FOOD SOVEREIGNTY, AGROECOLOGY AND BIOCULTURAL DIVERSITY

Constructing and Contesting Knowledge

Edited by Michel P. Pimbert

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DEMOCRATIZING KNOWLEDGE AND WAYS OF KNOWING FOR FOOD SOVEREIGNTY, AGROECOLOGY AND BIOCULTURAL DIVERSITY

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Introduction

Achieving food sovereignty, agroecology and biocultural diversity is a transformative process that seeks to expand the realms of democracy and freedom by regenerating a diversity of autonomous food systems based on social justice and ecological sustainability (Pimbert, 2008). As part of this transformation,[1] social movements are increasingly challenged to develop more *inclusive and participatory ways of knowing* to produce knowledge that is not only ecologically literate and socially just, but which also embodies the values of a new modernity as well as plural visions of the 'good life'. This is a huge challenge. To paraphrase the philosopher of science, Thomas Kuhn (1962), nothing less than a paradigm revolution is necessary to generate knowledge for food sovereignty, agroecology and biocultural diversity.

Previous chapters in this book have highlighted the need for a fundamental transformation of knowledge in the following areas:

- Reductionist science, which unlike more holistic knowledge and ways of knowing, has largely failed to promote the sustainable management of agro-ecosystems, natural resources or landscapes. For example, peasant farmers who want to grow their crops and rear their animals using agroecological approaches clearly need very different technical knowledge than that currently provided by the dominant agricultural research system, which focuses on the delivery of pesticides, growth hormones, food additives and other external inputs marketed by agri–chemical companies (Chapters 2, 3, 4 and 6).
- Crisis narratives that blame rural communities for environmental degradation and justify standard environmental management packages which neglect people's knowledge, priorities, locally adapted management systems and local institutions. Yet recent research has shown that several orthodox views on

people-environment interactions are myths that are often based on a-historical views and erroneous Malthusian assumptions (Chapters 3, 4 and 5).

- Current economic disciplines that underpin policies for growth and competitiveness in the food system. This is leading to the economic genocide of unprecedented numbers of small-scale producers (family farmers, pastoralists, fishers, farm workers, etc.) and rural livelihoods throughout the world. It is now imperative to re-think mainstream economics on the basis of radically different principles such as reciprocity, solidarity, respect, freedom, equity and sustainability (Chapters 5, 6 and 7).

More generally, scientific research offers an increasingly dismal picture with its daily reports of retractions, fraudulent peer reviews, 'fake science' and misinformed science-based policies (Benessia *et al.*, 2016). A growing number of citizens no longer trust scientists and the institutions they work for:

> Worldwide, we are facing a joint crisis in science and expertise … Today, the scientific enterprise produces somewhere in the order of 2 million papers a year, published in roughly 30,000 different journals. A blunt assessment has been made that perhaps half or more of all this production 'will not stand the test of time'…. Meanwhile, science has been challenged as an authoritative source of knowledge for both policy and everyday life … Perhaps nutrition is the field most in the spotlight. It took several decades for cholesterol to be absolved and for sugar to be re-indicted as the more serious health threat, thanks to the fact that the sugar industry sponsored a research program in the 1960s and 1970s, which successfully cast doubt on the hazards of sucrose – while promoting fat as the dietary culprit.
>
> *(Saltelli, 2016)*

During the second half of the twentieth century, universities in the USA have redefined their mission to serve private business and become much more profit-oriented in their operations and strategic objectives (Heller, 2016a). This business model has since spread worldwide. And most universities today increasingly embrace 'what we might call a cognitive capitalism, which pursues new forms of knowledge that can be more or less immediately commodified as intellectual property: patents, inventions, copyrights and even trademarks' (Heller, 2016b). Corporations and large financial investors increasingly control the directions and outcomes of research in the social and natural sciences, as well as in the humanities. Private-public sector partnerships, funding priorities, patents and other intellectual property rights – in addition to widespread corporate control and corruption of science – all ensure that mainstream research selectively favours the production of knowledge that reflects and reinforces the interests of company shareholders and financial institutions – from patented seeds and new natural products derived from indigenous and peasant knowledge to neo-liberal food policies and trade agreements (Chapters 1, 5 and 6; Heller, 2016b). Moreover, a set of legal rules is in place

to protect investors' rights in the frame of the World Trade Organization and in bilateral investment treaties and clauses in free-trade agreements. These 'trade and investment agreements have equipped private corporations with extraordinary and powerful tools for asserting and defending their commercial interests. Thus, foreign investors have been accorded the unilateral right to invoke binding investor-state dispute settlements (ISDS) to claim damages for violations of the broadly framed rights they now enjoy under these treaties' (Monsanto Tribunal, 2017). These provisions undermine the capacity of states to maintain policies, laws and practices protecting human and environmental rights, *including the freedom indispensable for academic research*.

In this context of free trade and binding ISDSs, research and innovations favoured by transnational corporations and financial investors all help fuel today's historically unprecedented concentration of wealth and power by a tiny minority of super-rich individuals (Chomsky, 2017). At the time of writing, the super-rich comprise less than 100 people who own and control more wealth than 50% of the world's population (Beaverstock and Hay, 2016). Contemporary dynamics of knowledge creation and use play a key role in the processes that underpin the generation of super-wealth and its unequal distribution within and between societies (Chomsky, 2017; Harvey, 2014; Hay and Beaverstock, 2016; Noble, 1995).

In sharp contrast, counter-hegemonic practices by peasant networks, indigenous peoples and social movements seek to reframe food, agriculture, biocultural landscapes and the 'good life' in terms of a larger vision based on radical pluralism and democracy, personal dignity and conviviality, autonomy and reciprocity and other principles that affirm the right to self-determination and justice (for example, see Esteva and Prakash, 2014). Making these other worlds possible requires the construction of radically different knowledge from that offered today by mainstream universities, policy think tanks and research institutes.

More than ever before, new ways of knowing are needed to construct knowledge for social inclusion, economic justice, environmental sustainability and cultural diversity. This is a formidable challenge because we need to simultaneously 'confront the question of what kinds of knowledge we want to produce, and recognize that that is at the same time a question about what kinds of power relations we want to support – and what kind of world we want to live in' (Kamminga, 1995).

Constructing knowledge for food sovereignty, agroecology and biocultural diversity entails reversing top-down research and the hegemony of scientism, as well as the current privatization of research and commodification of knowledge. It also means reversing the current democratic deficit in the governance of research by enabling more direct citizen control over the priorities and conduct of scientific, social and technological research. Transformation thus partly depends on making a radical shift from the existing top-down and increasingly corporate-controlled research system, to an approach which gives more agency and decision-making powers to peasant farmers, indigenous peoples, food workers, pastoralists and citizen-consumers in the production and validation of environmental, economic, social and technical knowledge.

This closing chapter first briefly identifies key moments at which previously excluded farmers and citizens can intervene in the politics of knowledge to decide what knowledge is produced, and for whose benefit. Next, the chapter critically explores two complementary approaches for democratizing the construction of knowledge(s) for food sovereignty, agroecology and biocultural diversity. The first emphasizes the potential of grassroots innovation and self-managed research to de-institutionalize research for autonomous learning and action. It focuses in particular on critical education and strengthening horizontal networks of farmers[2] and other citizens who actively produce knowledge in the many 'living campuses' where they derive their livelihoods. The second approach focuses on democratizing and transforming public research to better serve the common good rather than narrow economic interests. Particular attention is given here to institutional, pedagogical and methodological innovations that can enable citizen participation and agency throughout the entire research cycle – from deciding upstream strategic research and funding priorities to the co-production of knowledge and the framing of risk assessments.

Democratizing the politics of knowledge

Issues of power and whose knowledge counts are at the heart of the governance of research and its impacts on society. Nuanced and scholarly analysis of the politics of knowledge show how research is influenced by powerful combinations of political interests, dominant policy discourses and effective actor networks that span local, national and international levels (e.g. Apffel-Marglin *et al.*, 1990; Apffel-Marglin and Marglin, 1996; Dominguez Rubio and Baert, 2012; Meusburger *et al.*, 2015).

A few simple questions can help shed light on these politics and the processes that construct knowledge and innovations: Which actors are involved? Whose knowledge is included and whose is excluded? Where is 'knowledge-making' actually taking place? How is knowledge circulated and applied? Who has the final control and say? Whose interests are served? Is someone held accountable? If so, to whom and how? Asking these questions helps to shift attention from an analysis of knowledge per se (Is the knowledge produced by research addressing the relevant issues? Is scientific and technical knowledge good or misguided?) to the analysis of the *processes* of knowledge generation and its politics (Whose perspectives, priorities, values, knowledge, interests and aspirations are embedded in research and its products, and whose are excluded? Where, why and how is knowledge constructed and applied, for whose benefit and with what effects on environment and society?).

In practice, expanding knowledge democracy calls for institutional and method-ological innovations that enable the *direct* participation of farmers and other citizens in research and development (R&D) and, more generally, in the construction of knowledge. A focus on the entire R&D cycle allows for a shift from narrow concepts of co-inquiry and participatory research that confine non-researchers (peasant farmers, food workers, consumer-citizens) to 'end of the pipe' technology development (e.g. participatory technology development) to a more inclusive approach in

which farmers and other citizens can directly define the *upstream strategic priorities* of research and the overarching national policies for research and development. Instead of being seen as passive beneficiaries of trickle-down scientific develop-ment or technology transfer, farmers and other citizens are viewed as knowledge-able and active actors who can be centrally involved in both the 'upstream' choice and design of scientific innovations, and their 'downstream' implementation, spread and regulation. In this context, science and the construction of knowledge are seen as part of a bottom-up, participatory process in which citizens take centre stage in decisions on *what* knowledge is produced, *why, how* and *for whom*.

