

6

Unpacking and re-packing knowledge in development

Kees Jansen

In collaboration Cees Leeuwis, Sunil Mani, Esther Roquas, Margaret Skutsch, and Gerard Verschoor¹

Introduction

The knowledge issue pervades divergent discourses on poverty and development. According to the opening sentence of the 1998/99 World Development Report, 'Knowledge is like light. Weightless and intangible, it can easily travel the world, enlightening the lives of people everywhere. Yet billions of people still live in the darkness of poverty – unnecessarily'. For the World Bank, collapsing markets and failures in international competition are rooted in a lack of knowledge. Their widely shared concern is to prepare developing countries for the 'modern knowledge economy', particularly now that information technology plays such a large role in restructuring production and distribution processes. It is imagined that if the rapidly widening knowledge gap between developed countries' cutting edge biotechnology R&D and technologies available to the public sector in developing countries were closed, biotechnology tools applied in national research programmes of developing countries could bring a sustainable solution to world hunger (Rausser, Simon and Ameden 2000; Serageldin and Persley 2000). Introducing biotechnology products, such as transgenic crops, brings up another knowledge issue, namely that of building the scientific and regulatory capacity to implement biosafety measures (UNDP 2001; UNEP/GEF 2002). Likewise, the knowledge-issue emerges in proposals to transfer corporate knowledge management cultures to the field of development (Denning 1998; van der Velden 2002). Knowledge talk even pervades critiques of mainstream development thinking, which explore the role of western science in dominating development processes (Apffel-Marglin 1996), and defend culturally other, lay or indigenous knowledge.

This chapter aims to deepen knowledge talk and challenges both mainstream and critical views on knowledge in development. The three general concerns around which the approaches of the different authors converge,

appear to be crucial for this task.

The first concern is questioning dominant models on the role of knowledge in development. This critical understanding of the construction of knowledge needs to be linked to the question of re-packing interventions in knowledge processes, i.e. to the shaping of alternative practices of knowledge in development.

The second concern addresses the issue of power and inequality. We need to see how inequalities in knowledge add to other inequalities rooted in unequal trade, labour exploitation and colonial rule and are sustained by an interweaving of dominant models of development with certain views on knowledge.

The third concern is the possibility of alternative practices of knowledge in development in the context of globalization. This involves studying collective action around the creation of knowledge. Moreover, it means exploring the possible role of the public sector, both at the national and the international level, in constructing knowledge and providing collective goals in view of dominant ideologies on globalization.

These concerns inform the five cases presented in this paper. We start with a case in which NGO-university networks intervene in local knowledge systems in order to articulate these with the international climate change arena that can, until now exclusively, define 'good sustainable forestry practices'. The attention then shifts to the case of the contested introduction of genetically modified maize in Mexico, where the monopoly of 'experts' in knowledge creation is problematized. The third case calls for more research into the rather hidden work of expert networks advising policy makers in the international setting on the development of standards and regulations for handling new technologies. The fourth case focuses on the consequences of privatization models and the commoditization of knowledge for the quality and accessibility of innovation processes. The final case is inspired by concerns about the lack of investment in R&D in developing countries' industries resulting from the absence of the necessary state support and proposes research that brings the state back into the process of shaping knowledge for development. In the concluding section, we summarize how these five cases share the same three concerns outlined above. First however, we elaborate more on these concerns.

Studying knowledge talk

BEYOND A (DE)CONSTRUCTION OF THE KNOWLEDGE PERSPECTIVE

There is a long tradition of social science theories on knowledge, too vast to summarise here. Our research interest in unpacking the role of knowledge in development draws, as will be discussed, particularly on the 'social construc-

tion of knowledge approaches'.

The sociology of knowledge sees knowledge, and how it is constituted, as a cultural product shaped by social context and history. Knowledge thus cannot be treated as a thing in itself, as an objective, universally valid body of facts and theories, but must be understood in relation to the social setting in which it originated. This relation between social structures and knowledge systems, has been considered from different perspectives. Karl Marx was mainly concerned with how social relations of production determine ideologies, whereas other approaches (Holzner and Marx 1979) focused on the consequences of knowledge for the encompassing social system. Independent of this controversy on the direction of determination, there has been a general concern with the differential distribution of bodies of knowledge throughout the social structure (Holzner and Marx 1979). Recent research on knowledge construction has however shifted its focus from the study of macro relations to the study of the social context in which knowledge is created at a meso and/or micro level. There is, therefore, growing interest in organizational structures and processes of institutionalization, and in issues of authority, power, and difference (Swidler and Arditi 1994).

Many contributions to the sociology of knowledge criticise positivist social science and the idea that development is simply about applying the right knowledge. From this perspective, recent World Bank efforts to establish itself as a Knowledge Bank and its claim that 'Typically, developing countries have less ... know-how than industrial countries, and the poor have less than the non-poor' (World Bank 1998: 1), exhibit the fallacy of treating knowledge as a thing-like entity. So do World Bank representations of development as an issue of narrowing knowledge gaps and addressing the information problems that result from incomplete knowledge about attributes such as the quality of a product, the diligence of a worker, or the creditworthiness of a firm.

But even from within the World Bank, writings have emerged that go beyond the thing-like perspective on knowledge and attempt to situate knowledge in the broader complexities of real life. Stiglitz (1999) for example developed a model of knowledge for development that, he believes, is quite distinct from 'downloading best practices'. He argues that a body of global knowledge about 'best practices' exists and proposes to turn this 'tacit' or taken-for-granted knowledge into 'codified' knowledge that can be stored in knowledge banks. Local actors could then 'tap into the reservoir of global codified knowledge' (1999: 7) and localize the best practice. The model thus involves local experience and tacit knowledge and takes into account complexities, uncertainty, different values and unique circumstances. Stiglitz stresses the importance of involving local actors in building consensus from the multiplicity of values so

that many voices may define knowledge and 'best practices'. This, however, does not exclude all authority to judge certain kinds of knowledge, as Stiglitz sees a role for the knowledge bank in certifying the credibility of messengers and messages in this 'noisy world, with many alternative theories vying for centre stage' (1999: 12).

What connects the diverse critiques of positivist social science, and has filtered through into Stiglitz' thinking, is the relativization of truth. The certainty of knowledge is no longer seen as deriving from rational first givens or direct empirical experiences (Holzner and Marx 1979) and knowledge is considered within its socio-cultural and historical context. Disconnecting the diverse critiques, particularly since Berger and Luckmann's (1967) seminal treatise, is however the extent to which social reality is viewed as a construct of our knowledge. Points of debate concern the relativist position, that finds no grounds to assess the 'truth' of different knowledge claims and the strict constructivist position that no distinction can be made between 'reality' and 'knowledge'. We differ with extreme relativists for we believe the constructedness of realities does not make them less real. And unlike strict constructivists, we think there is a world existing independently of our knowledge of it. At another level of abstraction, knowledge itself is part of that world, and thus a reality that can be reflected upon. In stead of relativity and constructedness, we emphasise the *fallibility* of knowledge, which makes us wary of simple correspondence of 'truth' since 'the world can only be known under particular descriptions, in terms of available discourses, though it does not follow from this that no description or explanation is better than any other' (Sayer 2000: 2).²

This implies an emphasis in our research on the relation between knowledge and practice; not only cultural, but also technical practice, needed to transform nature into products for human consumption. The focus in the cases discussed below is, therefore, on knowledge crucial for production and distribution: sustainable forestry, GM maize, regulation of biotechnology, complex farming systems and R&D for innovation in industrial production lines. The cases show that studying such knowledge is not only of concern to scholars of production (engineers) and distribution (economists) but also to scholars of culture and knowledge (philosophers, anthropologists, sociologists). Bringing them together will deepen the debate on knowledge in development.³

In recent studies on knowledge construction, there has been a one-sided emphasis on agency. Therefore, to return structure and time to the analysis, we must also consider evolutionary economics, and particularly its concept of path-dependence (see also Kalb, this volume).⁴ Whereas neoclassical economics reduces firm behaviour to profit maximization and only considers the

effects of technology on production functions, thus making it unable to decide what R&D projects to sponsor (Coombs et al. 1992), evolutionary economics includes an analysis of innovation processes. Technology is no longer seen as an entirely plastic entity shaped at will by the all-knowing hand of market forces. In stead, evolutionary economics postulates that technology development in firms is 'path-dependent', related to the cultural matrix of those involved, and steered by a complex selection environment that includes government regulation and institutions such as science and law (Nelson 1995).⁵ Like sociological and anthropological approaches that focus on situated knowledge (e.g. Whatmore and Thorne 1997), evolutionary economics focuses on the connections between people, artefacts, and regulatory regimes.⁶ The concept of 'path-dependency', however, adds a strong recognition of time and other constraints on change; what is imaginable through our knowledge and realisable through our practice is shaped by existing circumstances, transmitted from the past (Marx 1995).

