? This logic also applies in attempts to interpret a participatory process, and is roughly analogous to the conditions of an experiment. To be effective in achieving its aims, each process needs to proceed from an understanding of its political, scientific, institutional and practical constraints. In designing a participatory initiative, any particular methodology – for example, a scenario workshop, participatory video, citizens' jury or stakeholder panel – will be partial and incomplete. An effective process will be achieved by combining a variety of individual approaches that together give rigour and credibility to the whole exercise. Getting the balance of techniques right in any particular context becomes easier as everyone involved in the process reflects with each other on what worked in the past.

Instead of recommending a single mechanism or optimal formula, this document outlines provisional working principles for individuals and organisations who wish to transform the power relations that govern the development of technologies. Each is followed by examples taken from the experiences described above.

Analysing the relationship between knowledge and power

No useful knowledge without opportunities for taking power

Participatory initiatives must not only look at the know-how and technical knowledge that is pertinent to a particular decision or issue, but also anticipate how the power relations between different groups will be affected by potential outcomes. In particular the power relations between those who are currently marginalised and companies, that can protect their technical knowledge through intellectual property rights systems and restrictive commercial practices, must be considered.

Girijan Deepika looked at power relations between marginalised rural people and government agencies such as forest-produce extraction agencies and pesticide promoters. They decided that they would retain more power by collectively campaigning for tighter controls on forest-produce extraction.

Farmer Field Schools and ITDG's Chivi project analysed the power of local farmers relative to those who were making decisions on their behalf about pesticide and seed policies in the national government. Their response was to organise farmers' unions and women's organisations to ensure that greater investments were made in non-pesticidal management of crop pests. Similarly, the Shambob project in Sudan helped local brick makers to organise their own co-operative that made the use of innovative brick-making technologies economically viable. Having analysed the threat presented by GM crops introduced by Monsanto to the self-reliance of smallholder farmers, the Landless Workers Movement joined other organisations in a national campaign to oppose GM crops.

Policy-makers generally make decisions based on the political pressure they are under, together with the evidence they can obtain to justify their decision. Being able to push both these levers is therefore vital to bringing about change.

Building alliances with other social justice groups is as important as collecting data

No initiative attempting to provide alternative technological perspectives can hope to provide the body of evidence that will have already been gathered by the technology's advocates. Without the resources of governments or large corporations, people can never win the battle of numbers with powerful techno-scientific agencies. However, the voluminous official data can be challenged by the judicious use of smaller quantities of highly valid evidence, often gathered using qualitative as well as quantitative methods.

Phase II and Seagate workers have worked with sympathetic researchers in Scotland and Thailand respectively, who found evidence that contradicts corporate and government claims of the safety of the semiconductor industry. However, the achievement of a policy impact has relied upon political support from wider social movements such as the union movement and CSOs.

Prajateerpu was designed, undertaken and disseminated by a transnational collective of co-researchers from the UK, India and the Netherlands. As well as

allowing a jury of marginal farmers to develop a detailed critique of World Bank and bilateral aid agency plans for their region, the process included coalition building with NGOs such as ITDG, Friends of the Earth, Christian Aid and ActionAid, whose advocacy added political weight to the research findings.

Allowing people to draw on the best of both worlds

Conveners of initiatives should avoid terminology that romanticises or demonises either 'traditional' knowledge or the 'techno-fix'. Different knowledge systems have been developed by different groups for different purposes.

The Quality Research in Dementia network has been careful not to give those proposing laboratory-based projects – for example, those relating to treatments or genetic tests for Alzheimer's – undue weight compared to research into better physical and social measures for those caring for existing sufferers. In so doing, it values the knowledge of carers equally with the technical knowledge of professionals.

Some Telegu-speaking witnesses in Prajateerpu used English scientific words, acronyms or jargon that could not be understood by most jurors. The facilitators of the process, who included native Telegu speakers who also spoke English, made sure the jurors understood such terms. Jurors in the UK GM Jury process did not favour GM crops being planted in the UK or abroad, but, on the evidence they had heard, some felt that the TV and newspaper coverage had not allowed pro-GM organisations enough space to defend possible future applications of such crops, which made them suspicious.