Democratizing knowledge through grassroots innovation and self-managed research

> In our interactions with the world, we are all involved in the production of knowledge about the world—in that sense, there is no single group of experts.
> *(Kamminga, 1995)*

Historically, a great deal of knowledge has been produced by people who have not received any professional university training. Well before scientific institutions and agricultural research stations existed, farmers and livestock keepers generated a huge diversity of locally adapted crop varieties and livestock breeds by working with nature. This agricultural biodiversity is an embodiment of peoples' knowledge and their labour. This is an important peasant heritage on which modern plant and animal breeding depends to develop pest resistant crops and livestock, as well as adaptations to climate change (FAO, 2010; FAO, 2015).

Even today in advanced industrial societies, farmers as well as ordinary citizens are engaged in the production of knowledge on a significant scale *outside* universi-ties and research institutes. People without any specialized professional training are increasingly involved in creating new knowledge and innovations in many different areas, including (Callon *et al.*, 2001; Charvolin *et al.*, 2007; Irwin, 1995):

- victims of pollution developing a people's epidemiology in rural and urban areas (Brown, 1992; Irwin 1995).
- citizens affected by HIV/AIDS or other illnesses engaging in scientific activ-ism to contest medical expertise and discrimination (Lorway, 2017).
- amateur naturalists and gardeners involved in national surveys or biodiversity conservation plans (www.naturescalendar.org.uk/science).
- computer game players contributing to the enrichment and design of new games.
- the world's open source community developing non-proprietary software and internet programmes (O'Mahony and Ferraro, 2007).
- community-based digital fabrication workshops known as hackerspaces, fab-labs and makerspaces. These spaces allow people to come together to learn about and use modern technologies of digital design and manufacturing. Skills

and tools are freely available to people who directly participate in design as well as peer-to-peer production. Hackerspaces, fablabs and makerspaces share knowledge through both social media and face-to-face meetings (Maxigas, 2012; Troxler, 2014; www.hackerspaces.org).

Self-organizing grassroots research and innovation networks play an increasingly important role in the practice of the larger social movements working for food sovereignty, agroecology and biocultural diversity. Some of the more emblematic examples of self-organized peasant-led research and grassroots innovation networks are briefly described in Box 8.1. By focusing on processes of knowledge creation and innovation, these networks of small-scale producers are generating an alternative material culture. Indeed, such grassroots research and innovation movements are 'distinctive because the principal means of social change is the development of new or alternative forms of material culture, a means of change that is often associated with calls for significant institutional and policy changes as well' (Hess, 2005).

BOX 8.1 EXAMPLES OF SELF-MANAGED RESEARCH AND GRASSROOTS INNOVATION MOVEMENTS CONSTRUCTING KNOWLEDGE FOR FOOD SOVEREIGNTY, AGROECOLOGY AND BIOCULTURAL DIVERSITY

Peasant farmers, indigenous peoples, pastoralists and other citizens engaged in grassroots research and innovation rarely work alone. They are usually members of a collective of peers, an affinity group or an association. Self-organized peasant-led research and innovation processes are typically part of horizontal socio-cultural networks that usually span large geographical areas.

The *Campesino a Campesino* (CAC) movements in Central America and Cuba. *Campesino a Campesino,* or Farmer to Farmer, is a grassroots movement which originated in the early 1970s in Guatemala and spread through Mexico, Nicaragua and Cuba. Mayan *campesinos* in Guatemala pioneered methods of soil and water conservation as well as an innovative farmer-to-farmer pedagogy which they initially shared with each other, and then with small peasant farmers in Mexico. This 'peasant pedagogy' has been well described by Holt-Giménez (2006). It is notable that the CAC process generated effective site-specific agroecological solutions as well as empowering forms of non-hierarchical communication and local social change which peasants themselves eventually spread throughout Central America and the Caribbean. Using their own farms as classrooms, the peasant farmers rely on principles of popular education and peer-to-peer learning to build local capacity, autonomy and empowerment. As a social process methodology, CAC has achieved a significant impact in Cuba where the National Association of Small Farmers (ANAP)

has adopted it along with the explicit goal of building a grassroots movement for agroecology (see Machín Sosa *et al.*, 2010, 2013). In less than a decade (from the mid-1990s), the transformation of conventional farms into diverse agroecological systems spread to more than one third of all peasant families in Cuba (Rosset *et al.*, 2011).

The Peasant Seeds Network in France. In 2003, the *Réseau Semences Paysannes* was created in France by the *Confederation Paysanne*, the National Coordination of Defenders of Farm Seeds and several organic farmers' associations. The *Réseau Semences Paysannes* comprises over 70 member organizations. This peasant network focuses not only on vegetable seeds but also on cereals, oilseeds, fruit and grapevines. The main objective of the network is for peasant farmers 'to regain total autonomy over seeds, which means being able to do our own plant breeding, and select plants in our own fields' (personal communication Guy Kastler, 24 November 2016). In this context, selecting and producing one's own seeds not only represents a fundamental rejection of the 'commercial and industrial productivist system', but is also a quest for autonomy, peasant identity and meaning. Members of the network engage in participatory and evolutionary plant breeding and facilitate grassroots research and innovations in agroecology. They also co-produce knowledge needed for their political advocacy work in defence of farmers' rights to save and exchange seeds, as well as for the recognition of their collective rights as innovators in national plant breeding programmes (see http://www.semenc-espaysannes.org).

Autonomous research and learning networks in Bangladesh. The *Nayakrishi Andolan*, or New Agriculture Movement, comprises over 300,000 farming families in 19 districts of Bangladesh. As an autonomous network for learning and action, the *Nayakrishi Andolan* builds on rural peoples' systemic art and science of combining and integrating all aspects of life. Its holistic orientation aims to re-unite those 'dimensions that civilisation has systematically broken into institutional and social silos, including livelihood (labour), wealth (capital), reciprocity (market), governance (government), spirituality (religious institutions), knowledge (science), aesthetics (arts), love (family) and pleasure (sex and entertainment)' (Mazhar *et al.*, 2006). This grassroots innovation movement has developed biodiversity-rich agriculture(s) based on ten simple rules derived from the day-to-day experiences and knowledge of male and female family farmers. These rules for the design and adaptive management of agroecosystems are reviewed every year to incorporate new peasant-generated knowledge and agroecological practices (see http://ubinig.org/index.php/nayakrishidetails/showAerticle/5/6).

The Zero Budget Natural Farming movement in India. Zero Budget Natural Farming (ZBNF) is both a set of farming methods and a grassroots peasant movement that has spread to various states in India. It has been very successful in southern India, and particularly in the State of Karnataka where

it first evolved. The ZBNF in Karnataka has been actively promoted by the *Karnataka Rajya Raitha Sangha* (KRRS), a member of *La Via Campesina*. 'Zero budget' natural farming seeks to significantly reduce production costs by ending dependence on all outside inputs and loans for farming. The word 'budget' refers to credit and expenses. Thus, the phrase 'zero budget' means not using any credit, and not spending any money on purchased inputs. 'Natural farming' means farming with nature and without synthetic pesticides and other chemicals. Peasant farmers are the main protagonists of the movement and they have relied on self-organized processes with a strong pedagogical content. The farmers mostly come from the middle peasantry – i.e. they own land. Most practising ZBNF farmers are informally linked to each other and engage in both organized and spontaneous farmer-to-farmer exchange activities. The main centrally organized activities are five day-long training workshops where farmers learn about philosophy, ecology, ZBNF practices and successful farmer experiences. As a grassroots innovation movement, ZBNF has been very effective in bringing agroecology to scale. For example, it is estimated that in the State of Karnataka some 100,000 small and family farmers practise ZBNF (FAO, 2016b).

Brazil's Landless Workers' Movement (o Movimento dos Trabalhadores Rurais Sem Terra or MST)

The MST is the largest and most powerful agrarian reform movement in Latin America. Since the 1980s, this grassroots movement has been struggling for equitable land redistribution by occupying unproductive land estates in Brazil. Transformative education is central to the MST's struggle for social justice and ecologically sustainable peasant farming. The MST has actively engaged in a deep discussion on the political role of education in collectively constructing a different model of development for the countryside. The emergent concept of *Educaçao do Campo* – 'education for the countryside' and 'education by the countryside' – is important is this regard. *Educaçao do Campo* is an 'education by and for the countryside, by and for its historic actors, and by and for the peasant people; also an education for the collective transformation of reality in the countryside' (Barbosa, 2016). The MST's more specific education programmes on agroecology and food sovereignty grew out of a recognition that agricultural knowledge – like land itself – is highly concentrated in the hands of élites, and inaccessible to marginalized communities. Most notably, MST has developed critical place-based agroecological education which promotes counter-hegemonic agricultural practices as alternatives to the dominant, capital-intensive model of large-scale farming in Brazil (Meek, 2015).