A culturalist critique of 'knowledge for development' thus needs to move beyond the pure constructivist analysis of knowledge and address the question of *reconstruction*: of how to work with knowledge. People must establish which knowledge is more practical or 'true'. This may include, in particular instances, the replacement or even exclusion of other, older knowledge for new, scientific knowledge that is better suited (Collins and Evans 2002). Not all knowledge is equally true, as its use in real life proves. We thus reject an 'anything goes' relativism. Thinking about knowledge implies thinking about intervening in concrete practices. The cases below do not only unpack knowledge interventions but also consider how to re-pack them. We should not see development interventions *a priori* as constraining and dominating processes, but ask questions about the content of the knowledge that is being generated, applied, transferred, and collected – or neglected – and about who is involved in, or excluded from, certain knowledge processes. This brings us to the issue of power and cognitive justice.

BROADENING COGNITIVE JUSTICE

The debates in development studies around power and knowledge generally revolve around contrasting knowledge claims and differences between knowledge systems, i.e. expert versus lay, and Western versus local knowledge. Since the 1980s and 1990s, local knowledge has become of great interest, sustained by three different perspectives (Jansen 1998). The utilitarian approach underlines local knowledge as a contribution to methods on development interventions: blending local with scientific knowledge could discover new ways of enhancing livelihoods (cf. Warren 1991). A utilitarian such as Agrawal, for

example, argues that before initiating 'processes of truth-making' and adding local knowledge into the category of 'indigenous knowledge' in knowledge databases, its potential utility for development should first be scientifically validated (Agrawal 2002: 292).

The anti-modernist view, in contrast, believes the utilitarian perspective will only understand what it can translate while in fact it is impossible to disentangle the technical, social, religious, aesthetic, and other characteristics of local knowledge (Banuri and Apffel-Marglin 1993; Apffel-Marglin 1996). This approach criticizes the universal pretensions of modern thought and takes local knowledge as an inspiration to decolonize our minds and abandon the Cartesian route to development by overcoming the separations of mind and body, subject and object and culture and nature.

The political economy view, however, rejects these romantic or preservationist views on local knowledge. It does not criticize modernization as such but only specific forms of modernization. It appeals to local knowledge as a source of political-economic empowerment (e.g. Thrupp 1989) and warns for overstating the uniqueness of local knowledge and taking a dichotomized, universal-versus- local view on knowledge. Local knowledge is namely in itself often differentiated and partial, and interweaves, hybridizes, and creolizes continuously with exogenous knowledge. One cannot assume a fixed boundary between locality and context (Jansen 1998). The difference between scientific and lay/local thought is often only gradual – both use experiments, logic, and causal thinking, as well as metaphors and associational thinking – and it follows that knowledge interventions could well address both domains of knowledge. The argument against privileging scientific thought is thus also an argument against privileging local knowledge.

A first implication of this third perspective is that the study of the knowledge of common people, such as small farmers, should always be interconnected with the study of the shaping of knowledge in large scale organizations, such as national and transnational firms, the state and international agencies. A second implication is that alternative development need not be preservationist and will often involve the appropriation of exogenous knowledge from dominant actor-networks.

Important in both the anti-modernist view and the political economy view is the issue of cognitive justice. Cognitive justice, as defined by Visvanathan (2001: 8), refers to 'the right of many forms of knowledge to exist because all knowledges are ... partial and complementary and because they contain incommensurable insights'. Therefore, no knowledge should be labelled secondary and museumized. The concept of cognitive justice thus locates the problem of power at a much deeper level than that of the unequal access to knowl-

edge stocks observed by World Bank staff (World Bank 1998). For 'to define knowledge as formal, abstractable knowledge is to impoverish knowledge and to deny the existence of tacit, embodied and, alternative knowledges' (Visvanathan 2001: 6).

We believe the issue of cognitive justice belongs to the core of development studies. But, in contrast to Visvanathan's argument, our emphasis is less on the epistemological status of specific bodies of knowledge or on their plurality and co-existence. For it is not enough to let all voices speak. Knowledge struggles continue, whether under the flag of consensus or confrontation. Cognitive justice is therefore, in our perspective, basically about politics, interests, and rights. This brings us to our next concern.

Keeping development in focus in the age of 'globalization' and 'governance'

While the need for public action to achieve cognitive justice, despite or rather because of globalizing complexities, is pressing, the public production of knowledge for development is increasingly under attack. One sort of critique emerges from the criticism of Development as an outdated, modernist concept. As Pansters and Siebers mention, in Dutch development studies many authors firstly deplore 'the fact that the concept of development has become closely linked to an evolutionary way of thinking in which so-called developing countries would have to go the same development path as the so-called developed world', and secondly reject the notion 'that social reality can be constructed and modified according to intentional and rational standards' (Pansters & Siebers 2001: 2-3).⁷ Our research however is informed by a third dimension of development, as recognised by Pansters and Siebers (2001), namely its potential to point out pressing needs arising from inequality and environmental threats.

This dimension of development emerged from the conviction of the post-World-war moral community that the alleviation of poverty would not occur simply through self-regulating processes of economic growth or social change but required concerted intervention (Cooper & Packard 1997). The concept has been crucial for rethinking unequal relationships in the era of decolonization, for demanding a larger share of the world's resources for the poorest countries without compromising their sovereignty, and for envisioning alternatives to present realities at the local and global level.⁸ Although aspects of control and domination are not absent from the development discourse, it simultaneously generates a demand for decency and equity. 'Development' can be an instrument for contestation and people can engage with it in 'more varied and complex forms than acquiescence or resistance' (Cooper and Packard 1997: 30). Moreover, it has the critical potential to search for alternatives to the anarchy

of the market by calling for collective action to address 'unequal distributions across and within countries' (cf. World Bank 1998: 1). Even in its most market-glorifying versions 'development' is about public action. At stake is, therefore, keeping development in focus, particularly in a time when the discourse of 'globalization' naturalises polarising economic processes as inevitable phenomena to which people, cultures, and politics can only adapt.

In this context, the concept of 'governance' has become increasingly popular for it is seen as *the* instrument to incorporate the poor and marginalised into globalization processes whose new complexities otherwise may lead to social disorder and catastrophes (see Kalb, this volume). The appeal of 'governance' is that it poses an alternative to both the government and the market and the idea that these two can compensate for each other's failures. 'Governance' does not refer to simple steering but to designing new forms of governing that overcome market and government failures through an interplay between active citizens, the state and private partners. The state has lost its monopoly to lay down the rules and enforce them: rules now have to be negotiated, meaning that input in policy formulation and implementation will have to come from a wide range of stakeholders (Jessop 2003). As Jessop however points out, there are also various sources of governance failure. Governance is not *the* answer to government failure: market failure, government failure *and* governance failure will persist and provoke questions about what to do (see Nuijten et al., this volume).