How to do it: competent technology-democratising processes

Lowering the entry requirements for involvement

The assumption that marginalised communities are necessarily passive or apathetic in response to initiatives aimed at democratising decision-making has long been discredited. The myth rests on a failure to acknowledge the many barriers to political participation that exist, particularly for those who have historically been the most disadvantaged. For example, people forced by poverty to work long hours may lack both time and energy to engage in political dialogue and community involvement.

When working in societies where an oral culture is still stronger than one based on the written word, it is important not to exclude non-literate people. The snowballing of any small campaign into something larger, especially one that embraces marginalised groups, will always depend upon the building of face-to-face relationships.

The Landless Workers Movement and the People of the Forest both originally developed their networks largely via activists, many of whom could not read or write. Though both organisations have adult literacy programmes, the movement is essentially run through meetings that use participatory tools to ensure that they are accessible to all, irrespective of formal educational attainment or whether not they are yet literate. Prajateerpu used three locally made films in the participants' own language to outline three contrasting visions for rural agricultural

development. This film-making was followed by oral evidence from witnesses who were cross-questioned by members of the jury face to face.

Valuing existing knowledge

While elements of education and information provision can be a useful part of initiatives, opportunities for the emancipatory use of existing knowledge systems and critical assessment of new knowledge should also be provided

ITDG's Chivi project, People of the Forest and the Farmer Field Schools were all peer-education initiatives that also allowed farmers to critique the prevailing bias of their agricultural extension systems. All three schemes allowed farmers and local health workers to build on their existing knowledge, much of which was recognised as valuable, and build more self-reliant systems of agriculture and health-care.

Joint agenda-setting

A prerequisite for the involvement of non-specialists in the development of new technologies is that they should have a say in deciding what issues need to be discussed. Unless there are compelling reasons that can be explained to participants, the agenda in any initiative should reflect the issues raised by those who have been previously marginalised from power. These groups or individuals should also be allowed to share control over the process as it proceeds.

The People of the Forest and the Landless Workers Movement are both owned and operated by those marginalised groups who have been denied the right to participate in decisions in the past. They decide on the agenda for deliberative processes and grassroots campaigns. The multi-stakeholder GM Jury was unable to allow participants to decide the agenda for discussion, because the jury's funders wanted the jurors to have a say in advance of an imminent government policy pronouncement. This political context was explained to the jurors, who were allowed to ask for witnesses and written information in addition to those chosen on their behalf.

Safeguarding validity and balance

A broad-based oversight process is vital and should include safeguards which ensure that multiple perspectives and a variety of stakeholder interests are represented.

Prajateerpu and UK GM Jury were both designed as high-profile contributions to politically sensitive debates. It was therefore important to set up an oversight committee containing representatives of a wide range of interest groups and funders. This safeguard ensured that the process could not be captured by any single lobby or organisation with a strong stake in the issue, as has been the case in other juries.

Creating alliances for change

'Do as I do, not just as I say'

In order to gain the trust of the people outside their organisations with whom they work, those advocating greater accountability must also build mechanisms for the involvement of marginalised groups, particularly women, within their own organisations.

It is symptomatic of the difficulty of practising, rather than just preaching, participatory approaches that the most powerful organisations that have pioneered innovations in participatory democracy have often failed to apply such practices to themselves. Referring to his experience with one such organisation, development analyst Nick Hildyard has suggested that:

> *'… perhaps the first thing that agencies serious about participation and pluralism might take is not to reach for the latest handbook on participatory techniques, but put their own house in order: to consider how their internal hierarchies, training techniques and office cultures discourage receptivity, flexibility, patience, open-mindedness, non-defensiveness, humour, curiosity and respect for the opinions of others.'*

In any organisation – large or small – this is easier said than done. Yet a failure to implement internally the very approaches that agencies are attempting to encourage externally soon becomes apparent to all those associated with the project, undermining the morale of all those involved.

ITDG's Chivi project, the Landless Workers Movement and Farmer Field Schools have all made efforts to address issues of hierarchy within their operations, particularly as they relate to gender. Women undertake the majority of farm tasks in the regions represented by all three initiatives, and their influence on the policies and practices of each organisation has increased in recent years.