Grassroots networks for food sovereignty and biocultural diversity in India, Indonesia, Iran and Peru. Indigenous communities in the Peruvian Andes, women peasant collectives in the drylands of south India, nomadic tribes of pastoralists in Iran, and peasant farmers from Java's rice

producing areas in Indonesia have all been involved in multi-scale networks working for food sovereignty and self-determination. These grassroots horizontal networks have participated in power-equalizing research that has involved both researchers and non-researchers in close co-operative engagement, jointly producing new knowledge on agroecology, biocultural diversity and food sovereignty. Peer-to-peer dialogues, farmer field schools and farmer exchanges for mutual learning within and between countries are some of the empowering pedagogies that have enabled the bottom-up construction of knowledge (Fakih *et al.*, 2003; Pimbert *et al.*, 2017).

URGENCI and community supported agriculture. URGENCI, the international network for Community Supported Agriculture (CSA), emphasizes the need to consider citizen-consumers as key subjects in peer-to-peer learning on agroecology and food sovereignty. Popular education about the realities of farming and the entire food system is at the heart of the CSA movement. The URGENCI network emphasizes mutual assistance and solidarity as well as direct connections and shared risk between farmers and the people who eat their food; agroecological farming methods (sometimes requiring organic certification); the importance of biocultural diversity; and high-quality and safe food that is accessible to as many people as possible and based on negotiated prices that are fair to producer and consumer. A recent survey of CSAs in 22 European countries estimates that there are currently 6,300 CSA initiatives producing food (vegetables, fruit, meat, dairy products, etc.) for over one million consumers (URGENCI, 2016).

L'Atelier Paysan **in France and Farm Hack in the USA.** These communities of farmers and mechanics use internet platforms to share knowledge about farm tools and machinery they design and build on their farms or in community workshops and co-operatives. These grassroots communities of innovators are interested in developing and sharing open-source tools for a resilient agriculture. They also sometimes assemble offline in the form of face-to-face meetings, workshops and hands-on building events. For example, *L'Atelier Paysan* not only distributes free plans on its website, it also organizes winter self-help training sessions, during which farmers train in metalworking and build tools which they can then use on their own farms. Lastly, these networks are inclusive of different types of knowledge holders and comprise not only farmers but also people with common interests: engineers, designers, architects, tinkerers, programmers and hackers. See http://farmhack.org/tools and http://www.latelierpaysan.org

These decentralized and distributed forms of peasant and peoples–led research and innovation sharply contrast with the organization and practice of mainstream science and technological R&D (Table 8.1). This is mainly because they seek to expand

TABLE 8.1 A comparison between grassroots innovation movements and institutions for science, technology and innovation

	Grassroots research and innovation movements	*Science, technology and innovation institutions*
Predominant actors	Local communities in rural and urban areas, indigenous peoples and peasant networks, civil society organizations, worker co-operatives, social entrepreneurs, NGOs and social movements	Universities, research centres, corporations, venture capital, science ministries and business entrepreneurs
Priority values	Social justice, autonomy, convivial communities, environmental justice, not necessarily focused on for-profit innovation, sustainable livelihoods and human well-being	Scientific advance, economic growth, for-profit innovation/ not necessarily focused on competitiveness
Type and quality of participation	Interactive participation in joint analysis, which leads to action plans and the formation of new local groups or the strengthening of existing ones. Self-mobilizing participation involving people taking initiatives independent of external institutions to change systems	Participation as a means for increasing the effectiveness of research and reaching pre-determined objectives decided by scientists. Mostly consultative, instrumental and passive participation in which scientists and professionals are under no obligation to take on board peoples' views
Incentives and drivers	Social needs, co-operation, community empowerment, mutual aid and solidarity, claiming citizens' right to participate in decision making	Market demand, corporate agendas, expert authority, career progression and reputation
Sources of investment	Community finance, donations, crowd source funding, state finance, development aid and grassroots ingenuity	Public funds, corporate investments, venture capital
Resources	Peoples' knowledge and assets, local organizations and the networks they form	Scientific and professional expertise, including technical infrastructure
Location of activity and sites of innovation	Villages, fields, forests, factories, backyards, co-operatives, neighbourhoods, online, community projects and social movements	Laboratories and R&D institutes, boardrooms and ministries, market-based firms and large corporations
Predominant forms of knowledge	Local, situated knowledge/ indigenous and peoples' knowledge	Scientific and technical knowledge

(continued)

TABLE 8.1 Continued

	Grassroots research and innovation movements	*Science, technology and innovation institutions*
Education	Emphasis on critical education that focuses on political and practical dimensions of change. Often counter-hegemonic educational activities based on plural knowledge systems	Banking model of education. Reflects dominant categories and epistemology of knowledge
Appropriation	Freely shared practices. Not appropriated by individuals – seen as common goods (e.g. knowledge commons)	Intellectual property framework strongly biased towards patent-based innovation and proprietary technologies
Emblematic fields of activity	Agroecology, alternative food networks and economies, small-scale renewable energy, community health and sanitation, housing and low-impact human settlements	Biotechnology, medicine, nanotechnology, synthetic biology and geo-engineering, surveillance technologies, weapons

Source: Adapted and modified from Fressoli *et al.*, 2014.

> 'knowledge democracy' which firstly 'acknowledges the importance of the existence of multiple epistemologies or ways of knowing such as organic, spiritual and land-based systems, frameworks arising from our social movements and the knowledge of the marginalized or excluded everywhere, or what is sometimes referred to as subaltern knowledge. Secondly it affirms that knowledge is both created and represented in multiple forms including text, image, numbers, story, music, drama, poetry, ceremony, meditation and more. Third, and fundamental to our thinking about knowledge democracy is understanding that knowledge is a powerful tool for taking action to deepen democracy and to struggle for a fairer and healthier world'
>
> *(Hall and Tandon, 2015)*

Similarly, the grassroots research and innovation movements described here are fundamentally different from 'citizen science' initiatives in which people act as amateur scientists and/or helpers to the scientific community (Haklay, 2015). These initiatives are usually large-scale scientific projects in which goals are reached more effectively and cheaply thanks to a mass of citizen contributors who 'participate' in surveys or experiments designed by a small number of scientists and the institutions that employ them.

In sharp contrast, networks of peasant farmers, pastoralists, indigenous peoples, fishers, food workers, forest dwellers and other citizens create knowledge and innovations through self-organizing processes under *their* control (see Table 8.1 and Box 8.1). For example, the grassroots innovation network *l'Atelier Paysan* in France is based on a vision of food sovereignty and democracy in which peasants *directly* control technological research and the development of farm machinery for agroecological and organic farming (InPACT, 2016).

Depending on history and context, grassroots ways of knowing and knowledge-creation processes unfold in different ways. Some horizontal networks for autonomous learning and action clearly distance themselves from the state and rely on self-mobilization and self-financing. But most peoples' networks promoting food sovereignty, agroecology and biocultural diversity often consciously adopt a dual power approach to transform existing knowledge, policies and practices. For example, farmers, pastoralists and indigenous peoples engage with formal scientists in participatory research on the basis of clearly negotiated roles, rights and responsibilities, while also maintaining a decentralized network of safe spaces for more autonomous and plural ways of knowing (experiential, local, tacit, feminine, empathizing, phenomenological etc.). This dual approach reflects an awareness of the partial and incomplete nature of all knowledge systems. Indeed, rather than uncritically valuing traditional knowledge and romanticizing the past, grassroots networks of peasant farmers generally embrace scientific knowledge and new technologies when they are appropriate to local needs and context. In the words of Alberto Gomez Flores:

> We *campesinos* have what is called the school of life, knowledge of life. We have the imagination and the ability to know what to do, but not the capacity to translate all of this in writing, or to technically support all of this. So there should be integration between the capacity of technical professionals from the universities and the everyday, practical knowledge that we have accumulated over generations as small farmers. We should try to integrate these different capacities.
>
> *(Alberto Gomez Flores, in Cohn et al., 2006)*

Worldwide, new entrants to farming and younger farmers are increasingly conscious that the development of miniaturization, multipurpose machines, computer-assisted technology for community design and manufacture, multimedia communication and open source software, new knowledge on the dynamic complexity and resilience of socio-ecological systems, reimagined economics and efficient renewable energy systems all have the potential to enhance local autonomy and self-determination (Bookchin, 1986; Cooley, 1982). When under the control of citizens, these innovations can help regenerate local ecologies and economies, minimize pollution and carbon footprints and expand the realms of freedom and culture by eliminating needless toil.

Many grassroots networks of small-scale food producers thus selectively incorporate external concepts and modern technologies to produce social and technical knowledge for autonomy, cultural affirmation and self-determination. For example, in the drylands of Andhra Pradesh, India, grassroots collectives of women *dalit*[3] farmers use modern digital video technology to co-create, document and share knowledge on agroecological farming, biocultural diversity, and food sovereignty. Their community and participatory video films have been an integral part of research processes in which university-trained professionals and non-literate, marginalized

peasants and rural people have worked as co-inquirers – producing new knowledge that challenges the dominance of western science. This video making has transformed the lives of the people involved, empowered marginalized people – especially the *dalit* women – and facilitated counter-hegemonic social and ecological change. An important impact of this decentralized knowledge creation process and reliance on modern global communication technologies is that the videos travel across borders and cultural boundaries to inspire a younger generation of peasant farmers, scholars and practitioners to find better ways of doing research *with, by* and *for* people, not just on people (The Community Media Trust *et al.*, 2008).

These grassroots networks operate at different scales – local, national, regional and, increasingly, at the global level. They work from the bottom up and tend to be organized based on a more horizontal and egalitarian logic. The knowledge and innovations they develop can either be conceptual, methodological, technical and/ or institutional. They often rely on forms of adult and critical education to build the capabilities and confidence of participants in grassroots networks. Farmers and other citizens are part of non-hierarchical 'peer-to-peer' collectives which typically seek to go beyond the concepts, categories, criteria and epistemology of dominant knowledge in the natural and social sciences, as well as in the humanities. Most notably, grassroots networks aim to strengthen farmer/citizen-led research and innovation as a key strategy for spreading food sovereignty, agroecology and biocultural diversity to more people and places.