We therefore make two critical observations regarding 'governance'. Firstly, leaving aside the discussion about the most realistic or desirable governance-government combinations, we think that an intervention in knowledge processes in the name of development should always rethink the issue of politics, and thus think about differences, resources, power, control and conflict, and about what kind of state operation is most desirable. The question of what the state bureaucracy should look like, should not be thrown out with the governance bathwater. The public sector remains a crucial and contested terrain to be studied and 'intervened in' by those who question current social relationships and the present distribution of wealth, resources, and opportunities.

Secondly, a proper understanding of knowledge in development requires the study of both old and new forms of government and governance intervention in knowledge processes and the interaction between them. Because development is a contingent, contextualized and changing process, the connections and disconnections made by multiple actors require our research attention. In an idealized model of knowledge intervention in the policy making process, each group of actors had its own knowledge base and differentiated role: politicians provided for the needs of the people and businesses and in case of

insufficient information called in experts to advise them. Today, however, most people no longer accept this ideal model. Different lobbying groups now press their case and call into question the 'facts' presented by others, challenging the 'established' knowledge base. It is now common to believe that experts are in cahoots with business or are called in to legitimize decisions already made by politicians who do not have the real interests of the people at heart.

Whether or not this is true is beside the point: the point is rather that people, businesses and interest groups all possess different information. They try to inject not just their values but also their 'truth' into the system at different points, using their own knowledge base and, increasingly, their understanding of other groups' norms and knowledge bases. Social scientists have argued that knowledge of all these groups is socially constructed. But actually everyone basically knows this. Few people believe in universal, unbiased truths or simply respect 'experts' when it comes to knowledge inputs into the policy making process.

The research lines summarized below thus also take this third general concern into account and explore the new forms of connections between various actor networks and the way they change interventions in the creation, transfer, adaptation, and hybridization of knowledge.

Examples of research into knowledge in development

CASE 1. CONNECTING LOCAL COMMUNITIES TO GLOBAL KNOWLEDGE SYSTEMS:

COMMUNITY BASED SUSTAINABLE FOREST MANAGEMENT AND THE KYOTO PROCESS

Rationale

This case examines knowledge relationships in the formulation of international policy and particularly the potential inclusion of sustainable forest management (SFM) as a Clean Development Mechanism within the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The hypothesis is that the influence of indigenous and other local level knowledge on this kind of policy may be enhanced by packaging such knowledge in 'hi-tech' forms, i.e. electronically, so that it can be appreciated by the relevant political fora and the epistemic communities advising them. The research aims to construct knowledge interventions and develop local capacity to gain access to finance under the climate change treaties for community based SFM activities.

These activities recently emerged, independently of their carbon saving function, as a means of reversing the degradation of natural forests in developing countries while simultaneously providing local communities with greater income (Smith and Scherr 2002). State owned natural forest is contracted out

to local communities, which then have exclusive rights to harvest products under a management plan that balances the rate of harvesting and natural regeneration. The long term impacts of SFM programmes, and their success in terms of forest health and the distribution of benefits, need further study. But at present many professionals find it a cost effective and 'fairer' model for forest management and considerably increased sequestration of carbon. Still, this type of forest management, unlike the creation of 'carbon sinks' by new forest plantations, has not been accepted under the Clean Development Mechanism rules of the Kyoto Protocol. If it were, large amounts of funding would become available for community based SFM and many poor rural people would be able to 'harvest' carbon alongside traditional forest products such as fuel wood.

At present, international climate funds are overwhelmingly spent on large scale industrial projects in developing countries, bypassing the vast majority of the population. Moreover, although climate change policy is made internationally, the interests of the South are underrepresented, partly because of imbalances of knowledge concerning the policy process. This research aims to address these inequalities by facilitating the link between 'the people', in this case the marginalized rural populations in developing countries, and 'policy-makers' and 'experts'.

Local knowledge of forest management is seen in this research both as utilitarian (Warren 1991) and as a source of political-economic empowerment for common people (Thrupp 1989). This research should also, however, be relevant in changing international climate policy so that it becomes more beneficial to marginalized rural people in developing countries. And, at another level, it will examine the more general issue of how the 'development machine' operates – on the basis of whose knowledge and constructed in what way. This case thus also offers an examination of the perceived 'powerlessness' of local knowledge confronted with 'modern, scientific' knowledge, and of the danger of the appropriation of local knowledge by the scientific community (Agrawal 1995).

Contributions to rethinking knowledge in development

This research intends to contribute to linking local actors and global actors in new ways by examining the issue at hand from different levels. At the local level, research will be undertaken in communities undertaking SFM under a variety of schemes.⁹ The aim will be to measure the sustainability of their activities and to assess the carbon that is saved. Working with groups backstopping SFM activity at the grassroots level, experiments will be conducted to assess the extent to which local communities are able to use hi-tech methods such as lap-top based Geographical Information Systems (GIS), sequential photo series and a variety of electronic visualization techniques to record the carbon balance

of their activities. Use of such technology by local communities is developing rapidly, as are participatory applications using hand held computers in land, watershed, and forest management. It will be important to keep in mind that knowledge, and its translation via such media, may not be universal and may be 'captured' by some groups such as village elites or NGOs.

At the policy making level, the processes underlying the decision to exclude SFM, but to include afforestation/reforestation under the Clean Development Mechanism, will be analysed to understand what factors were taken into consideration, by whom, and why. The policy was heavily influenced by 'independent' experts from an advisory body to the UNFCCC: the Land Use, Land Change and Forestry Commission. The simple hypothesis is that SFM was rejected on technical grounds because the carbon sequestered by SFM is difficult to monitor as the creation of a baseline is problematic and the risks of loss of forest due to other human uses is higher than in afforestation projects. There may also however be more political reasons for the decision. An analysis of the decision could throw light on the base, ownership and form of the knowledge that affected the policy outcome.

An important factor, at a third level, is that representation of Southern interests in international policy development is limited by power imbalances and a lack of information (Gupta 1997). Research will therefore explore how the designated authorities in developing countries engage in climate change policy development, what their knowledge of the technical and political issues is, and how they bring this across. It is hypothesized that increased visibility of the benefits of SFM, through data storage and presentation in electronic form, will increase not only local authorities' interest in SFM as a viable carbon approach, but also, more importantly, their leverage in accessing funds, and thus the regularity with which this strategy is advanced in the international debate.

CASE 2. CONTESTING THE TRICKLE DOWN MODEL OF SCIENTIFIC INFLUENCE:

GM MAIZE IN MEXICO

Rationale

Scientific knowledge may be directly related to large-scale interventions in a country's economy and society. In order to explore this relationship, we use the case of the North American Free Trade Agreement (NAFTA) and the ensuing release of genetically manipulated maize in Mexico.

A series of controversies about the possible effects of NAFTA emerged in Mexico, the U.S. and Canada in 1994. Pressure groups and politicians fiercely tried to convince each other of either the negative consequences or the positive spin-offs. No solutions pleased all and 'experts' were flown in to settle

the thorny issues. From their respective disciplines, econometrists, lawyers, agronomists and engineers confidently produced rational solutions and advice on future courses of action. Most experts advocated laissez-faire, whereas some recommended temporary protection of vulnerable economic activities such as maize production. Policy makers took up the latter cluster of recommendations. When NAFTA came into being in 1994, Mexican farmers would enjoy protection from cheap US maize through import tariffs that would last until 2008 – time enough, experts argued, for Mexican peasants to modernize their farms and prepare for open competition. In a classic showcase of autocratic power, however, Mexico never levied any tariffs on imported maize.