Build bridges between technical and non-technical cultures of knowledge

As well as drawing on the know-how and common sense of non-elites, especially of women, initiatives in this area should build bridges with scientists, technologists and associated analysts who are willing to build relationships of solidarity with people who are marginalised from policy-making processes.

Scientists and technologists who become involved in such processes are often enthusiastic about joining non-specialists in opening up and challenging areas of scientific knowledge, rather than treating them as sacrosanct. The Shambob project in Sudan saw the sharing of knowledge and experiences between local innovators, who knew the materials available and what worked in buildings, with ITDG specialists in efficient fuel use.

Phase II made links with academic epidemiologists, allowing workers to obtain assessments of the effects of exposure to toxic chemicals in semiconductor factories that were conducted independently of their employers. These assessments in 'lay epidemiology' exposed flaws in the government inspections that forced the agency responsible to improve its system of monitoring.

The Quality Research in Dementia network built links between research scientists and those caring for Alzheimer's sufferers during the meetings at which decisions about future funding were made. Farmer Field Schools involved interactions between agricultural scientists and farmers, leading to a greater understanding between the two groups and the improvement of non-pesticidal pest control methods.

Build global-local coalitions

Where an issue has global ramifications, attempts should be made to build a transnational community of enquiry, which recognises diversity of local know-how and knowledge systems.

ITDG's involvement in Prajateerpu led to a sharing of skills between the different project teams. The following year, ITDG built on the Indian process, using it to develop the Izwi ne Tarisiro process in a Zimbabwean political context. A growing international community of enquiry involving CSOs, unions, and even some government officials is now attempting to strengthen mechanisms of democratic accountability in agricultural development.

Beginning in 2000, the Landless Workers Movement has built links with international solidarity movements outside Brazil to develop the World Social Forum process that has spawned many national and regional forums. Events in different parts of the world invite those active in diverse social justice initiatives to come together every two years to look at common issues on which they can build their collective capacity for social change.

6 Towards broader-based alliances

Creating a perception of the 'voice of the people' is as old as politics itself. Social analyst Dorothy Nelkin pointed out in 1979 that much of what passes for participation in governance can best be understood as attempts by the powerful to co-opt the public. Various institutions have recently undertaken pseudo-democratic exercises that convince themselves – even if not those in whose interests they claim to act – that they have given 'the public' a voice on new technologies. Commenting on the UK government's 2003 'GM Nation' exercise, a Times editorial reflected a widespread perception that 'promising to consult the public is the perfect way to put off making a decision or to provide cover for an unpopular decision that has already been made'.

With people around the world sceptical about the extent to which powerful institutions genuinely want to take their views on board, future attempts at giving the public a bigger voice must go beyond conventional notions of 'consultation'. A lesson that should be drawn from the experiences described here is that those initiating 'bottom-up' democratising processes within people's movements need to engage more effectively with policy-makers who need to justify their policies by conducting 'top-down' consultations. Such an engagement allows the policy space that has been opened up to be occupied by the voices of people whose views have been previously marginalised.

The experiences also demonstrate that initiating any sort of participatory processes within hierarchically organised institutions is fraught with obstacles. Anyone thinking of undertaking an exercise in technology democracy within an organisation needs first to consider three questions: what might motivate the particular individual and their organisation to undertake the exercise, what capacity and enthusiasm exists within the organisation to support such an initiative, and to what extent can a broad-based coalition be created to help people have a say in decisions in the longer term? A failure to ask these questions has left many attempts at democratising technology isolated and unable to reach a scale on which they might have lasting impact.

To become meaningful, 'democratising technology' must move on from being isolated institutional experiments towards becoming a core element of all governance processes, thereby widening the range of options everyone has in their lives. Many wealthier consumers can already exercise technology choice, most dramatically shown during the ongoing GM food controversy, by buying or boycotting a particular technology in the marketplace. But a choice between technologies, even one as far-reaching as GM, is often not available to those communities living under a burden of long-term debt. If it is to mean anything, democratising technology must lead to those currently without spending power having the freedom to choose which technological future is best for them.