Equally important, self-managed research and grassroots innovation networks help *democratize* the politics and production of knowledge. For example, autonomy, democratic control, endogenous solutions and solidarity remain central objectives for peasants and other small-scale producers involved in the Farmer-Scientist Partnership for Development in The Philippines (MASIPAG). Reversals from normal practices ensure that peasants – rather than scientists alone – determine research priorities and oversee a power-equalizing process of knowledge creation in farmers' fields and villages (Vicente, 1993; Bachmann *et al.*, 2009; www.masipag.org).

Deepening democracy in the construction of knowledge for food sovereignty, agroecology and biocultural diversity depends on further strengthening grassroots research and innovation networks. This can be done through actions that amplify and reinforce several transformative processes, described in the sections which follow.

Education for critical consciousness and place-based learning

Critical education is at the heart of what makes self-managed research and grassroots innovation networks successful and capable of 'going to scale'. For many actors involved in these horizontal networks, education is about raising critical consciousness for transformation and peoples' empowerment. This educational philosophy is strongly grounded in traditions of popular education – particularly Paulo Freire's work on critical pedagogy, dialogic education and agricultural extension (1970, 1973). Critical pedagogy helps students learn 'to perceive social, political,

and economic contradictions, and to take action against the oppressive elements of reality' (Freire, 1973). Grassroots networks such as those described in Box 8.1 use education as a tool for developing critical consciousness and encouraging peasant farmers to learn from their own reality, to recognize the power structures that shape their lives and to transform social and economic injustice in their communities and wider society. Values such as shared knowledge and shared learning, spirit, struggle, solidarity and love often motivate progressive social change and transformation (hooks, 2003). Lastly, education for critical consciousness usually reflects a deep commitment to radical democracy and human rights. It emphasizes hope and a politics of possibilities (Amsler, 2015; hooks, 1994, 2003).

Within the larger movements for food sovereignty, agroecology and biocultural diversity, pedagogies of hope believe in peoples' ability to make history and transform society. In the first instance, emancipatory and deeply enabling pedagogies seek to dissolve the mental blockages or prejudice that often translate into the disabling practices of agricultural extension and natural resource bureaucracies. Indeed, the history of grassroots self-managed research and innovation networks has been – and still is – partly about breaking down deeply embedded mental stereotypes that cast farmers and rural people – and especially women – in subservient and helpless roles. A large body of field-based evidence strongly supports the view that hope and trust in people's abilities is not just a naïve act of faith: peasant family farmers, farm workers, fishers, indigenous peoples and pastoralists – men and women – can transcend their limitations when given a chance (see Box 8.2; and also Holt-Giménez, 2006; Machín Sosa *et al.*, 2013; Meek, 2015; Rosset *et al.*, 2011; Pimbert *et al.*, 2017).

BOX 8.2 CRITICAL EDUCATION HELPS DISPEL MYTHS ABOUT FARMER IGNORANCE IN INDONESIA

Following a devastating pest outbreak induced by the use and abuse of pesticide applications in rice farming in Indonesia, the government introduced a national integrated pest management (IPM) programme in 1989. A co-operative programme between the Food and Agriculture Organization of the United Nations (FAO) and the Indonesian Government specifically pioneered methods for training rice farmers to understand the agroecology of plant-pest relations. The FAO programme centred on farmer field schools (FFS); schools without walls, based on Paulo Freire's pedagogy for critical education (Freire, 1973). The aim was to make farmers experts in their own fields, enabling them to replace their reliance on pesticides and other external inputs with their skills, knowledge and labour. Over time the emphasis of the programme shifted towards community organization, community planning and management of IPM, and became known as Community IPM (see also Box 8.4 below). According to the former Director of the FAO Community IPM Programme in Asia, the outcomes of the FFS pedagogy and its horizontal spread at the community level helped disprove at least four enduring myths about peasant farmers:

1. **Farmers are ignorant and scientists are the experts.** At the outset, few believed that farmers could even identify insects, let alone deal with something as abstract as field ecology. But soon, most of the disbelievers had seen with their own eyes that farmers could indeed master 'complex' agroecology.

2. **Farmers cannot train other farmers.** The Community IPM programme postulated that if farmers could master the process of 'discovery learning' in their own fields, they could also facilitate other farmers in their learning. The first 'Farmer to Farmer' IPM field schools emerged spontaneously. They were then built in as an integral part of the programme. By 1999, nearly 50% of all IPM Farmer Field Schools were organized and run by IPM Farmer Trainers. Over 20,000 field school graduates have gone on to be trained as Farmer Trainers and conduct field schools for other farmers.

3. **Farmers cannot do research.** Most believed that farmers would be limited to simple experiments and 'demplots'. However, in hundreds of locations farmers have engaged in field-based scientific investigations of complex local problems. Farmers have undertaken activities previously thought impossible, such as the rearing, breeding, spreading and maintaining of biocontrol agent complexes (parasitoids, virus, bacteria) while training other farmers in their use. Now, 'farmer researchers' are often invited to national research meetings to present their findings and their programmes on participatory plant breeding, ecological approaches to soil fertility management, IPM and agroecology in rice, vegetables and other crops. Researchers unfamiliar with the independence, intelligence and diligence of peasant farmers are initially shocked. These same researchers found that a significant number of farmers were out-producing research stations. This flew in the face of the opinions of many experts who viewed farmers as the main problem in agriculture production instead of recognizing them as potential problem solvers.

4. **Farmers are incapable of strategic planning and organizing complex programmes.** Farmer-led planning and organizing activities now extend from the neighbourhood to the national arena. There are many examples of farmers holding dialogues with government ministers and creating farmer forums to develop advocacy on peasant rights. From the late 1990s, organized grassroots farmer networks in Indonesia slowly gained increasing access and much greater leverage over local, regional and even national policies. Here too, patronizing views that cast farmers as passive actors in need of professional help and guidance were proven wrong.

(Modified from Dilts, 1999; Fakih *et al.*, 2003)

Moreover, education for critical consciousness values people's experiential knowl-edge and place–based learning. The detailed and intimate knowledge of the places where one lives and works matters, as does the tacit knowledge that comes from

learning by doing. In the *Nayakrishi Andolan* movement for example, this living knowledge is co-generated and distributed in multiple spaces: in fields and farming landscapes, in the workshops of mechanics and carpenters and in the many village campuses inhabited by men and women peasant farmers as well as by potters, artisans and healers, fishers and hunters, leaders and priests, story tellers and musicians (Box 8.1 and Mazhar *et al.*, 2006). Peasant farmers and other citizens involved in this way of knowing rely on their senses (smell, sight, taste, touch, hearing...) to perceive and interpret phenomena. Most notably, observations and sense-making activities are carried out in real-life situations – in the field and *in vivo*. Careful observations and inclusive conversations help map, analyze, understand and respond to complex and ever-changing natural and social phenomena in place-specific situations. In contrast with most science, technology and innovation institutions (Table 8.1), peasant farmers, indigenous peoples, pastoralists, forest dwellers and other citizens tend to be involved as full and whole human beings, with all their senses engaged in a relation of empathy with living beings, minerals and the wider environment. Intimate conversations as well as emotional and spiritual bonds with plants, animals, ecosystems, landscapes and human communities are viewed as legitimate sources of knowledge and ways of knowing for many indigenous and peasant communities (Chapter 6 in this book; Posey, 1999; Toledo and Barrera-Bassols, 2009). For indigenous peoples in Peru for example,

> the Andes is a world of affectionate conversationalists because it is love for the world which allows life to flow … A pre-requisite in this nurturance is that we all be disposed to listen perpetually and in each circumstance to the 'speaking', to the sign of each one … In the conversation each member of the Pacha[4] is recognized as a sensible organism in constant speech. Here language is not only a human attribute but one belonging to all members of the Pacha and communication takes place through the senses – which are like the 'windows' of life. It is through them that one converses with everyone … Conversation is thus an attitude, a mode of being in unison with life, a knowing how to listen and knowing how to say things at the appropriate moment.
> *(Rengifo Vasquez, 1998)*

When and where grassroots research and innovation networks create such safe spaces for communication and action, theory and interpretive frameworks are often built from knowledge that echoes and reflects the *sensuous* and *sensitive* qualities of human beings and their intimate relationship with place.

Horizontalism and dialogic knowledge production

Grassroots peasant networks often rely on an explicitly horizontal form of participatory knowledge production and sharing which breaks down the dichotomy between learners and teachers. This 'horizontalism' mediates 'democratic communication on a level plane and involves – or at least intentionally strives towards – non-hierarchical

and anti-authoritarian creation rather than reaction' (Sitrin, 2006). New knowledge is produced among equals through face-to-face communication in a process of 'dialogic education' (Freire, 1970) in which everyone has something to share, and each perspective is seen as valuable. In this democratic process of knowledge co-production and sharing, participants are the subjects of their own process of discovery, innovation, learning and agency. Such horizontal knowledge production is exemplified by the *Campesino a Campesino* (CaC) approach, and to varying degrees by the other peasant networks described in Box 8.1.