In 1996, the United States Department of Agriculture (USDA) allowed American farmers to produce and export genetically modified (GM) maize and it soon found its way into Mexico, evoking fears about genetic contamination of local varieties. Again, the issue was hotly debated. Geneticists then settled the controversy by ‘proving’ that genetic modification is harmless. And again, a decision was taken on the basis of this knowledge as Mexican authorities approved importation. As a trade-off, the strict condition was posed that the GM maize could be used for consumption purposes only. Eventually, however, most assumptions underlying scientists’ solutions proved incorrect. By 1998 the domestic price for corn had fallen to a mere 45 per cent of pre-NAFTA levels, a large part of Mexico’s 3.2 million small-scale farmers was bankrupt, and foreign multinational companies captured 25 per cent of the Mexican maize market. To make things worse, regulatory frameworks failed and by 1999 farmers all over Mexico were sowing GM corn, which resulted in horizontal gene transfer to local maize varieties.

This case points to the close relationship between scientific knowledge and large-scale interventions. The decision to release GM maize, we hypothesize, was taken on the basis of knowledge produced by a few and used by still fewer to intervene in a controversial situation that affected many: a paradigm case of the so-called ‘trickle down’ model of scientific knowledge and influence, which works as follows. First, decision-makers turn to scientific experts, who ‘frame’ the problem so that it is made calculable, manageable, reduced. Then, the problem is taken to the laboratory where, through an appeal to positivist, scientific methods, knowledge is produced. Finally, the answers are ‘scaled-up’ by politicians, economists or captains of industry. In this ‘trickle down’ model of scientific influence, knowledge emerges from the lab and is then passed on to society at large.

Contributions to rethinking knowledge in development

Taking decisions on the basis of the ‘trickle down’ model raises a range of

problems to be studied. First there is the problem of framing. In the 'trickle down' model, complex problems are framed to make them fit within the laboratory walls. The walls however have moved outwards as econometrists, geneticists and lawyers depend on peasant households, maize fields and MNCs for their data. These situations may be described as 'collective experiments' (Latour 1999) wherein a variety of dissimilar actors, from the laboratory to the consumer, become progressively entangled. Reducing the controversy around the release of GM maize to its 'scientific essence' is futile, quite simply because the controversy is simultaneously a political question, a moral exercise and a scientific experiment .

Secondly, there is the dilemma of scaling up. In the 'trickle down' model, scaling up solutions to complex problems is tricky because they grow out of laboratory experiments, from simplification mechanisms that 'seek to tame the many erratically changing variables that exist in the wild world, keeping some stable and simply excluding others from the argument' (Law and Mol 2002: 2). The problem is that what was not foreseen is likely to happen anyway.

A third problem relates to morality. Since Bacon and Descartes, the public can accept or reject experts' knowledge, but it can certainly not add to it, dispute it, let alone contribute to its elaboration. In the 'trickle down' model knowledge is unequally distributed. This is particularly problematic in cases with high moral and political content, such as genetic modification. As Latour (1999: 243) argues, 'if there is one thing that does not require an expert and cannot be taken out of the hands of [the lay people], it is deciding what is right and wrong, what is good and bad.' Expert knowledge may effectively shortcut political process and keep the crowds at bay, but it cannot solve normative issues.

Therefore, nothing could be more inadequate for designing collective experiments than the 'trickle down' model of knowledge with its two clearly separated forums, one of scientists bringing piecemeal solutions to complex problems and the other of lay persons waiting for the experts' advice. This old difference that separated 'true' knowledge from passions and interests has eroded, giving way for what Callon, Law, and Rip (1986) coin a 'hybrid forum'. In a single, hybrid forum both experts and non-experts actively participate in debates, tests and attempts at interpretation – in short, in experimentation and collective learning. In these hybrid forums everything becomes controversial (Callon 1998). Thus in the example of GM maize a single, hybrid forum includes multinational companies, national and international environmental NGO's, local agricultural associations, indigenous groups, universities and research centres, religious organizations, consumers, and ministries, who all put forward potentially incompatible definitions of the situation and proposed

solutions – thus indicating the absence of a stabilized, central knowledge base that may help to reach consensus. The actors do not necessarily attack pre-existing knowledge, and may coincide on a number of issues, such as ‘maize is the backbone of the peasant economy’ or that ‘nearly 70 per cent of farmers cultivate native or *criollo* varieties’. Yet on other issues opinions differ sharply: indigenous communities consider corn to be at the heart of their culture whilst for DuPont maize is a commodity just like any other; NGO’s appeal to precautionary principles to which Mexico subscribed by signing the Convention of Biological Diversity yet scientific articles demonstrate the safety of GM-maize. The list of controversial issues is huge and growing as more and more actors become involved.

Collective experiments have moved outside the walls of the laboratory and become increasingly democratized as certain actors refuse to swallow ‘expert advice’ and fight for their voice to be heard. Thus we will study the emergence of social movements challenging the introduction of GM-maize such as organized producers of organic maize, hundreds of *tortillerías* that sell only certified organic produce, or consumer associations who turn their back on US maize. Each of these movements frames the controversy differently, has specific demands, and employs the necessary tactics. The knowledge that emerges thus coincides with the constitution of alternative collective identities that in turn help shape the rules of using scientific knowledge.

CASE 3. INTERNATIONALIZATION OF SCIENCE-POLICY INTERACTIONS AND THE MODELLING OF BIOTECHNOLOGY REGULATION FOR DEVELOPING COUNTRIES

Rationale

Biotechnology arouses heated debates, increasingly also in developing countries. Technological uncertainties, potentially high risks for biosafety and human health, ethics, and economic interests in high investments and projected future profits, all invoke demands for regulation. Experts play a central role in making this regulation and international organizations such as the FAO, WHO, and UNEP continuously set up expert advisory committees around controversial technical issues to generate cognitive consensus, codified in laws, standards, guidelines and best practices. Some major concerns warrant more research into the hidden role of international expertise networks operating in plant biotechnology regulation. The models, standards and guidelines that international expert committees design for application in developing countries are not simple translations of technical arguments into policy advice but are laden with norms, beliefs, assumptions and notions of validity of the supposedly ‘neutral’ experts. In fact, expert committees exist not so much for their scientific value as for their political and regulatory value in legitimizing political

decisions through seemingly neutral, independent statements of truth.

A redefined version of the concept of 'epistemic community' is relevant here. The concept refers to a nation-wide or worldwide group of professionals with recognized competence and an authoritative claim to policy-relevant knowledge within a certain domain (Haas 1992). Such increasingly international expert communities articulate cause-and-effect relationships of complex problems, help states to identify their interests, frame the collective debate, propose specific policies, and identify points for negotiation. The process of consensus construction in epistemic communities however needs to be explained rather than presumed (Grundmann 1996), and the unqualified separation of reason from social processes needs to be disrupted. Therefore we must examine the influence of ideological frameworks on the content of knowledge generated by international epistemic communities, whose members' views are conditioned by the institutions in which they work.

Our central premise is that these international epistemic communities differ from circles of policymakers in their arguments, authority structures and discursive styles. Epistemic communities are neither purely political or purely scientific groups. They have the specific task to order, select and filter information, and to develop system knowledge rather than scientific knowledge: they produce policy recommendations rather than proposals for new research or scientifically interesting, but policy irrelevant knowledge. This inherent tension between science and politics, make epistemic communities a special social category.

A second concern about the increasing role of international epistemic communities in modelling biotechnology regulation is the unequal participation of developed and developing countries in generating cognitive consensus and setting standards. At international meetings, delegations from developing countries are relatively small, but influence is also unequal as economic interests and the use of hegemonic power affect the agenda, operation and the status of advisory groups. The process whereby a certain view becomes dominant is complex and not necessarily a direct result of hegemonic international relations, corporate interests or similar external forces. We hypothesize that a complex combination of internal and external factors and processes determine the outcome of expert networks. This demands careful empirical study. Ultimately, we doubt whether through epistemic communities 'reason' may defeat economic interests in policymaking (Grundmann 1996).