While this document has described the first stirrings of a twenty-first century movement for democratising science and technology, it is already clear that such a movement cannot achieve widespread social change without a much broader coalition of support among technocrats, scientists, unions, CSOs and numerous

others acting in solidarity with them. The actions of Sudanese brick makers, Indian, Indonesian and African smallholder farmers, Scottish semiconductor workers and the Brazilian landless all demonstrate that science cannot be democratised without 'bottom-up' people's movements acting in partnership with scientists and 'top-down' decision-makers. Action by such broadly-based coalitions is the only way that the economic and social benefits achieved for a minority of the world's population during the first two hundred years of industrialisation can sustainably be extended to include those whose voices have yet to be heard.

7 Further reading

Experiences

Quality Research in Dementia, UK
Alzheimer's Society 2004 *The Quality Research in Dementia Network*, Alzheimer's Society, UK. Download from *www.qrd.alzheimers.org.uk*

People of the Forest – *Girijan Deepika*, India
ActionAid 2003 *Yakshi and Girijan Deepika,* ActionAid, UK. Download from *http://217.206.205.24/compower/pdfversion/cpaction/R002.pdf* and *www.anthra.org*

Farmer Field Schools, Indonesia
Fakih M. et al. 2003 *Community Integrated Pest Management in Indonesia: Institutionalising Participation and People Centred Approaches*; Institutionalising Participation Series; IIED, IDS and READ.
Download from *www.iied.org/docs/sarl/comm_pestmgmt_indo.pdf*

ITDG Chivi Project, Zimbabwe
Murwira K. et al. 2000 *Beating Hunger, the Chivi Experience: A Community-based Approach to Food Security in Zimbabwe.* ITDG Publishing, UK

Landless Workers Movement, Brazil
Brandford S. and Rocha J. 2003 *Cutting the wire: The story of the landless movement in Brazil*. Latin America Bureau, London. Also see *www.mst.org.br*

Shambob Brick Producers Co-operative, Sudan
ITDG 2001 *Building in Partnership: The Story of Shambob.* ITDG, UK
Download from: *www.itdg.org/?id=shelter_peoplestories*

Semiconductors and Health, Scotland
Watterson A. et al. 2003 'Health and Safety Executive Inspection of UK Semiconductor Manufacturers.' *Int. J. Occup. Environ. Health* 2003;9:392–395

Watterson A. 1995 'Lay, worker and community epidemiology.' *Pesticides News* 30:8-9
Download from *http://217.154.68.186/pestnews/pn30/pn30p8.htm*

Seagate, Thailand
Foran T. 2001 *Corporate Social Responsibility at Nine Multinational Electronics Firms in Thailand: A Preliminary Analysis*: The Nautilus Institute for Security and Sustainable Development. San Francisco

Corporate Accountability Project 2002 *Beyond Good Deeds: Case Studies of a New Agenda for Corporate Accountability*: National Heritage Institute (NHI), The Nautilus Institute for Security and Sustainable Development, and Human Rights Advocates (HRA). San Francisco

Indian Farmer Suicides
Vasavi A.R. 1999 *Harbingers of Rain: Land & Life in South India*. Oxford University Press, New Delhi

Vasavi AR 1999 'Agrarian Distress in Bidar: Market, State and Suicides', *Economic & Political Weekly*, August 7, 2263-69. Download from *www.epw.org.in*

***Prajateerpu*, India**
Wakeford T. and Pimbert M. 2004 'Prajateerpu, power and knowledge: The politics of participatory action research in development. Part 2. Analysis, reflections and implications.' *Action Research* 2: 25–46. Download from *www.prajateerpu.org*

Izwi neTarisiro, Zimbabwe
Rusike E. 2003 'Izwi neTarisiro: Voice and Vision' *Seedling*, October. Download from *www.grain.org/seedling/?id=273*

Juridos OGM, Brazil
Toni A. and Braun von J. 2001 'Poor citizens decide on the introduction of GMOs in Brazil.' *Biotechnology and Development Monitor*, 47:7-9.
Download from *www.biotech-monitor.nl/4703.htm*