For many peasant and indigenous networks working for food sovereignty, agroecology and biocultural diversity, horizontal knowledge production takes the form of a *diálogo de saberes*: a 'dialogue among different knowledges and ways of knowing' (Martínez-Torres and Rosset 2014). Different knowledges within peasant networks have been able to dialogue with each other, and also with the knowledge of external scientists and technicians invited to participate in dialogues with farmers, fishers, forest dependent people and pastoralists. For example, *diálogos de saberes* have allowed indigenous communities in the Peruvian Andes to gain the confidence to engage in intercultural dialogues with scientists and extension agents on practices for food sovereignty. Four different topics were critically explored in the intercultural dialogues between indigenous and scientific knowledges in Peru: (1) adaptation to climate change in the Andes; (2) fisheries management in Lake Titicaca; (3) animal breeding programmes for alpaca and llamas; and (4) the conservation and use of genetically diverse Andean crops in indigenous farming (Salas, 2013).

This process is usually empowering for marginalized groups because it:

> embraces subaltern knowledges, especially those that sustained traditional cultures and today re-signify their identities and position themselves in a dialogue of resistance to the dominant culture that imposes its supreme knowledge. *Diálogo de saberes* is a dialogue with interlocutors who have been stripped of their own words and memory, traditional knowledges that have been buried by the imposition of modernity, and the dialogue becomes an investigation, an exegesis, a hermeneutics of erased texts; it is a therapeutic politics to return the words and the meaning of languages whose flow has been blocked.
>
> *(Leff, 2004, my translation)*

More generally, horizontal networks value and work with the diversity of peoples' knowledge. As such, grassroots research and innovation seeks to reverse 'cognitive injustice' and 'epistemicide' (Boaventura de Souza Santos, 2014). The idea of cognitive justice emphasizes the right for different forms of knowledge – and their associated practices, livelihoods, ways of being and ecologies – to coexist (Visvanathan, 1997). As Visvanathan argues, cognitive justice is 'the constitutional right of different systems of knowledge to exist as part of a dialogue and debate'. This implies the continued existence of 'the ecologies that would let these forms of knowledge survive and thrive not in a preservationist sense but as active practices' (Visvanathan,

2005). For example, the successful protection of biocultural heritage in the Potato Park in Peru has grown out of local communities' affirmation of their sovereign right to sustain their *entire* knowledge system, including the landscape and territories that renew biodiversity, culture and livelihoods (Box 8.3).

BOX 8.3 INDIGENOUS COMMUNITIES CLAIMING COGNITIVE JUSTICE IN PERU

The concept of Indigenous Biocultural Heritage Territories (IBCHT) has guided a successful community-led initiative in the Potato Park in Cuzco, Peru. Located in a biodiversity hotspot for potatoes, the park is an IBCHT centred on the protection of potato biodiversity and related knowledge. The area is home to more than 4,000 varieties of potato as well as other traditional Andean crops, including quinoa and oca. The Potato Park provides an alternative approach for protecting traditional knowledge. It protects not only the intellectual, but also the landscape, biological, economic and cultural components of knowledge systems, thereby halting loss of traditional knowledge as well as misappropriation. Communities' collective control over their knowledge has been strengthened by systematically affirming the holistic and indivisible nature of their rights to land, territories and self- determination. Cognitive justice is being claimed as the concept of IBCHT is increasingly recognized in national and international negotiations on the protection of biodiversity and knowledge.

(Argumedo and Pimbert, 2008; http://biocultural.iied.org)

The collective construction of technical, practical and political knowledge

Closely related empowering pedagogies allow people to participate in the joint production of *collective* knowledge throughout their horizontal networks. These pedagogies usually encourage radical visions for food sovereignty, agroecology and biocultural diversity. They include the social process methodology used in constructing sustainable peasant agriculture and food sovereignty in Cuba (Rosset *et al.*, 2011); the *Campesino a Campesino* approach in Central America (Holt-Giménez, 2006); peasant–run Farmer Field Schools in Indonesia (Fakih *et al.*, 2003; Pontius *et al.*, 2002); 'phenomenon-based learning', which engages students in an innovative pedagogical model for agroecological teaching and learning in real–world situations (Francis *et al.*, 2011; Francis *et al.*, 2013); decolonizing pedagogies and methodologies for research by indigenous peoples (Chilisa, 2012; Smith, 2012; Zavala, 2013); and the social learning methods of the thousands of villagers who are *gono gobeshoks* (people's researchers) for whom participatory research has 'sharpened their minds' and helped them develop self-reliance in Bangladesh (Wadsworth,

2005). In many ways, these empowering pedagogies seek to develop an attitude of inquiry which enhances people's awareness and understanding that they are part of a social and ecological order, and are 'radically interconnected with all other beings, not bounded individuals experiencing the world in isolation. Thus, an attitude of inquiry seeks active and increasing participation with the human and more-than-human world' (Marshall and Reason, 2007).

It is also noteworthy that these pedagogical processes generate not only technical knowledge needed to solve agronomic problems like pest outbreaks and soil erosion. They also facilitate the construction of practical and political knowledge. This is largely because these pedagogies are integrated and integrative forms of critical education. They usually unify different domains of learning (technical, practical and political), rather than contain them in separate categories that break down education into the usual cognitive, affective and psychomotor areas. Most of these empowering pedagogies are based on the taxonomy of learning put forward by Jurgen Habermas (1971). In this Critical Theory Perspective, people approach knowledge with an 'orientation toward technical control, toward mutual understanding in the conduct of life, and toward emancipation from seemingly "natural" constraint' (Habermas, 1971). Habermas' learning framework thus simultaneously addresses three fundamental human interests: the technical domain of work, the domain of interaction and communicative action and the domain of emancipatory action for empowerment (Ingram, 1987).

By integrating these three domains of learning, grassroots research and innovation networks construct new knowledge on environmental, institutional, social and technical issues. Practical and political knowledge as well as holistic and phenomenological understandings of complex dynamic realities emerge from specific places throughout these peer-to-peer networks and dialogues among different knowledges. Peoples' inclusion and participation in the creation of new knowledge thus provide the concepts, practices and institutional innovations needed for the horizontal spread of agroecology, biocultural diversity and food sovereignty. Some noteworthy examples are given in Box 8.4.

BOX 8.4 SELECTED EXAMPLES OF PRACTICAL AND POLITICAL KNOWLEDGE GENERATED BY HORIZONTAL NETWORKS OF PEASANT FARMERS

Participatory research by the *Movimiento Campesino a Campesino* on the impacts of Hurricane Mitch. In October 1998, Hurricane Mitch dumped 20–50% of the average annual rainfall on parts of Central America in only five days. Mitch's torrential rains destroyed natural vegetation and standing crops ready to be harvested. Millions of tons of topsoil were washed down from hillsides into rivers. While first reports indicated massive agricultural damage, closer observation showed that small farms usually described as

'sustainable' appeared to have suffered less damage than their 'conventional' neighbours (Bunch, 1998; Ernst, 1998). These farms generally belonged to peasant farmers working within the *Movimiento Campesino a Campesino* (Farmer to Farmer Movement or MCAC) on the Central American hillsides. The farming practices often used in this movement included a wide range of soil conservation and agroecological methods, tested and promoted by these smallholders for over 20 years. A more systematic survey carried out by the MCAC confirmed that farms using agroecological diversification practices such as agroforestry, cover crops and intercropping were less damaged by the hurricane. With the help of 40 non-governmental organizations and 100 farmer-technician teams, 1,743 farmers measured key agroecological indicators on 1,804 plots paired under the same topographical conditions. The study included 360 communities and 24 departments in Nicaragua, Honduras and Guatemala. This coverage, and the massive mobilization of farmer-technician field research teams, was made possible by the existence of the MCAC and its capacity to mobilize farmers. The MCAC study found that agroecological farms had 20–40% more topsoil, greater soil moisture as well as less erosion and gully formation. They also experienced significantly lower crop and economic losses than their conventional monoculture neighbours (Holt-Giménez, 2002). The findings of this grassroots-led study emphasized the importance of increasing plant diversity and complexity in agroecosystems to reduce vulnerability to extreme climatic events. The knowledge generated by the MCAC in the late 1990s thus supports more recent scientific evidence which shows that agroecosystems are more resilient to shocks and stresses when they are part of a complex landscape matrix (Perfecto *et al.*, 2009). In particular, the resilience of a complex landscape matrix depends on it being made up of genetically heterogeneous and diversified cropping systems that use appropriate techniques to increase soil organic matter and conserve water.

Innovations in plant breeding by the Réseau Semences Paysannes (RSP). In sharp contrast with mainstream science, members of the French Peasant Seeds Network (RSP; see Box 8.1) clearly reject the reductionist, utilitarian and mechanistic view of the living world. For example, in the early phases of participatory plant breeding work, farmers criticized researchers for using such terms as 'genetic material', 'weeds' and 'quantifiable selection criteria'. In contrast, the RSP farmers described their relationship with their crops as *living* plants and companions. They never view the plant as an *object*. The peasant farmers have a strong emotional attachment to plants and see them as a source of knowledge and inspiration, provided one has a friendly and empathizing relationship with them. This emotional bond with plants clearly positions the farmers outside the positivist scientific paradigm which values a cool 'objective detachment' in the pursuit of knowledge. The farmers' ways of knowing are thus radically different from the epistemological norms of mainstream plant genetics and breeding. The RSP's more holistic understanding

of dynamic complexity and participants' engagement with the living world is leading to new forms of evolutionary plant breeding, enabling this peasant network to generate crop varieties that are resilient to climate change and suited to a diversity of unique situations. It is becoming apparent that the peasant farmers' experiential knowledge and phenomenological understanding of the living world resonate with new insights of modern genetics and biology. This is true, for example, in the areas of fluid genomes and indeterminate relations between genes and the environment; non-linear dynamics, plasticity and the emergence of new forms; epigenetic effects in which the environment modulates genetic expression and leads to heritable phenotypic changes; emergent properties and the self-organization of the living world (Commoner, 2003; Mae Wan Ho, 2013; Pouteau, 2007a/b). Yet this knowledge creation is happening largely outside universities and the national agricultural research system where there is no, or very little, work on evolutionary plant breeding (Réseau Semences Paysannes, 2004; Pimbert, 2011; www.semencespaysannes.org).