Contributions to rethinking knowledge in development

The research contributes to rethinking four thorny issues. The first concerns capacity building. Proposals to develop biotechnology in developing countries

often ignore the dilemmas between 'doing things right' along predefined scientific standards, and exploring new avenues of 'doing the right thing'. The chance of escaping conventional thinking is low, since available knowledge will define what kind of new expertise is wanted. Much work needs to be done if one assumes that the escape from underdevelopment needs unconventional thinking and authentic R&D and that expert formation should be about social learning around local problems rather than capacity building along dominant models.

A second issue concerns the tensions between standardization and harmonization on the one hand, and heterogeneity and complexity on the other. Expert formation by international organizations is driven by a universalizing science and the internationalization of epistemic communities tends to enforce harmonized standards. However, national political, economic, and social conditions and specific ecological and technical environments tend to be diverse, heterogeneous and complex. 'Doing things right' emphasizes a universally applicable science and harmonized standards while 'doing the right thing' emphasizes contextualizing standards and allowing for locally specific trajectories. Interesting is how international expertise deals with specific contexts when building science-based universal guidelines, that in turn need to be translated to the specific conditions of individual developing countries.

A third issue concerns the production of consensus. Does consensus result from rational argument or imposed compromise? How is consensus achieved among divided perspectives? The ideal type epistemic community as defined by Haas (1992) supposes that scientists and technologists come to a consensus by virtue of their scientific and technical knowledge rather than as representatives of certain organizations or countries. But reaching scientific consensus may be difficult or impossible because of scientific uncertainties, and often external forces influence consensus making. Detailed empirical research can unravel how consensus building or hegemonic knowledge construction takes place. Challenges are firstly to analytically disarticulate the technical from the political (Collins and Evans 2002) and secondly to overcome reductionist versions of political economy, social constructivism, and positivist science, which respectively prioritize external power struggles, prioritize internal power struggles, or disregard power completely. This last point may sound like a regression, a technocratic response to the mess of political interests. However, our view on knowledge by definition excludes the possibility of technocracy. Any proposal for technology development is laden with judgements, and is thus political. This observation, however, does not mean better knowledge is not possible or should not inform decision-making.

The fourth issue concerns the legitimacy of technical decisions in a field

where science and politics intersect. One could propose experts' recommendations to be accountable only to peer review, i.e. to other experts who decide whether the arguments are sound, valid, and based on substantial evidence. In contrast, one could also propose democratic evaluation of expert recommendations with participation of all groups in society. The first view implies a technocratic view on policy advice; the latter a politicization of epistemic communities and expert knowledge. We start from an agnostic position towards this technocracy versus politicization problem, allowing us to study how it is solved in concrete situations.

CASE 4. COMMODITIZATION OF KNOWLEDGE AND THE CHANGING DYNAMICS OF
(MULTI-STAKEHOLDER?) INNOVATION PROCESSES

Rationale

The privatization of agricultural extension services, driven by dominant ideas on globalization and governance (see Kalb; Nuyten et al., both this volume), impinges on innovation processes. 'Agricultural extension', an institutionalized form of knowledge intervention for agricultural development, was until the 1980's mainly studied to predict and influence the adoption of innovations by individual farmers (see Rogers 1983). However, the tendency among extension institutions of indiscriminately promoting badly adapted and pre-defined innovations, often developed by researchers with little understanding of farmers' problems and priorities (Röling 1988), has lately given rise to a considerable amount of critical thinking in extension studies and to radical changes in extension theory. The very idea of what constitutes an innovation and how it is brought about has changed dramatically. Innovations are now not just a technical phenomenon, but also include a re-organization of social relationships. This implies that 'adoption' is a collective rather than an individual phenomenon, thus requiring co-ordinated action. 'Successful' innovations, moreover, develop in a non-linear manner and depend on the integration of knowledge from various sources, whereby science often plays a relatively minor role. Innovation processes are, furthermore, political in nature, often involving tension, conflict and unequal division of resources among stakeholders. Conceptions regarding the possible role(s) of the 'extensionist' or 'change agent' have changed. While previously they had to 'provide advice' or 'disseminate innovations', they must now facilitate the design of well-adapted socio-technical innovations, i.e. their role is to support multi-stakeholder processes of network building, social learning and conflict management to arrive at novel social and technical arrangements (Leeuwis and Pyburn 2002).

Within this changed perspective on 'agricultural extension', the privatization of agricultural extension and the commoditization of knowledge is criti-

cally assessed. The reasons for governments to stimulate the development of markets for agricultural knowledge and information include dissatisfaction with the functioning of agricultural extension, budget constraints, structural adjustment policies, and reduced public support for subsidizing the agricultural sector (Leeuwis 2000). Policy makers increasingly believe market mechanisms can be applied to 'knowledge intervention'. Even if many governments still fund extension activities, the 'delivery' is increasingly contracted out to private companies (Marsh and Pannell 1998, Umali and Schwarz 1994). And although agricultural research is rarely fully privatized, applied and strategic agricultural research institutes are becoming independent organizations competing, through the tendering system, in a 'market' for research outputs. 'Input' financing is thus replaced by 'output' financing. Together, these tendencies form the contours of a newly emerging market for applied agricultural knowledge and information.

Creating a market implies organizing excludability of others from the marketed product in order to assign it with the necessary property rights and price (Umali and Schwarz 1994). This raises questions about the consequences of the 'commoditization of knowledge' on access to knowledge and information, i.e. how does substitution, exclusion and relocation occur for different categories of actors?

Contributions to rethinking knowledge in development

Several studies have already suggested that the focus of extension and applied research is likely to shift to well-resourced clients (Marsh and Pannell 1998). It has however hardly been studied how the commoditization of knowledge affects the dynamics of innovation processes, e.g. in terms of network building, social learning and conflict management. Assuming that innovation processes demand creative and flexible co-operation within knowledge networks (Van Schoubroeck 1999), preliminary studies suggest that several obstacles for such co-operation exist in the emerging knowledge markets (Leeuwis 2000). Firstly, it has become more difficult to work on things that cannot in advance be assigned the clear 'product' definition that tendering procedures require, thus limiting the horizon, flexibility and creativity of innovation processes and reducing the scope for taking on board learning experiences and intuitions. Moreover, co-operation between applied research and extension is hindered by competition for resources and contracts, and disagreement on payments. Similarly, the reduced exchange of free knowledge and information among parties in the network, including reduced horizontal exchange among farmers, may hamper the formulation of well-articulated collective 'demands' for research and extension (Oerlemans et al. 1997). The availability of applied research for

primary agriculture is also under threat due to shifting client perceptions and increased bureaucracy and transaction costs (Marsh and Pannell 1998).

It turns out that the idea that applied agricultural knowledge can be treated as a private and/or toll good, may only be valid in the case of 'proven' and easily adaptable innovations that are already available. The overall impression is that 'knowledge markets' complicate the very processes necessary to arrive at such 'proven' innovations, because commoditization of knowledge leads to interaction patterns that hinder flexible cooperation and creativity. The notions of 'supply' and 'demand' are often not applicable to innovation processes. In the discourse on privatization, the 'demand' side is mostly associated with users of knowledge (farmers) while the suppliers are supposedly the developers (researchers) and transmitters of knowledge (extension agents). Thus, the metaphor of supply and demand reintroduces the earlier abandoned idea of a clear division of tasks between the three parties. In an effective innovation process it tends to be unclear who 'supplies' and who 'demands' knowledge and information, as successful innovation requires the integration of relevant, often intangible, knowledge from several parties. This means that it is inherently unclear who should be paying whom in a multi-party innovation process. Consequently, a market does not seem the right institutional arrangement for bringing about innovation.

