WIRED FOR CHANGE: THE LINKS BETWEEN ICTs AND DEVELOPMENT DISCOURSES

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Abstract: The ICT revolution’s promises and threats for developing countries can be brought into clearer perspective if we pay attention to the underlying discourses on development and knowledge employed in this debate. This paper suggests that those who enthusiastically embrace ICTs tend to operate within a modernization discourse, while sceptics are influenced by dependency and post-colonial discourses of development. Both perspectives operate with a liberal notion of knowledge as separate from power. The paper argues that a more fruitful approach is to analyse the role ICTs play in the power–knowledge nexus. Copyright © 2002 John Wiley & Sons, Ltd.

1 INTRODUCTION

This paper seeks to untie the package of promises and threats through which the information and communication technology (ICT) ‘revolution’ has been discussed in the development literature. It dwells on two points. First, it argues that the promises of the new technologies for developing countries are formulated within a broader discourse of modernization and development, which is based on the assumption that a deficiency in knowledge is partly responsible for underdevelopment. This way of looking at knowledge and development harks back to the modernization literature of the 1960s, where the main problem was also seen to lie with the diffusion of Western knowledge to the rest of the world. ICTs are regarded as a neutral, transparent media which function as conduit for the information and knowledge required to develop. A comparison between radio and the Internet as new ICTs in their respective periods demonstrates the continuity of modernization thinking, but also points out a shift from a focus on centralized, state-led development agency, to a more decentralized vision of development agency.

Secondly, an examination of the threats that ICTs allegedly present for developing countries reveals different discourses of power and knowledge operating in the various

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strands of literature. Those who are critical of the mainstream development paradigm find the prospect of accelerating the spread of Western knowledge through the new ICTs alarming. They see it associated with the expansion of the capitalist economy into ever more remote parts of the globe, and into ever finer capillaries of society. However, there lies some hope in using the new technologies to produce a different truth about capitalist development, from the perspective of its victims, those who have been excluded from it, and through critical scholarship which can reveal the false promises of mainstream development discourse. In this sense the new technologies can become sources of empowerment and emancipation; they are the tools through which true knowledge can be established and disseminated.

In concluding, this paper suggests another way of looking at the new ICTs, by analysing knowledge as a ‘companion to the constructs of power which shape our world’ (Ransom, 1997, p. 22). In this sense, ICTs may ‘offer unexpected opportunities that groups at the margin could seize to construct innovative visions and practices’ (Escobar, 1995, p. 225), but these alternative visions and practices cannot be seen as located outside the knowledge–power nexus. The new technologies may in fact facilitate these marginalised groups’ incorporation into the mainstream, but they also enhance the impact of these groups on the ‘constructs of power which shape our world’. In other words, the new ICTs expose more people to new forms of control, but they themselves are also increasingly exposed to being transformed by the human groups they enrol (Feenberg, 1995).

2 KNOWLEDGE, COMMUNICATION AND MODERNIZATION

In comparing knowledge with the weightlessness and intangibility of light, the World Development Report (World Bank, 1998, p. 1) uses a liberal model of knowledge. Knowledge is universal and pure, and even though we do not have complete knowledge, vast quantities of it are already available, located mainly in the richer countries. New ICTs offer unprecedented possibilities for diffusing knowledge to developing countries, and to advance their population’s well-being, notably by opening up new income opportunities for the poor and improving governance through sharing knowledge among institutions, governments and think tanks. The report acknowledges that the use of new ICTs is still limited in developing countries, and the ‘knowledge gap’ (defined as technical know-how) between developing countries and their richer counterparts may be increasing, as inequalities in the capacity to create knowledge exceed even those in income. Furthermore, ‘information gaps’ (knowledge about attributes) may also widen within developing countries, ‘where a fortunate few surf the World Wide Web while others remain illiterate’ (World Bank, 1998, p. 14). These essentially external limitations to the spread of knowledge are being tackled in the World Bank’s Global Development Gateway, ‘a proactive policy that fosters network development in emerging economies’, with the key objective of using the Internet ‘as a tool to reduce poverty and support sustainable development’ (World Bank, 2000, pp. 3,5).