GM Juries, UK
PEALS 2003 *The People's Report on GM Crops*, PEALS, University of Newcastle, UK.
Download from *www.gmjury.org*

Issues for the future

Gender and HIV/AIDS
International Community of Women Living with HIV/AIDS 2004 *HIV Positive Women, Poverty and Gender Inequality*. ICW, UK.
Download from *www.icw.org/tiki-download_file.php?fileId=62*

UNAIDS 2004 *World AIDS Campaign 2004: Women, Girls, HIV and AIDS.* Download from *www.unaids.org/html/pub/wac/wac-2004_strategynote_en_pdf.pdf*

Climate Change

Intergovernmental Panel on Climate Change 2004 *Integrating sustainable development and climate change in the IPCC* Fourth Assessment Report, IPCC, Switzerland Download from *www.ipcc.ch/pub/colombo.pdf*

New Economics Foundation 2004 *The end of development? Global warming, disasters and the great reversal of human progress.* NEF, UK. Download from *www.neweconomics.org/gen/climate_change_top.aspx?page=1036&folder=146&*

Global Commons Institute 2004 *Convergence to globally equal per capita emissions rights by 2030.* GCI, UK. Download from *www.gci.org.uk/cc760.html*

Rising Tide 2001 *High consumption lifestyles and their contribution to climate change.* Rising Tide, UK. Download from *www.risingtide.org.uk/pages/resources/lifestyl.htm*

Nanotechnology

Greenpeace 2003 *Future technologies, today's choices: Nanotechnology, Artificial Intelligence and Robotics: A technical, political and institutional map of emerging technologies.* Greenpeace, UK. Download from *www.greenpeace.org.uk/contentlookup.cfm?ucidparam=20030721113521&menupoint=A-L*

Royal Society and Royal Academy of Engineering 2004 *Nanoscience and nanotechnologies: opportunities and uncertainties*: *Evidence from Civil Society groups.* Royal Society, UK. Download from *www.nanotec.org.uk/CivilSocietyGroups.pdf*.

ETC Group (Action Group on Erosion, Technology and Concentration) 2004 *Converging technologies for food and agriculture: Nanotech for Tummies.* ETC Group, Canada Download from *www.etcgroup.org/publications.asp*

General reading on participatory democracy

Borrini-Feyerabend G. et al. 2004 *Sharing power. Learning by doing in co-management of natural resources throughout the world*. IIED and IUCN. London IIED, UK

Brock K. et al. 2001 'Power, Knowledge & Political Spaces in the Framing of Poverty Policy.' *Institute of Development Studies Working Paper* 143, Institute of Development Studies, UK. Download from *www.ids.ac.uk/ids/bookshop/wp/wp143.pdf*

Cooke B. and Kothari U. (eds) 2001 *Participation: the New Tyranny?* Zed Books, UK

Crewe E. and Harrison E. 1998 *Whose Development?: Ethnography of Aid*.
Zed Books, UK

Edmond G. and Mercer D. 1997 ‘Scientific literacy and the jury: Reconsidering jury “competence”’ *Public Understanding of Science* 6:327-59.

Ferguson J. 1994 *The Anti-politics Machine: Development, Depoliticization and Bureaucratic Power in Lesotho*. University of Minnesota Press, USA

Greenwood D.J. 2002. ‘Action research: unfulfilled promises and unmet challenges.’ *Concepts and transformation*, 7(2):117-139

Greenwood D. J. and Levin M. 1998 *Introduction to Action Research: Social Research for Social Change Sage,* USA

Harriss J. 2001 *Depoliticising development: The World Bank and social capital.* Manohar Publishers and Distributors, UK

PEALS 2004 *The DIY Citizens Jury Project*, University of Newcastle, UK. Download from *www.citizensjury.org*

Rahman M.A. 1991 ‘The theoretical standpoint of PAR.’ in
Fals-Borda, O. and Rahman, M. (Eds) *Action and Knowledge: Breaking the monopoly with participatory action research*. New York: The Apex Press, USA

Warren M.R. 2001 *Dry bones rattling: Community building to revitalize American democracy*. Princeton University Press, USA