The overall innovative capacity of agrarian knowledge networks may suffer from the commoditization of knowledge, particularly for forms of agriculture that are least amenable to standardized recipes, and on which relatively little knowledge is available. This includes forms of agriculture that aspire or are 'forced' to work with few external inputs and/or with limited means to control the environment, such as ecological or rain-fed agriculture, requiring complex, diverse and locally specific knowledge and innovations (Leeuwis 2000). Therefore, more systematic research into the changing dynamics of innovation processes in a context of privatization is necessary, also from a perspective of developing the appropriate responses and more suitable institutional arrangements to facilitate innovation.

CASE 5. THE ROLE OF THE STATE IN GENERATING KNOWLEDGE IN DEVELOPING COUNTRIES

Rationale

The production of goods and services necessarily depends on the use of knowledge. The knowledge intensity of production has increased manifold in the last two decades, clearly indicated by the increased share of traded knowledge intensive products (Mani 2000). The production and export of these products also takes place in developing countries, though with a considerable concentration of it in a few Asian countries.

Knowledge underlying production, whether industrial or non industrial, can be formal or non-formal. We however only consider the first type. Even in freely competitive markets, there are a number of disincentives to the creation of formalized knowledge. This raises the question of whether there are reasons to defend state support for formal knowledge creation, especially within industrial enterprises in developing countries.

Though of great importance, the role of state intervention in the generation of knowledge has received little attention. The only major attempt has been by the World Bank (1998), whose study emphasized the role of the state in developing countries, but interpreted it narrowly as freeing up trade and investment regimes through international trade in commodities and in capital. Very little empirical evidence, however, supports the idea that formalized industrial knowledge can be obtained through free trade. Rather, this type of very location specific knowledge will have to be created locally through the right types of institutions and incentive systems. More research into the main theoretical and empirical reasons for public intervention in knowledge creation is necessary.

Contributions to rethinking knowledge in development

A first issue is whether there is a theoretical rationale for state interventions in industry-linked R&D in developing countries. We believe these reasons are the two types of 'market failure' that exist in R&D financing by private sector agents.

The first type of failure happens when the investor that performs R&D also finances it. This failure is captured in the so called 'appropriability' argument: R&D investments result in the production of new knowledge that is non-rival in its use and can therefore, despite the existence of intellectual property right mechanisms, be imitated by competitor firms at lower costs than the costs of creating it from scratch. The failure results from the failure to appropriate the full returns of own research. The gap existing between private and social rates of return for certain innovations, justifies public policy measures to combat possible underinvestment in R&D by private sector agents. These public policy measures include fiscal incentives for R&D, research grants, strengthening of the intellectual property regime and financing of research partnerships.

The second type of failure exists when the innovation investor has to seek funding from an external financier. Here, a second gap exists, between the private rate of return and the cost of capital. Conventional capital markets, whether based on debt or equity, eschew innovation projects as their outputs are uncertain and unpredictable. To correct for this failure, specialized financial institutions, such as venture capital institutions, have been established, usually

with state support.

Apart from these two theoretical arguments, current research has also found several empirical reasons justifying state intervention, particularly in the context of firms operating in developing countries. One is that especially since the mid 1980's, there is a slowing down of investments in R&D by business enterprises, accompanied by a reduction of its funding by governments, across the world. There is, moreover, little evidence of internationalization of R&D: most US patents granted to the world's largest companies are still based on research conducted in their home countries (Patel and Vega 1998). In addition, there are growing imperfections in the market for new, disembodied technologies, which shows considerable year-to-year fluctuations and is actually shrinking in size. Increasingly, technologies are transferred to developing countries not through the market but through internal transfers between the parent firm and affiliates of large TNC's and through foreign direct investment. Here there is, however, little empirical evidence of positive spillovers to local, unaffiliated companies. In those countries, like Singapore, where there are positive spillovers, these are the direct result of explicit, ingenious public policies. In sum, the globalization of technology generally affects developing countries only in an insignificant manner, if at all, and the market for technology is shrinking and not very competitive.

Our recent and ongoing research (Mani 2002) suggests that developing countries need their own public innovation policies and we believe, in conflict with currently dominant discourses, that it is important to rethink the public instruments and institutions that encourage knowledge creation at the firm level. Here it is particularly important to keep in mind differences between developing countries for these can be significant. This is already revealed through a simple indicator such as the issue of US patents to particular countries: of all developing countries, only eleven received US patents (Mani 2002).

The differences between countries affect their definition and scope for state intervention. The widely cited pieces of Nelson (1959) and Arrow (1962) assume that formalized knowledge is only created through the R&D efforts of firms and research institutes. Undeniably, however, knowledge is also created through a variety of non-R&D routes. In some developing countries, the main medium for knowledge creation is through formalized R&D activities within industrial enterprises or in research institutes, whereas in other countries firms and institutes can generate knowledge through a variety of non-R&D channels, such as the installation of new vintages of capital goods and the consequent information provided by suppliers. Understanding these differences leads to better informed choices for state action. In the first group of countries, state intervention would best take the form of financial incentives such as tax credits

and research grants targeted at raising R&D investments at the firm level. In the second group, the preferred policy would include grants and concessional loans for acquiring new technologies from other firms and institutions and changing these technologies to suit local conditions. Such strategies have to be balanced with the need for public expenditure to sustain a critical mass of scientists and engineers.

There are thus various theoretical and empirical grounds justifying further research on state involvement in supporting R&D. The possibility of government failure does not relieve us from the task, obvious to anyone who takes seriously the right of developing countries to develop their own industries, to debate how governments should compensate for market failure in this field of knowledge in development.

Conclusions

This chapter sketched the broad contours of a research framework on knowledge in development that builds on a fruitful exchange of ideas between different research programmes. The first shared concern was how to unpack both knowledge in development and interventions in knowledge processes by different actors. The five cases go beyond simple descriptions of access and issues of distribution and redistribution of knowledge as a thing that you can have or not have. They underline the importance of zooming in on the social shaping of knowledge and access to knowledge. Moreover, they see knowledge in terms of processes and relationships and try to understand how knowledge is embedded in its social and political-economic historical context. To some degree, all five research trajectories also intend to analyse how and why certain knowledge is constructed, analysing how certain models, classifications, and ideas about knowledge in development processes are presented as inevitable 'facts' (Hacking 1999). For example, they intend to understand how certain theories about the need for privatization and withdrawal of the state from investing in R&D or extension services contrast with everyday dynamics of innovation processes and extension. Three of the cases underline the importance of unpacking the role of expertise through problematizing the 'trickle down' model of scientific biotechnology knowledge and the monopoly of 'experts' in defining collective action, criticizing the criteria for eligibility of forestry projects within the various treaties in the international climate change process, analysing how certain principles about risk assessment become dominant, unravelling who becomes involved in advisory groups and why, and identifying the possible consequences for the knowledge constructed after such processes of inclusion and exclusion.

Typically, the research trajectories are not restricted to closed knowledge

systems and do not separate local knowledge from external knowledge. In each case there is a focus on controversies about knowledge in the light of social, economic, and political shifts, that can be labelled under the term 'globalization': the problem of connecting forestry communities to international organizations that dominate the definition of policy models on climate change and the codification of knowledge required to participate in the decision making process; the controversial role of science supporting large-scale technological interventions based on the free trade idiom; the obfuscated internationalization of science-policy interactions to model regulation for developing countries; and the consequences of the privatization ideology on state support for R&D in firms and for communication and innovation in the agricultural sector. The cases study the new connections and disconnections that result from these contemporary political processes.