The World Bank’s concern with the connections between knowledge, development and ICTs is not altogether new. Some 30 years ago, key protagonists of the Modernization School focused their attention on the connections between knowledge, communication and development. Wilbur Schramm maintained that communication’s role was to ‘implant and extend the idea of change, to raise the aspirations of . . . people so that they will want a larger economy and a modernized society’ (Schramm, 1967, p. 18), and most importantly,
to teach them the new skills required to achieve this goal. However, people also had to be taught ‘to take part in planning and governing; to tighten their belts, harden their muscles, work longer, and wait for their rewards’ (Schramm, 1967, p. 19). Thus communication, for the Modernization School of development, played a key role in shaping the mind and body of Third World individuals such that they could bring about, and function in, a modern society.

For modernization scholars, the message itself was never in doubt. Lerner (1967b) forcefully argued that for developing countries, the West represented their own future: Western countries possessed the attributes of a modern, developed society which the rest of the world desired. Myrdal (1968) also took for granted that the modernization ideals which had come out of the European Enlightenment were destined to spread across the whole world, ‘diffused through education and technology transfer to the ‘elites’ of the periphery’ (Leys, 1996, p. 10).

In short, there was widespread agreement in the 1960s that modernization was the diffusion of Western knowledge and ideas. The only points of debate were over how the message of modernization should be packaged in order to improve its reception and effectiveness. Communication was the crux of the process of international development co-operation, and the process of selecting and adapting Western institutions turned the less developed nation into an ‘active agent of a constructive and even creative process’ (Lerner, 1967a, p. 120). The unique contribution of mass communication to the development process was to galvanize the population of a particular society, and thus create a ‘climate for development’ (Lerner, 1967a, p. 124) based on Western know-how.

Returning to the World Bank’s recent formulation of a new development paradigm based on knowledge, there are some striking continuities with the modernization school’s way of thinking. By setting itself up as the ‘knowledge bank’, the World Bank assumes the role of defining the gaps of knowledge around the world, and the role of fountain of knowledge to fill these gaps (Standing, 2000). Not only does this exacerbate the World Bank’s dominant position as provider of the knowledge on which development programmes are based but, as Standing (2000) points out, it is likely to privilege knowledge as a quantitative issue and give more weight to measurable knowledge (see also van der Velden’s paper in this collection). In this sense, Lerner’s ‘desirable attributes’ are still given more importance by the World Bank today than a healthy environment or a strong sense of community.

An argument can be made, however, that the World Bank’s enthusiastic embrace of the Internet as a tool for gathering and accessing knowledge marks a departure from the modernization school’s hierarchical visions of development diffusion. This becomes clear when we compare the Internet with radio, which triggered a communication revolution in developing countries in the 1950s and 1960s. Jamison and McAnany (1978, p. 9) claimed that

on a worldwide scale it is the medium of radio that has been man’s most potent communication innovation since the development of writing. The large-scale manufacture of cheap, battery operated transistor radios has been the breakthrough responsible for putting most of the world’s people into an international communication network.

The authors argue that once radio had been made affordable and independent of the electricity grid, its potential use in the development process was dramatically enhanced. Even disadvantaged groups in developing countries could now be motivated
(e.g. to participate in literacy or immunization campaigns), provided with information, educated, and told what to do. Throughout the 1960s and 1970s, development theorists and practitioners held firmly on to the belief that radio held the key to modernization of the underdeveloped rural populations (Ansu-Kyereh, 1992; see also Hornik, 1988).

Implicit in this view on the role of radio in development communication are three key assumptions: that disadvantage stems from lack of knowledge and information; that knowledge and information is disseminated from a central point, usually the government; and that this knowledge and information is by definition beneficial and useful to recipients. These three assumptions together lead to a blurring of the difference between motivating and directing people to participate in development programmes, because the Third World subject is constructed as a rational individual who, given access to objective development knowledge by their government, will gladly absorb and act upon it. If they failed to do so, it was not the truth and social desirability of development messages that were in doubt, but the quality of the audience and their capacity to behave like rational, enlightened human beings.