Indonesian farmer networks develop knowledge for a Peasant Rights Charter in Indonesia. As more farmers trained other farmers, the Farmer Field School (FFS) programme in Indonesia (described in Box 8.2) was able to be relatively flexible and responsive in developing new curricula to meet the evolving needs of farmers. A wide range of FFS curricula were developed by and for this grassroots network – ranging from *How to Strengthen Farmer Trainers* to a curriculum on *Participatory Ecology Training and Soil Management*. The principles of FFS were extended from rice to other crops such as vegetables and cotton, and from IPM to integrated nutrient management, plant breeding and participatory health monitoring. FFS pedagogies also broadened from the technical to the empowerment domain as farmers' social learning and action focused on building the knowledge they needed to engage in advocacy, policy processes and governance (Pontius *et al.*, 2002). Critical education in the form of FFS for advocacy and political literacy soon led to the formation of a large farmer movement asking for agrarian reform and fundamental changes in agricultural policy. By May 2000, an alliance for Peasant Rights had emerged from below. This grassroots network of FFS and local organizations mobilized farmers' collective knowledge to develop a Peasants' Rights Charter. The charter was used as early as April 2001 to argue for the protection and fulfilment of farmers' basic rights in national fora and policy dialogues with the Indonesian Human Rights Commission. The charter emphasized eight key areas in particular (Fakih *et al.*, 2003):

1. Livelihood rights (rights to sufficient and healthy food and a reasonably good job)
2. Resource control rights (rights to fertile land, rights to biological diversity)
3. Production rights (including technology choices)
4. Consumption rights (including the right to choose what to produce)

5.   Marketing rights (including market access rights), quality protection and property rights
6.   Political and social rights (including the right to organize themselves/ build their own organizations)
7.   Reproductive rights (as they relate to both human reproduction and maintaining biological diversity)
8.   Rights to free expression (including the rights of language, culture, religion and arts).

In many ways, the Indonesian Peasants' Rights Charter thus anticipated and prefigured thinking that has since spread throughout the international food sovereignty movement – see for example *La Via Campesina*'s 'Declaration of Rights of Peasants' and its call for an International Convention on the Rights of Peasants (La Via Campesina, 2009). It is noteworthy that the collective knowledge developed by Indonesian grassroots peasant networks 15 years ago has helped frame today's discussions on the recent United Nations Draft Declaration on the Rights of Peasants and Other People Working in Rural Areas (Claeys, 2015; http://www.ohchr.org/EN/HRBodies/HRC/RuralAreas/Pages/3rdSession.aspx).

Building extended peer communities to validate and protect collective knowledge

All members of grassroots horizontal networks are viewed as knowledge producers and users who act as an 'extended peer community'. This peer group not only creates a space for conviviality and meaningful exchanges of opinion, it also plays a key role in validating new knowledge and innovations. As active participants in the construction of knowledge, peasant farmers, pastoralists, food workers, indigenous peoples, fishers, forest dwellers, urban farmers and other citizens introduce 'facts' and sources of knowledge which scientists working in more standardized and ideal research conditions simply cannot 'factor in' and/or assess. The subsequent cross-checking of facts and opinions, analysis of collected information, questions about the quality and validity of knowledge, farmer and citizen deliberations and peer-to-peer reviews are all involved in the *in situ* validation of useful knowledge. This is essentially an 'extended peer review' process and the practice of a post-normal science[5] in horizontal networks of grassroots research and innovation (Ravetz, 1971, 2006; Funtowicz and Ravetz, 1990 and 1993). Unlike peer reviews that only involve 'scientific experts', extended peer communities also include farmers, pastoralists and other citizens. The diversity of perspectives and interests represented in extended peer groups will vary depending on the complexity and scale of the issues dealt with. Their decentralized and distributed nature enhances community and socio-ecological resilience because 'extended peer communities' enable the *in situ* validation of knowledge-based solutions needed for local adaptive responses to

social and environmental challenges. As such, horizontal networks of locally rooted extended peer communities are particularly well suited for the validation of knowledge in a fast-changing, unpredictable and uncertain world (e.g. climate change, spread of new diseases, unstable markets, political change etc.).

The kind of knowledge that emerges from this process of social learning has been well described by James Scott in his book 'Seeing like a State' (1998). He speaks of 'forms of knowledge embedded in local experience' (*mêtis*) and sharply contrasts them with 'the more general, abstract knowledge displayed by the state and technical agencies'. *Mêtis*, says Scott, is 'plastic, local and divergent … It is, in fact, the idiosyncrasies of *mêtis*, its contextualities and its fragmentation that make it so permeable, so open to new ideas'. As he suggests,

> *mêtis*, with the premium it places on practical knowledge, experience and stochastic reasoning, is of course not merely the now superseded precursor of scientific knowledge. It is a mode of reasoning most appropriate to complex material and social tasks where the uncertainties are so daunting that we must trust our (experienced) intuition and feel our way.
>
> *(Scott, 1998)*

This production of *collective* knowledge is intimately linked with the nurturing of human relations and reciprocity within grassroots networks of self-managed research and innovation. People are involved in a deeply sense-making activity through the co-construction of collective knowledge for food sovereignty, agro-ecology and biocultural diversity. Moreover, there is usually a strong commitment to ensuring that knowledge, genetic resources and other innovations remain *accessible to all*. The enclosure and privatization of knowledge in particular is seen as incompatible with the ethos of sharing that characterizes many horizontally organized networks of self-managed research and grassroots innovation. For example, patents on seeds make it illegal for farmers to save and exchange seeds, and thus deeply undermine the collective nature of peer-to-peer knowledge production within peasant networks (Box 8.5). More generally, these emergent community economies (Gibson-Graham 2006) and knowledge commons (Bollier and Helfrich, 2012, 2015) fundamentally reframe the 'economy' and 'knowledge' to emphasize certain ethics and values (solidarity, fairness, co-operation, ecological etc) over others (individualism, competition, compulsive acquisition, enclosure and monopoly control).

BOX 8.5 PEER-TO-PEER KNOWLEDGE CREATION IN THE *RÉSEAU SEMENCES PAYSANNES:* RECIPROCITY AND THE NEED TO PROTECT COLLECTIVE KNOWLEDGE

Members of the *Réseau Semences Paysannes* (RSP; see Boxes 8.1 and 8.4) are organized into horizontal networks that link many people and places

throughout France. Within the RSP, seeds are exchanged among peasant farmers who have the capacity to observe and experiment, who have a caring relationship with plants and who are sincere in their motivations. The farmers exchange seeds as gifts in the sense defined by Marcel Mauss in his classic work 'The Gift' (1990). This gift exchange leads to a mutual interdependence between giver and receiver. The giver does not merely give an object but also part of himself, because the object is indissolubly linked to the giver: 'the objects are never completely separated from the men who exchange them' (Mauss, 1990). Because of this bond between giver and gift, the act of giving creates a social bond with an obligation to reciprocate on the part of the recipient. It is the fact that the identity of the giver is invariably bound up with the object given that causes the gift to have a power which compels the recipient to reciprocate. According to Mauss (1990), solidarity is achieved through the social bonds created by gift exchange. This is a deeply sense-making activity for people involved.

By affirming the importance of reciprocal peer-to-peer exchanges of seed and knowledge among members of their network, the RSP is essentially developing a solidarity-based economy that is clearly distinct from today's more anonymous commodity exchanges. This solidarity-based moral economy thus creates an autonomous space in which the de-commoditization of seeds and farmer knowledge becomes possible though a *diálogo de saberes* (see above). Indeed, RSP not only rejects the modern forms of enclosure that increasingly privatize and commodify seeds and farmers' knowledge—for example, the new European Union seed regulations and World Trade Organization (WTO) compatible intellectual property rights legislation (patents and plant breeders' rights). It also actively works to develop new knowledge on seed legislation and policies that recognize the secular rights of farmers to freely save and exchange seeds, as well as their rights to collective knowledge. The peasant network's understanding of 'good' economics is thus radically different from the neo-liberal model of commodity exchange and privatization which is, implicitly or explicitly, an integral part of the normative framework adopted by most professional plant breeders, research institutes and policy makers.

(www.semencespaysannes.org)

Strengthening local organizations to scale out grassroots research and innovation

Expanding knowledge for food sovereignty, agroecology and biocultural diversity partly depends on ever more people and communities engaging in grassroots self-managed research and innovation over ever larger territories. This process of geographical spread and numerical increase ('scaling out') is distinct from the process of 'scaling up', which means institutionalizing enabling policies and practices for research, education, extension and credit (see IIRR, 2000; Pachico and Fujisaka,

2004; Pimbert, 2004). The changes needed in public research and education are discussed later in the chapter.