General reading on technology and democracy

Abraham J. 1995 *Science, Politics and the Pharmaceutical Industry. Controversy and bias in drug regulation*. UCL Press, UK

Alvares C. 1992 ‘Science’ in W Sachs (ed) *The Development Dictionary*. Zed Books, London, UK

Anonymous (editorial) 2004 ‘Going public: Should scientists let the public help them decide how government research funds are spent? Yes they should, because the consequences are to be welcomed, not feared.’ *Nature* 431:833

Brown P. and Mikkelsen E.J. 1997 *No Safe Place: Toxic waste leukemia and community action.* University of California Press, USA

Buhler W. Morse S. Beadle A. and Arthur E. 2002 *Science, Agriculture and Research: A Compromised Participation?* Earthscan, London, UK

Drahos P. and Braithwaite J. 2002 *Information Feudalism: Who Owns the Knowledge Economy?* Earthscan, UK

Drahos P. 2004 *Who Owns the Knowledge Economy? Political Organising Behind TRIPS*, Corner House Briefing 32. Download from *www.thecornerhouse.org.uk*

Epstein S. 1998 *Impure Science: AIDS, Activism and the Politics of Knowledge*. University of California Press, USA

Greenberg D. 2001 *Science, Money and Politics*, University of Chicago Press, USA

Irwin A. and Michael M. 2003 *Science, Social Theory and Public Knowledge*. Open University Press, UK

Jennings B.H. 1988 *Foundations of International Agricultural Research: Science and Politics in Mexican Agriculture*. Westview, USA

Kamminga H. 1995 ‘Is a Science for the People Possible?’ in
Wakeford T. and Walters M. (eds), *Science for the Earth*, Wiley, Chichester, UK

Khan H.A. 2003 ‘Technology, modernity and development’ in
Misa T.J. et al. (eds) *Modernity and Technology*, MIT Press, Boston, USA

Lapierre D. and Moro J. 2002 *Five Past Midnight in Bhopal*. Scribner, UK

Pimbert, M.P. 2003 ‘The promise of participation: democratising the management of bio-diversity’, *Seedling*, July 2003: 20-25. Download from *www.grain.org/seedling/?id=243*

Prakash G. 1999 *Another Reason: Science and the Imagination of Modern India* Princeton University Press, New Jersey, USA

Ravetz J. 2005 *The No-Nonsense Guide to Science*, Verso, UK

Rowell A. 2003 *Don't Worry (It's Safe to Eat): The True Story of GM Food, BSE and Foot and Mouth*. Earthscan, UK

Shapin S. 1996 *The Scientific Revolution* University of Chicago Press, USA

Stirling A. 2005 ‘Opening up or closing down? Analysis, participation and power in the social appraisal of technology’ in Leach et al. (eds) *Science and Citizens: Globalization and the Challenge of Engagement*, Zed Books, UK

Tweedale G. 2000 *Magic Mineral to Killer Dust: Turner and Newell and the asbestos hazard*. Oxford University Press, UK

Vishvanathan S. 1997 *A Carnival for Science: Essays on science, technology and development*. Oxford University Press, UK/India

Watson-Verran H. and Turnball D. 1995 ‘Science and other indigenous knowledge systems’. pp115-139 in Jasanoff S. et al. (eds) *Handbook of Science and Technology Studies*, Sage, USA

Wilsdon J. and Willis R. 2004 *See-through Science: Why public engagement needs to move upstream*, Demos, UK

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ITDG

ITDG – the Intermediate Technology Development Group – helps people to use technology in the fight against poverty. We work in partnership with communities to develop practical answers to their problems, based on local knowledge and skills and putting people's needs first.

ITDG is a charity registered in the United Kingdom which works directly in four regions of the developing world – Latin America, East Africa, Southern Africa and South Asia, with particular concentration on Peru, Kenya, Sudan, Zimbabwe, Sri Lanka, Bangladesh and Nepal.

ITDG has a unique approach to development – we don't start with technology, but with people. The tools may be simple or sophisticated – but to provide long-term, appropriate and practical answers, they must be firmly in the hands of local people: people who shape technology and control it for themselves.

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