Schramm noted the top-down nature of mass communication in the 1960s, commenting that ‘a very large part of development communication flows between a leadership bent on modernizing and a reluctant, if not resistant, mass’ (Schramm, 1967, p. 16). This resistance could partially be conquered and behaviour change achieved, he argued, by making sure that the messages were culturally relevant, properly explained and correctly targeted. Equally importantly, communication had to be a two-way process, so that target groups could take a more active role in overcoming their resistance to change. Radio forums in India exemplified the potential of two-way communication, whereby ‘a group of farmer-leaders meet once a week to hear a radio talk by an expert, then they discuss what to do about the suggestions he makes’ (Schramm, 1967, p. 13) under the guidance of a village community worker. The main purpose of this exercise, however, was not to relay the farmers’ views back to the expert, but rather to facilitate the adoption of expert knowledge. Recognizing that messages are ‘processed by individuals placed in specific social contexts’ (Castells, 1996, p. 336), the Indian radio forums sought to influence the processing of knowledge.

Despite some modernization scholars’ efforts to represent radio as two-way communication, it was a particularly appropriate technology in the days of state-led development planning. Easily controlled by governments, it suited a one-way flow of communication, from the top to the grassroots. By the 1990s, a more decentralized view of development had emerged, both in terms of how it should be conducted and by whom, and who is in charge of producing the knowledge required for development. The most important influences contributing to this shift were neo-liberal critiques of development economics (e.g. Lal, 1985), the failures of Marxist-influenced state development planning (Leys, 1996), and the rise of non-government organizations which stake their alternative approach to development on grassroots participation and empowerment (Brohman, 1996; Edwards, 1989). The market—a multitude of private firms and individuals—came to replace the state as the key development agent.

In many ways the Internet symbolizes the new development orthodoxy of market-led, decentralized development, presenting itself as the technology of our age, with a non-hierarchical structure and capacity for cross-cultural communication, rather than mere top-down diffusion. However, the World Development Report 1998/99 shows that while the World Bank no longer sees the state as the main source of modernization ideas, it still shares the Modernization School’s views that what prevents modernization in developing
countries is a lack of access to the kind of knowledge that Western developed countries possess.

The World Bank acknowledges the new ICTs’ ‘potential for teaching government and institutions about the poor, for designing programmes that benefit them, and for enhancing their participation and empowerment’ (World Bank, 1998, p. 60). As an example of what the World Bank means by a beneficial form of participation and empowerment by the poor, it cites women in Panama tapping into a global market by posting images of their handicrafts on the Internet. Rather than wait for their governments to pave the way for free trade, better health services, or better resourced schools, Third World communities and NGOs can use the Internet to help get access to resources and information (e.g. Coeur de Roy, 1997) anywhere in the world.

The current development paradigm no longer sees a central point of dissemination of development information which could compare with the role of the state in the radio days of the 1960s. One implication is that development subjects have to be more active in finding out the information most relevant to them in a rapidly changing world. Furthermore, they cannot afford not to be part of the informational network, because ‘information generation, processing, and transmission become the fundamental sources of productivity and power’ (Castells, 1996, p. 21 fn33). This leads to the second implication, that the diverse development agents, including mainstream development institutions like the World Bank, and people-oriented NGOs, are increasingly converging on a common platform to bridge the divide between the information rich and poor, and use the information technology revolution for desirable social ends, however defined.

The Global Development Gateway (World Bank, 2000) is one expression of this convergence. It was foreshadowed in the World Bank financed InfoDev programme, begun in 1995 to foster information technology projects that address the needs of the poor in developing countries. One such project, by the Intermediate Technology Development Group (ITDG) in the Peruvian province of Cajamarca, serves as an example of how NGOs have begun to speak the language of market liberalism. Thus, ITDG states that it seeks to ‘increase the productive capacity of small producers’ by building a self-sustainable information system that provides ‘quality information at a fair price’. In the information society, it points out, ‘the privileged, if not exclusive, economic agent is the individual capable of self-equipping and self-informing’ (ITDG, 2000).

So far, my argument has been that one, and arguably dominant, approach to ICTs in development has been framed by modernization theory, which perceived development spreading from the West to the rest of the world, crucially aided by modern communication technologies. It is due to this conceptual framework that the World Bank report on ‘knowledge for development’ reads much like the communication theories of the Modernization School in the 1960s. It tends to assume, along with ‘much scholarship about knowledge and development’, ‘that the main task is to transfer commoditised chunks of information and knowledge from one place to another’ (Chataway and Wield, 2000, p. 817).