The horizontal scaling out of grassroots innovation and research is driven in large part by the processes identified thus far in this chapter: critical education and empowering pedagogies, nurturing a sense of place through experiential knowledge, dialogues between different knowledges (*diálogos de saberes*), horizontal networks for peer-to-peer learning, emphasis on practical and political knowledge, extended peer communities to validate knowledge and collective knowledge sharing. All these processes depend on co-ordinated action made possible by local organizations that bring people together for joint activities – from resource management, labour-sharing, marketing and other activities that would be too costly, or impossible, if done alone.

Local organizations[6] play a key role in facilitating collective action and co-ordinated knowledge creation within grassroots research and innovation networks. In the first instance, knowledge is generated as part of the day-to-day activities mediated by local organizations that have been set up for different purposes within communities (Pimbert, 2009a), such as:

1. sustaining the ecological basis of food systems – including producing knowledge and joint actions for the local adaptive management of land and the development of reliable bio-physical indicators to track and respond to change;
2. co-ordinating human skills, knowledge and labour to generate both use values and exchange values in the economy of the food system;
3. governing food systems – including decisions about people's access to food and natural resources as well as collectively generating the political knowledge needed to shape policies and institutions.

In the second instance, new organizations can be especially created to co-ordinate local processes of social learning based on critical education, empowering pedagogies, *diálogos de saberes,* as well as the peer-to-peer production of knowledge. Notable examples include Farmer Field Schools based on Freirian principles (Fakih *et al*, 2003; Pontius *et al.*, 2002); food sovereignty and agroecology schools run by peasant themselves (Meek, 2015; Rosset and Martinez Torres, 2012); permaculture schools for radical transformation (Beckie and Berezan, 2017); women's *Sangham*[7] networks for autonomy and food sovereignty (Women Sanghams *et al.*, 1999); *communidades de base* as decolonizing organic structures among agricultural indigenous communities in Mexico, Nicaragua and Colombia (Fals Borda, 1987); social movements based on horizontal links between local peasant organizations (Holt-Giménez, 2006, 2002; Rosset *et al.*, 2011); and educational organizations that work with the Brazilian Landless Workers' Movement (MST) to promote critical place-based education for agroecology, food sovereignty and *Educação do Campo* (Meek, 2015; Meek and Tarlau, 2015).

Several organizations with different functions, powers and responsibilities are thus usually involved in facilitating the construction of knowledge for food

sovereignty, agroecology and biocultural diversity. Such 'nested organizations' and their polycentric networks operate at different scales and act in complementary ways (Ostrom, 2005, 2010). These interlinked organizations not only provide the institutional landscape that is needed to manage the social and ecological realms in which food systems are embedded, they also provide the organizational fabric that enables the co-ordinated and timely production of collective knowledge by grassroots networks of peasants, indigenous peoples, fishers, pastoralists and urban farmers (Pimbert, 2009a, 2009b). At the FAO's Regional Agroecology Symposium in Budapest in 2016, the role of local organizations in renewing the commons of collective knowledge was strongly emphasized by Guy Kastler (a French peasant farmer and member of *La Via Campesina,* see Box 8.1): 'there is no agroecology knowledge without strong farmer organisations'.

Nested local organizations also often work to holistically integrate knowledge on the ecology, economy and culture of places. This makes it possible to express the unity of all knowledge beyond disciplines: a key aim and claim of transdisciplinary research today (Nicolescu, 2008, 1994; Lang *et al.*, 2012). For Andean indigenous communities living in the Potato Park (Peru), agricultural production, landscape management, economic exchanges and spiritual life are mediated by interacting networks of local organizations which include producer associations, women organizations responsible for running barter markets for food and medicinal plants, farmer groups with specialist knowledge on crop breeding, the women's restaurant collectives and groups of shamans (Argumedo and Pimbert, 2005; www.andes.org). This polycentric network of local organizations supports indigenous ways of knowing, seeing and thinking that holistically link different areas of life while also generating new knowledge (Argumedo and Pimbert, 2010; Marti and Pimbert, 2007).

Nested local organizations and the horizontal networks they form thus play a crucially important role in the construction of knowledge for food sovereignty, agroecology and biocultural diversity. And without exception, all major success stories in these areas depend on nested local organizations to facilitate and coordinate collective action at different scales (see Box 8.1 for examples). Webs of interacting local organizations provide the basis for autonomous learning and action, self-managed research and grassroots innovations (conceptual, technical, social and political innovations). They also provide the institutional landscape and social organization that allows for the potentially more decentralized, horizontally distributed and democratically controlled production of knowledge. Horizontal networks of local organizations of farmers and other citizens should therefore be strengthened to enhance their capacity to 'scale out' the processes described above.

Yet on all continents, local organizations and their capacity for self-administration have been undermined by a toxic cocktail of large-scale authoritarian state development plans (Scott, 1998) and a capitalist modernity that thrives on 'accumulation by dispossession' (Harvey, 2004). As farmers and farms have dramatically declined in numbers, land and capital have become concentrated into larger and larger farm holdings.[8] The net result of these trends is that there are simply fewer

and fewer farmers around to build local organizations and engage in participatory processes. Without people there is, by definition, no participation possible and no capacity to develop strong local organizations. As a result, many rural communities are no longer in charge of managing their local food systems, economies and environments. Most significantly, they are not 'trusted' by state bureaucracies to be able to do so (see Scott, 1998, 2009). In many places, communities continue to be actively disempowered, and their local organizations are becoming incapable of co-ordinating collective action in the social, economic, ecological and political realms. Re-creating and strengthening local organizations and their polycentric webs is thus a key priority for citizens who seek to democratize research and exercise their right to construct knowledge for the society they want. Wider policy and economic changes for food sovereignty are also required to provide farmers and other citizens with the *free time* and *material security* needed to build local organizations, engage in participatory decision making and sustain their knowledge systems (Chapters 1 and 7 in this book). As Pedro Magana Guerrero – a former peasant leader of UNORCA[9] in Mexico – says, the 'consolidation of alternatives rests completely on what is happening at the local level, it depends on the development of organisations in their regions, in their countries. This gives viability to a global process' (Pedro Magana Guerrero, cited in Desmarais, 2007).

However, local organizations and the networks they form should not be romantically idealized and viewed as unproblematic. They are not always welcoming spaces for women, nor inclusive of the marginalized, nor free from manipulation by more powerful actors. Community-based local organizations can sometimes be overwhelmed by internal inequities and social injustices, with decisions taken by the powerful (the men, the landowners, the 'upper' castes and privileged classes). This is often at the expense of the relatively powerless (women, landless farm workers, pastoralists, forest peoples, urban slum dwellers etc.). These shortcomings in relation to equity, gender, social inclusion, race and entitlements of the very poor and marginalized clearly need to be acknowledged and tackled by social movements (hooks, 1994; Masson *et al.*, 2017). Nurturing a conscious social commitment to a politics of freedom, equity and gender inclusion is key in ensuring that grassroots research and innovation networks do not reproduce overt or subtle forms of exclusion, including enduring forms of homophobia, misogyny and patriarchy. Fortunately, local organizations that facilitate knowledge creation for food sovereignty, agroecology and biocultural diversity are well positioned to harness critical place-based education and horizontal social methodologies for transformation 'within'. Through their counter-hegemonic practice, they can collectively decide and organize to promote critical education and decolonizing pedagogies that deepen freedom from patriarchy and injustice. By becoming safer spaces for communication and action, local organizations and collective structures can also cultivate a non-hierarchical sensibility, empathy and mutual respect, diversity and social inclusion, as well as citizenship and the art of participatory democracy.

Last but not least, local organizations and collective structures that facilitate the 'scaling out' of grassroots research and innovation also have a potentially key role

in 'scaling up' policies and practices designed to democratize public research on food, agriculture, environment and society. When part of larger federations and social movements, local organizations of peasant farmers and other citizens can greatly influence decisions on national research priorities and funding. More specifically, federated networks of local organizations help build the countervailing power needed for citizens to claim and realize their rights to democratically participate in the governance of national research systems and universities. This is further discussed in the next section, which focuses on the transformations needed in public research for the widespread construction of knowledge for food sovereignty, agroecology and biocultural diversity.

Democratizing and transforming public research

University-based scholars and researchers can produce critical and counter-hegemonic knowledge which grassroots networks of farmers value and do use. Contributors to this volume exemplify this trend. Similarly, the *Centre for Agroecology, Water and Resilience* at Coventry University has recently published over 35 examples of critical research projects in Africa, Asia, the Americas and Europe that offer alternatives to dominant knowledge on food, agriculture and human well-being (People's Knowledge Editorial Collective, 2017). These diverse case studies show how monopolies of knowledge by élites can be contested through collaborations between academics and social movements as well as community–university partnerships. Co-inquiry, participatory action research (PAR), feminist PAR inquiry and other forms of liberatory inquiry are shown to be effective in openly challenging racism, sexism, colonialism and hierarchies of knowledge in science and its practice.

A simplistic rejection of all research and science as a whole will therefore not do. Instead, the issue here is how to transform existing research systems (universities, research institutes, policy think tanks, research extension services...) so that they can contribute more appropriate knowledge for food sovereignty, agroecology and biocultural diversity? Under what conditions can alliances and complementarities be built between self-managing grassroots research networks and public research institutions? Which institutional and methodological innovations are required to develop new forms of collective intelligence that combine the partial and incomplete knowledges of scientists, peasant farmers and indigenous peoples? What transformations will help decolonize research so that indigenous ways of knowing are reclaimed and can flourish? How can critical, deviant and disobedient knowledge thrive in research organizations rather than be disciplined and punished? How can public research and education be reinvented to generate many more 'organic intellectuals' (*sensu* Gramsci, 1978) rather than traditional academic intellectuals and liberal scholars who prop up the leading scientific organizations that 'do little except chase money and reinforce the ruling nexus of politics and finance' (Macilwain, 2016)?