A second concern, emerging from the unpacking of knowledge processes, is the issue of power and inequality, linking the observation of differential access to knowledge to a more profound analysis of inequality, asymmetrical power relations, and conflict. The privatization of extension services may increase selectivity within privatized knowledge networks: both research and extension tend to be directed towards more resourceful clients. Commoditization of knowledge seems to go along with arrangements that obstruct participation of farmers and industrial firms in developing countries in innovation processes, which is likely to reduce innovative capacity. Moreover, it may also pose constraints for public agencies such as extension organizations, research institutes, and regulatory agencies, to take on new roles and mandates that are more in line with both new societal challenges and conceptual understanding of innovation processes. Several of the research programmes focus on the framing of problems by experts and politicians and how this disenfranchises the non-experts and makes them invisible. Expertise creates legitimacy and authority to intervene. The question has been raised whether local knowledge should be trusted by the international community. This is a question of knowledge content and skills, but also of reliability and susceptibility to cheating. Privatization, the commoditization of knowledge, and the framing of the problems by international expertise networks may increase North-South inequalities: firms from the South cannot innovate to be competitive, experts from the North define what are important risks, the needs of resource-poor farmers are not addressed by the research and extension systems, local forestry communities are excluded from decision making about forestry projects, and so on. This may also enlarge tensions and conflicts within Southern societies, for example, between resource-rich industrial agriculture and resource-poor farmers, between national firms and subsidiaries of transnational corporations

and between experts and lay persons.

Inequality, asymmetrical power relations and domination are, however, contested. Poor farmers, lay people, and national firms frame the problems in their own terms and contest the privatization of extension systems, the expert definitions of risks and sustainable forestry, and the protection of transnational corporations and producers in the North through a lopsided application of the 'free market' ideology. Contestations over power in knowledge shaping are not only situated at a highly subtle, almost abstract epistemological level but are also a day to day affair, present in making choices, taking positions, and acting.

This points to the third shared concern. The research programmes all intend to contribute to a re-packing of knowledge interventions in order to address inequalities. It is not possible to stand on the sideline as neutral observers and interpreters. Within a power-laden domain, certain theories and practices have to be supported or alternative actions imagined and initiated. These research programmes therefore aim to formulate policy alternatives which redress the negative consequences of current forms of privatization, commoditization of knowledge, domination of international expertise networks by a few countries, commercial forces and dominant models in carbon saving projects. Most do not see a post-modern, fragmented world, where the dominant approach to knowledge is inescapable, but a complex world where contestation and negotiation include making alliances, realizing small improvements, and playing at fields traced out by powerful players. One programme advocates a new role for extensionists as facilitators of processes of learning. It not only aims at an alternative process of knowledge generation and transfer, but also at alternative knowledge, about more complex farming systems such as ecological agriculture. Other programmes also aim for specific alternatives: biosafety regulation which is tailor-made to variations in local ecological and socio-economic conditions, criteria for carbon saving which include sustainable forestry by local communities, criteria for defining when state action is needed to support firm investment in technology innovation, and imaginations of maize not only as a commodity but also as a cultural element. All the research programmes reconstruct the need for a greater level of public responsibility in dealing with issues pertaining to knowledge and innovation. Collective action in the public sphere, using both government and governance instruments, is needed more than ever to address inequalities in knowledge issues. We thus believe that cognitive justice, in its broader definition, should be a core concern of development studies.

Notes

1. Kees Jansen is connected to the Technology and Agrarian Development group, Wageningen University (corresponding author: kees.jansen@wur.nl; Hollandseweg 1, 6706 KN Wageningen, The Netherlands); Cees Leeuwis is part of the Communication and Innovation Studies group, Wageningen University; Sunil Mani is linked to the United Nations University/Institute for New Technologies in Maastricht; Esther Roquas is co-ordinator for CERES at Wageningen University; Margaret Skutsch is connected to the Technology and Development Group, University of Twente; and Gerard Verschoor is part of the Rural Development Sociology group, Wageningen University. The authors are grateful to Bert Helmsing for his comments on an earlier version of this paper (the usual disclaimer applies).
2. 'If the world itself was a product or a construction of our knowledge, then our knowledge would surely be infallible, for how could we ever be mistaken about anything?' (Sayer 2000: 2).
3. Our interest in new knowledge, technological change, and innovation differs from the current interest in the 'knowledge society' and 'technological culture'. Rapid and substantial changes take place due to new information and communication technologies, but this does not imply that knowledge and technology determine social relationships and social change in a qualitatively different way than in the past. Technology and knowledge have always been central elements of society. They are not exclusive characteristics of advanced, modern, or post-modern societies. The concepts of knowledge society and technological culture are in this sense misleading and ethnocentric. They tend to privilege certain forms of knowledge over others, and may ignore the social, economic, and political conditions that create dominance of one knowledge system over others as well as inequalities in access to specific kinds of knowledge. Hence, research on, for example, local forestry practices or industrial assembly lines is as 'modern' as research on Geographical Information Systems, telecom sectors, and biotechnology.
4. Within anthropology, the neo-Durkheimian grid-group cultural theory has actively kept the idea of meanings embedded in structures and social groups central to anthropological thinking (e.g. Milton 1996; Richards 2004).
5. This idea of 'cultural matrix' has many similarities to the notion of 'thought styles' or 'cultural bias' as developed by the neo-Durkheimian grid-group cultural theory (Douglas and Ney 1998; Schwarz and Thompson 1990); see the preceding note.
6. The attention that evolutionary economics pays to actors' expectations, uncertainties in the process of technological change, and to the idea that an economic calculation of technology decisions can only be made ex-post, brings it close to sociological questioning of technological change. For the remaining differences between these approaches see MacKenzie (1992).
7. Some other early contributions from the Netherlands to this critique of 'development' are Nederveen Pieterse (1991), Long and Long (1992), Schuurman (1992), and Slater (1992).
8. Cooper and Packard (1997: 30) make an important observation about one problematic aspect of the development construct. '(T)he power of the development construct lay [sic] in its rejection of the past and its aspirations for the future rather than its capacity to address the complexities and the possibilities that lay within ongoing processes.' Both hegemonic views on development as well as subaltern views may overlook this element of 'development'.
9. A series of ten in depth case studies in Tanzania, Uganda, Senegal, Mali, Nepal and India is planned.