The main difference between the two approaches lies in the reduced importance of the state in the diffusion process. Thus, the current version promotes the view that knowledge for development, while still mainly produced by advanced societies, can be made available to communities and individuals in developing countries more cheaply and more directly through the new ICTs. A failure to analyse critically the theory of knowledge underpinning the World Development report leads well-intended projects such as that of ITDG in Peru to effectively bolster the old argument that underdevelopment is a function of
knowledge deficiency, as well as to shift the responsibility for getting ‘the right knowledge’ onto what Ferguson (1990) calls the ‘objects of development’.

3 EXCLUSION, DEPENDENCY AND IMPERIALISM

The ITDG project can also be interpreted as a constructive response to those who, like Hoogvelt (1997), claim that development is dead for those who are excluded from the global system, made irrelevant to its high-tech information-driven capitalism both as producers and as consumers. Castells takes a similar perspective to Hoogvelt’s, arguing that uneven development can no longer be understood in terms of the First World/Third World dichotomy. Instead, social inequality and polarization are increasing between the dynamic segments of countries which form the global network society, on the one hand, and the ‘switched-off territories and peoples’ (Castells, 1998, p. 354) on the other. The main hopes for the latter rest in the black economy (e.g. the trafficking of drugs and people) or in social movements seeking alternatives to mainstream development.

Like dependency theory, these pessimistic scenarios are shaped by a two-tier model of the world, but there is an important difference. It is the exclusion of peoples and territories from the informational mode of development, rather than their dependent integration, which constitutes the problem. The efforts by ITDG to build, with the World Bank’s financial support, an information system for marginalised rural producers in Peru to bring them into the national and global information loop could therefore be seen as a positive step.

From the broader perspectives of Hoogvelt and Castells, however, the prospects of poor countries and population groups are seen in a much dimmer light than from the World Bank’s perspective because they argue that wealth, power and knowledge depend on societies’ and individuals’ capacity to control and use ICTs. In a market-based global economy, initial advantages in technological know-how will accumulate rather than diminish over time, thus advantaging the more developed countries (James, 2000).

The gap in technical know-how already forced developing countries to increase their capital spending on imported technology from US$400 million in 1965, to US$10 billion in 1995 (Neelmechan, 1997, p. 362). Even the Internet is ‘becoming a densely commodified’ realm (Haraway, 1997, p. 4) where the ‘public commons’ are increasingly hemmed in by electronic propaganda and commerce. The public commons are severely limited by the cost of access to the Internet, particularly in many low income countries where telephone connection is less extensive and more expensive—both in relative and in absolute terms—than in high income countries. And even if access is made affordable, as in community information centres that are, more often than not, driven by the non-profit sector, much of the information the Internet offers is of little relevance to Third World users (Hedley, 1998; see also Main, 2001).

Even more serious than practical arguments relating to the funding, accessibility and relevance of the new ICTs are those which focus on the kind of knowledge they diffuse. Ziauddin Sardar (1996) offers a particularly strident critique of the idea that new ICTs could shift the boundaries of power and knowledge in the world. He sees the Internet as a new phase in a long history of the West’s attempt to colonize not only the territory and the body but also the mind of the Third World ‘other’.

ICTs have played an important role in this endeavour, as Martin Power’s examination of ‘radio colonization’ in Mozambique demonstrates. The Portuguese colonial state’s ‘Native
Hour’ radio programmes about health, agriculture and Portuguese culture were designed to civilize and modernize the non-white populations of Mozambique, while ‘denying . . .
their complex cultural identities and their pasts’ (Power, 2000, p. 607). However, when the final hour of Portuguese imperialism arrived, rather late, in 1974, the Mozambican liberation movement was able to invade the offices of the radio station and seize the airwaves to broadcast their own version of Mozambican history and present. According to Sardar, this is no longer possible in the age of the Internet. ‘Cyberspace is a giant step forward towards museumisation of the world’, he claims; ‘anything remotely different from Western culture will exist only in digital form’ (Sardar, 1996, p. 19). In this form, the diversity of non-Western past, present and future can be manipulated, or even erased.

Hence, the World Bank’s self-appointment as the manager of the creation, transfer, and management of knowledge (World Bank, 1998, p. 143) can be interpreted as another step in establishing the hegemony of Western knowledge, into which profitable aspects of non-Western indigenous knowledge have been incorporated. It continues the dominant trend in development studies to construct the West as holding the key to the development of the South—first capital and technology, now ideas and knowledge. At the same time, the recipe of development through knowledge delivered via new ICTs sits comfortably with a long tradition in western thought that seeks the solution of the world’s ills, and ultimately, salvation, in technological breakthroughs (e.g. Noble, 1997; Wertheim, 1999). As Noble (1997, p. 206) points out, however, these usually fail to deliver because we fail to recognise that ‘worldly subordination and relations of power’ tend to direct the benefits of new technologies to the already privileged.

The pessimistic accounts based on structural analysis of global inequality and globalisation of capitalism nevertheless offer a window of hope for those who want to see the new ICTs used to improve the world. Because the Internet makes possible ‘horizontal, global communication’ which is very difficult to censor or control (Castells, 1996, p. 352), it can also be used by locally based and virtual communities to represent themselves, to network with non-governmental organizations for human centred development, or to gather support for political struggles that challenge national or global elites. As Walch (1999) points out, information is a necessary, albeit insufficient, ingredient for social action. In his study on networking for/as social and political change, he argues that the Internet constitutes an area of discourse which escapes the hegemonic control of states and capital, and therefore can give rise to emancipatory praxis.

The southern Mexican Zapatista movement’s use of the Internet to publicize their struggle for social justice, political autonomy and their own definition of development has captured a number of scholars’ attention as probably the first example of such a praxis (Castells, 1997; Cleaver, 1998; Walch, 1999). Pitched against an authoritarian state and the newly established North American Free Trade Agreement, the EZLN (Zapatista Army of National Liberation) used e-mail messages in ways that effectively side-stepped a largely government-controlled media, and succeeded in building global support for their cause.

Underpinning the Zapatista movement’s appeal as an example for the Internet’s emancipatory potentials is the assumption that truth and power can be separated. As Holloway and Pelaez (1998, pp. 4–5) argue, the Zapatistas’ aim is not to take power but, to the contrary, to abolish power because it hinders the construction of a world based on freedom, justice and democracy which most ordinary people desire. Against the powerful, the Zapatista arm themselves with ‘the truth of their humanity’. Their position as an oppressed, exploited minority legitimises their claim to truth, and the Internet provides the
democratic space for self-representation. The position at the margin of global capitalism and state power, in ‘switched-off’ territory, thus becomes a space of empowerment and alternative development visions.

In a structural account of power, however, the prospects of movements such as the Zapatistas’ being able to reconstruct society’s institutions are rather slim. This is because people are viewed as being ‘confined to multiple, segregated locales’, increasingly distant from the global elites they confront, which are retrenched in ‘immaterial palaces made out of communication networks and information flows’ (Castells, 1998, p. 352). Unlike the Mozambican radio station, these palaces cannot be seized by the people. Their voices get lost among the innumerable representations on the Internet.

4 KNOWLEDGE AND POWER

What limits both the modernization and the structuralist analyses of promises and threats of new ICTs is a static view of knowledge and power, and a failure to grasp the creative, productive potential of new ICTs in the hands of ordinary people. To elaborate on the first point, the World Bank’s conceptualization of knowledge can be criticized for ignoring its political dimension, presenting it instead as a public good that is essentially innocent of power, but at the same time enabling. In contrast, critics such as Sardar (1996) regard knowledge as corrupted by power, as reflecting the West’s colonising interests. Both views share a notion that knowledge and power are separate entities.

A different scenario comes into perspective when we employ Foucault’s way of connecting knowledge and power. For Foucault, knowledge is a form of power ‘because it represents ‘this’ and not ‘that’” (Ransom, 1997, p. 19). He argued that power, rather than being external to and imposed on scientific knowledge, is what legitimates the true and distinguishes from the false: “‘Truth’ is linked in a circular relation with systems of power that produce and sustain it, and to effects of power which it induces and which extend it’ (Foucault, 2000, p. 132). In other words, knowledge involves selecting out certain characteristics and aspects, usually those that promote the interests of those who do the selecting. The universalisation of Western scientific knowledge is thus interwoven with relations of power, involving the imposition of the rules pertaining to the creation of scientific knowledge, and the disqualification of other kinds of knowledge. ‘[I]t is through the re-emergence of these low-ranking knowledges, these unqualified, even directly disqualified knowledges . . . that criticism performs its work’ (Foucault, 1980, p. 82).