References

- Agrawal, A. 1995. Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, 26: pp. 413-439.
- Agrawal, A. 2002. Indigenous knowledge and the politics of classification. *International Social Science Journal*, 54(173): pp. 287-297.
- Apffel-Marglin, F. 1996. Introduction: Rationality and the world. In: F. Apffel-Marglin and S. A. Marglin (eds), *Decolonizing knowledge: From development to dialogue*. Oxford: Clarendon Press: pp. 1-39.
- Arrow, K.J. 1962. Economic welfare and the allocation of resources of invention. In: R.R. Nelson (ed.), *The rate and direction of inventive activity: Economic and social factors*. Princeton, NJ: Princeton University Press: pp. 609-625.
- Banuri, T., and F. Apffel-Marglin 1993. A systems-of-knowledge analysis of deforestation, participation and management. In: T. Banuri and F. Apffel Marglin (eds), *Who will save the forests? Knowledge power and environmental destruction*. London: Zed: pp. 1-23.
- Berger, P. L., and T. Luckmann 1967. *The social construction of reality: A treatise in the sociology of knowledge*. Garden City: Anchor Books.
- Callon, M. 1998. An essay on framing and overflowing: economic externalities revisited by sociology. In: M. Callon (ed.), *The laws of the markets*. Oxford: Blackwell Publishers: pp. 244-269.
- Callon, M., J. Law and A. Rip (eds.) 1986. *Mapping the dynamics of science and technology: sociology of science in the real world*. London: Macmillan.
- Collins, H.M., and R. Evans 2002. The third wave of science studies: Studies of expertise and experience. *Social Studies of Science*, 32(2): pp. 235-296.
- Coombs, R., P. Saviotti, and V. Walsh 1992. Technology and the firm: The convergence of economic and sociological approaches? In: R. Coombs, P. Saviotti, and V. Walsh (eds), *Technological change and company strategies*. London: Academic Press: pp. 1-24.
- Cooper, F., and R. Packard (eds) 1997. *International development and the social sciences: Essays on the history and politics of knowledge*. Berkeley: University of California Press.
- Denning, S. 1998. *What is knowledge management?* Washington, D.C.: World Bank.
- Douglas, M., and S. Ney 1998. *Missing persons: A critique of the social sciences*. Berkeley: University of California Press.
- Grundmann, R. 1996. *Mending the ozone layer: The role of transnational policy networks*. Köln: Max-Planck-Institut für Gesellschaftsforschung, MPIFG Discussion Paper 96/8.
- Gupta, J. (1997) *The climate change convention and developing countries – From conflict to consensus?* Dordrecht: Kluwer.
- Haas, P. M. 1992. Introduction: Epistemic communities and international policy coordination. *International Organization*, 46(1): pp. 1-35.
- Hacking, I. 1999. *The social construction of what?* Cambridge: Harvard University Press.
- Holzner, B., and J. H. Marx 1979. *Knowledge application: The knowledge system in society*. Boston: Allyn and Bacon.
- Jansen, K. 1998. *Political ecology, mountain agriculture, and knowledge in Honduras*. Amsterdam: Thela Publishers.
- Jessop, B. 2003. Governance and metagovernance. On reflexivity, requisite variety, and requisite irony. In: H. Bang (ed.) *Governance, governmentality and democracy*. Manchester: Manchester University Press: (forthcoming).
- Latour, B. 1999. *Pandora's hope: Essays on the reality of science studies*. Cambridge: Harvard University Press.
- Law, J. and A. Mol 2002. *Complexities. Social studies of knowledge practices*. Durham and London: Duke University Press.
- Leeuwis, C. 2000. Learning to be sustainable. Does the Dutch agrarian knowledge market fail? *European Journal of Agricultural Education and Extension*, 7(2):pp. 79-92.
- Leeuwis, C and R. Pyburn (eds.) 2002. *Wheelbarrows full of frogs. Social learning in rural resource management. International research and reflections*. Assen: van Gorcum.

- Long, N., and A. Long (eds) 1992. *Battlefields of knowledge. The interlocking of theory and practice in social research and development*. London: Routledge.
- MacKenzie, D. 1992. Economic and sociological explanation of technical change. In: R. Coombs, P. Saviotti, and V. Walsh (eds), *Technological change and company strategies*. London: Academic Press: pp. 25-48.
- Mani, S. 2000. Exports of high technology products from developing countries: Is it real or a statistical artifact? Discussion Paper Series # 2000-1, Maastricht: United Nations University/Institute for New Technologies.
- Mani, S. 2002. *Government, innovation and technology policy, an international comparative analysis*. Cheltenham: Edward Elgar.
- Marsh, S. and D. Pannell 1998. The changing relationship between private and public sector agricultural extension in Australia. *Rural Society*, 8(2): pp. 133-149.
- Marx, K. (1995 [1852/1869]) *The Eighteenth Brumaire of Louis Napoleon*. Marx/Engels Internet Archive: <http://www.marxists.org/archive/marx/works/1852/18th-brumaire/index.htm>.
- Milton, K. 1996. *Environmentalism and cultural theory. Exploring the role of anthropology in environmental discourse*. London: Routledge.
- Nederveen Pieterse, J. 1991. Dilemmas of development discourse: The crisis of developmentalism and the comparative method. *Development and Change*, 22: pp. 5-29.
- Nelson, R. R. 1959. The simple economics of basic scientific research. *Journal of Political Economy* 67(3): pp. 297-306.
- Nelson, R. R. 1995. Recent evolutionary theorizing about economic change. *Journal of Economic Literature*, 33: pp. 48-90.
- Oerlemans, N., J. Proost and J. Rauwhorst 1997. Farmers' study groups in the Netherlands. In: L. Veldhuizen, A. Waters-Bayer and R. Ramirez (eds), *Farmers' research in practice. Lessons from the field*. London: Intermediate Technology Publications: pp. 263-277.
- Pansters, W., and H. Siebers 2001. *In search of common ground: Reflections on articulating concepts and theoretical orientations in CERES*. Utrecht: CERES, Research School for Resource Studies for Development.
- Patel, P. and Vega, M (1998). 'Patterns of internationalisation of corporate technology: Location versus home country advantages'. *Research Policy*, 28(2-3): pp. 145-155.
- Rausser, G., L. Simon, and H. Ameden 2000. Public-private alliances in biotechnology: Can they narrow the knowledge gaps between rich and poor? *Food Policy*, 25: pp. 499-513.
- Richards, P. 2004. Private versus public? Agenda setting in international agro-technologies. In: K. Jansen and S. Vellema (eds), *Agribusiness and society: Corporate responses to environmentalism, market opportunities and public regulation*. London: Zed: pp. 261-288.
- Rogers, E.M. 1983. *Diffusion of innovations*, 3rd edition. New York: Free Press.
- Röling, N.G. 1988. *Extension science: Information systems in agricultural development*. Cambridge: Cambridge University Press.
- Sayer, A. 2000. *Realism and social science*. London: Sage.
- Schuurman, F. 1992. Post-impasse ontwikkelingstheorieën. *Derde Wereld*, 11(1): pp. 9-50.
- Schwarz, M., and M. Thompson 1990. *Divided we stand: Redefining politics, technology and social choice*. Hertfordshire: Harvester Wheatsheaf.
- Serageldin, I., and G. J. Persley 2000. *Promethean science: Agricultural biotechnology, the environment, and the poor*. Washington: Consultative Group on International Agricultural Research.
- Slater, D. 1992. De politieke betekenissen van ontwikkeling: Op zoek naar nieuwe horizonten. *Derde Wereld*, 11(1): pp. 51-70.
- Smith, J. and S.J. Scherr 2002. *Forest carbon and local livelihoods; an assessment of opportunities and policy recommendations*. Bogor: CIFOR.
- Stiglitz, J. 1999. Scan globally, reinvent locally: Knowledge infrastructure and the localization of knowledge. Keynote Address First Global Development Network Conference, December 1999, Bonn, Germany.

- Swidler, A., and J. Arditì 1994. The new sociology of knowledge. *Annual Review of Sociology*, 20: pp. 305-329.
- Thrupp, L. A. 1989. Legitimizing local knowledge: From displacement to empowerment for Third World people. *Agriculture and Human Values*, 6(3): pp. 13-24.
- Umali, D.L. and L. Schwarz 1994. Public and private agricultural extension: beyond traditional boundaries. World Bank Discussion Paper. Washington: World Bank.
- UNDP 2001. *Human development report 2001: Making new technologies work for human development*. New York: Oxford University Press.
- UNEP/GEF 2002. *Synthesis report of regional biosafety workshops- 2002*.
- van der Velden, M. 2002. Knowledge facts, knowledge fiction: The role of ICTs in knowledge management for development. *Journal of International Development*, 14: pp. 25-37.
- van Schoubroeck, F.H.J. 1999. Learning to fight a fly: developing citrus IPM in Bhutan. Ph.D. dissertation. Wageningen University. Wageningen.
- Visvanathan, S. 2001. Knowledge and information in the network society. Seminar 503, www.india-seminar.com/2001/503/503shiv/visvanathan.htm (5 June 2003).
- Warren, D. M. 1991. *Using indigenous knowledge in agricultural development*. Washington: World Bank Discussion Papers no.126, The World Bank.
- Whatmore, S., and L. Thorne 1997. Nourishing networks: Alternative geographies of food. In: D. Goodman and M. Watts (eds), *Globalising food: Agrarian questions and global restructuring*. London: Routledge: pp. 287-304.
- World Bank 1998. *Knowledge for development*. New York: Oxford University Press.