Escobar (1995) and Ferguson (1990) have effectively used this insight in their respective analyses of how development institutions like the World Bank have constructed (not simply identified) the central problems of development and the target groups for development intervention. There are now numerous studies that seek to excavate these half-buried, local knowledges, in order to demonstrate how partial and powerful the knowledge of scientific experts has been (e.g. Mahiri, 1998). Unlike structuralists such as Holloway and Pelaez, Foucault denies that such critical analysis will produce some form of knowledge (e.g. the Zapatistas’ truth) that ‘can act as the platform from which we can denounce power’ (Ransom, 1997, p. 21). Instead of seeing marginalized groups, such as the Zapatistas, as forging emancipatory visions of society outside power relations, their agency is an element in a particular set of power relations. What the Zapatista version of truth helps us see is the effects of power of a centralising discourse that is considered to be scientific (Foucault, 1980). In other words, their local, fragmented knowledge plays a role...
in the struggle against the coercion of the discourse of economic globalization that portrays itself as rational, unitary and scientific.

As Dean (1999, p. 70–71) points out, to work through the agency of the marginalized, poor, minorities and so on ‘is to seek to establish particular kinds of power relations, and to effect a specific use of expertise’ or knowledge. Hence, ITDG’s rural information system project, which seeks to empower poor Peruvian peasants, is as much an exercise of governing these peasants, to reconstitute them as informed and capable agents in a global market economy. Dean (1999) argues that regimes of government do not refer just to institutions and operations of the state, but also to the activities and knowledges that define and co-ordinate relations between state agencies, communities, professionals, individuals and, we can add, supra-state agencies. From this perspective, ITDG forms part of the institutions and functions of the World Bank’s discourse on knowledge and new ICTs for development.

Foucault’s concept of power–knowledge does not, however, describe an omnipotent and amorphous form of power to which everything is subjected, as does Castells’ notion of the immaterial palaces of the global network elites. Knowledge and power do not collapse into each other. Therefore, by analysing the forces at work in a field of power and knowledge, we open up political possibilities, as Ransom (1997, p. 23) makes clear: ‘If power and knowledge are intertwined, it follows that one way to understand power—potentially to destabilise it or change its form—is to take a firm hold of the knowledge that is right there at the center of its operations.’

The biodiversity network serves as an example of this process. As Escobar (1999) describes, the network incorporates dominant sites and knowledges that are produced by the World Bank and the United Nations, Third World government sites, and other subaltern sites maintained by NGOs and social movements. The question is, can local models of nature, of local cultural, ecological and social practices, have an impact on the biodiversity debate, such that the world can be redefined and reconstructed? Escobar suggests that this is possible:

As they circulate through the network, truths are transformed, reinscribed into other knowledge–power constellations, resisted, subverted, or recreated to serve other ends . . . by social movements, which become, themselves, the sites of important counter-discourses. (Escobar, 1999, p. 43).

5 CONCLUSION

This paper has sought to trace the links between various positions on the role of new ICTs in development, and broader debates on development, knowledge and power. In Sections 2 and 3 I have argued that the optimistic stance of the World Bank was strongly related to modernization theory, while the pessimistic stance on ICTs was based on a dependency theory argument. Both positions have in common that they separate knowledge from power.

If we look at power and knowledge as mutually constitutive, then the question whether new technologies in the hands of subaltern groups can foster new practices of being, knowing and doing becomes more open-ended. Escobar’s analysis leaves more space for optimism than Castells’ because he is conscious of the productive aspects of power. If power is conceived as ‘a productive network that runs through the whole social body’, ‘induces pleasure, forms knowledge, produces discourse’ (Foucault, 2000, p. 120), then
subaltern groups are also a part of this network, not excluded from power relations. Knowledge is a potential site for resistance, and since the new ICTs offer more access to information and faster communication, they make the job of constructing counter-discourses easier.

However, these alternative visions of development do not sit apart from the mainstream, but rather, they will be incorporated into, and contribute to shifts within the mainstream. Information networks, such as the biodiversity network, are most effective in producing counter-discourses if they remain aware of the power–knowledge nexus of which the Internet is a part, and are active in place-based change (Escobar, 1999). Efforts by international development institutions to promote development through knowledge are more likely to bear fruit if they adopt a broader approach to knowledge, one that draws more actively on local and regional knowledges and understands better the multiple, transdisciplinary sites of knowledge production and the social nature of its distribution (Chataway and Wield, 2000).

REFERENCES