Grassroots movements for food sovereignty, agroecology and biocultural diversity also recognize the liberating potential of modern science and technology. But as

argued in the previous section, organized networks of farmers, indigenous peoples and other citizens should *directly* decide what new knowledge and innovations are needed, for whom, when, where and under what conditions. This means re-embedding farmers and other citizens in the production of transdisciplinary knowledge in ways that fundamentally democratize research organizations and decolonize research methods in the social and natural sciences as well as the humanities. Some of the radical transformations required in the governance, culture, organization and professional practice of public research are highlighted below.

Putting citizens at the heart of decision making in research

Throughout the world, the governance and funding of higher education, science and technological research and development (R&D) are largely controlled by upper-middle class men who are increasingly distant from diverse local realities as they align themselves more and more with corporate interests (Beder, 2006a, 2006b; Chomsky, 2017; People's Knowledge Editorial Collective, 2017; Benessia *et al.*, 2016). Several institutional and methodological innovations can help reverse the current democratic deficit in the governance of research and development (R&D). By putting farmers and other citizens at the centre of decision making for R&D, the social innovations highlighted below can also help (re)construct knowledge for food sovereignty, agroecology and biocultural diversity.

At one level, existing governance and funding bodies for R&D can be reformed and opened up to more citizen participation by including more gender-balanced representation of peasant farmers, indigenous peoples, pastoralists, fisherfolk, farm workers, artisanal food processors and citizen-consumers. However, this more equitable representation of citizens in structures that govern research (boards, funding bodies, expert committees …) will also need to be complemented by more transformative and direct forms of democracy that create space for the voice and agency of hitherto excluded people. This is consistent with the food sovereignty paradigm and its central emphasis on the fundamental right of citizens to decide their own food and agricultural policies.

There are four key moments or stages at which direct citizen participation can occur in the research and development cycle:

1. the framing of national policies for science and development;
2. the choice of upstream strategic priorities for R&D, including decisions on budget allocations by funding bodies;
3. during scientific and technological research – the production and validation of knowledge in the natural and social sciences, as well as the arts and humanities;
4. in evaluating research results and impacts, including risk and sustainability assessments.

Participatory methods and deliberative processes that genuinely include different actors are important in 'opening up' the entire research cycle to greater citizens'

oversight and democratic control over *what* knowledge is produced, *for whom, how, where* and *with* what likely effects. In practice, a range of methodological approaches and processes can be used to facilitate direct engagement and participation of farmers and citizen-consumers in different stages of the R&D cycle. For both scientific and technological research, as well as risk and impact evaluations (Stages 3 and 4 above), a suite of methods for participatory inquiry can be combined in different sequences. Such participatory methods and systems of inquiry (see Box 8.7 further below) enable farmers and citizens to use their own knowledge to analyze their conditions and participate in co-inquiries with outsiders (e.g. scientists, planners and other professionals) (Chambers, 1993, 1996, 2008; Chilisa, 2012; Pretty and Chambers, 1993; Salas, 2013; Salas *et al.*, 2007; Zavala, 2013).

A range of institutional and methodological innovations can also be used to enhance citizen deliberation and inclusion in the governance of national research systems (Pimbert, 2010; Testart, 2015). These innovations are particularly appropriate for involving farmers and citizens in agenda setting and the upstream definition of research priorities, the framing of national policies for scientific research and development, decisions on research funding and budget allocations, as well as in risk and sustainability assessments (Stages 1, 2 and 4 above). Examples of these methods for deliberative and inclusive processes (DIPs) include citizens' juries, scenario workshops, public hearings, multi-criteria mapping and visioning exercises (see Coote and Lenaghan, 1997; Lowndes and Stoker, 1998; Pimbert and Wakeford, 2003; Stirling and Maher, 1999; Wakeford and Pimbert, 2004).

When these participatory methods are used well and are not designed to close down debates,[10] they are part of a process in which new practical and political knowledge can be constructed for food sovereignty, agroecology and biocultural diversity (Pimbert, 2010). An example of the latter is the global initiative known as Democratising Agricultural Research (www.excludedvoices.org). Here participatory methods enabled deliberative and inclusive processes in which small-scale producers and other citizens were invited to decide on the kind of agricultural research they want in the Andean region (Bolivia, Ecuador and Peru), South Asia (India, Nepal and Sri Lanka) and West Africa (Burkina Faso, Benin, Mali and Senegal):

- The *Raita Teerpu* (the 'farmer's verdict') took place in the State of Karnataka in 2009. It brought peasants, especially women, *Dalits* and indigenous peoples in a citizens' jury set up to analyze the relevance of agricultural research for small farmers. After carefully listening to evidence given by specialist witnesses from government, the private sector, research institutes, activists and peasants, the jury of marginalized small farmers and landless farm workers presented their policy recommendations to decision makers and the media in Bangalore, the capital of the State of Karnataka. The extensive use of media (radio, TV, newspapers, recordings in local language …) before, during and after the *Raita Teerpu* ensured that over 10 million households followed these farmer deliberations and heard the jury's recommendations on what kind of agricultural

research is needed for marginalized peasants, who represent the majority of the population in Karnataka and rural India (http://www.raitateerpu.com).

- An international workshop in 2013 shared lessons from Africa, Asia and Latin America with a wider community of European peasants, policy makers and representatives of the donor community. Known as the St. Ulrich Workshop on Democratising Agricultural Research for Food Sovereignty and Peasant Agrarian Cultures, this international workshop brought together 95 participants from a total of 17 countries (www.excludedvoices.org). Inspired by their peers from the global South, several European participants followed up by organizing networks of farmer-to-farmer exchanges, *diálogos de saberes,* and actions aimed at democratizing agricultural research in Europe (see DARE at www.agroecologynow.org). More generally, the multimedia resources[11] and other outcomes generated by these emblematic farmer-citizen deliberations and *diálogos de saberes* continue to inspire the food sovereignty movement and its struggles to democratize agricultural research.

- A high-level policy dialogue on agricultural research and the future of farming brought together West African family farmers and representatives from the Alliance for a Green Revolution in Africa (AGRA) and its main funders: The Gates Foundation and the UK's Department for International Development (DFID). Chaired by the UN Special Rapporteur on the Right to Food this three-day event was organized in Ghana in 2012 (Pimbert, 2012). The West African farmers had previously participated in a series of citizens' juries on the governance and priorities of agricultural research (Pimbert *et al.*, 2011). They had been mandated by their peers to discuss the citizens' juries' recommendations for policy and practice with AGRA and its donors. While the views of AGRA scientists and farmers converged on some points, this dialogue of different knowledges highlighted strongly divergent visions for the future of farming in West Africa and on the kind of agricultural research needed by the small-scale producers who produce most of the food in the region (IIED *et al.*, 2012). Guided by their vision of food sovereignty and family farming, the West African farmers continue to organize and argue for a fundamental rethinking and reorientation of the research done in their name.[12] This long-term participatory process in West Africa is thus enabling hitherto excluded and subaltern farmers – men and women – to mobilize their knowledge and build the countervailing power needed to democratize and re-invent agricultural research for food sovereignty, agroecology and biocultural diversity.

Putting citizens at the heart of decision making in research depends on successfully scaling up and institutionalizing people's participation in the policies and practices of national systems. However, institutionalizing participation (see Box 8.6) can have substantially different outcomes depending on whether the process and methods are primarily used to enhance control by powerful actors and justify their decisions or whether, instead, they aim to devolve power away from dominant institutions to strengthen peoples' sovereignty and autonomous decision making.

> ### BOX 8.6 INSTITUTIONALIZING PARTICIPATORY APPROACHES AND PEOPLE-CENTRED PROCESSES
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> The term 'institutionalization' describes the process whereby social practices such as participation become regular and continuous enough to be called institutions. The dynamics of institutionalizing participation and people-centred approaches imply long-term and sustained changes which recognize conflicts between different agendas, interests, values and coalitions of power. In practice, the process of institutionalizing participatory approaches emphasizes several interrelated levels of change:
>
> - Spreading and scaling up change from the micro (e.g. project/local) to the macro (e.g. policy/national) level.
> - Scaling out from a single line department, sector or initiative to catalyze wider changes in organizations (e.g. government and donor agencies, non-governmental organizations, civil society groups and federations, private corporations) and in policy processes.
> - Changing attitudes, behaviour, norms, skills, procedures, management systems, organizational culture and structure, as well as policy change.
> - Including more people and places through lateral spread, from village to village, municipality to municipality, district to district and so on.

At one end of the spectrum, the notion of 'institutionalizing participation' is used only as a discourse or rhetorical label to make projects and proposals attractive to donors and policy makers, while actions continue to be disempowering and extractive (Arnstein, 1969; Pretty, 1994). At the other end of the 'institutionalizing participation' continuum, participatory approaches, methods and processes are used as part of a strategy of policy and organizational transformation as well as local institutional development that decentralizes and redistributes power in the hands of peasant farmers, indigenous peoples, pastoralists, landless farm workers and other citizens (Pimbert, 2011). 'Institutionalizing participation' in this context depends on the capacity of social movements and federated citizens to exert the counter-hegemonic and countervailing power needed to put *direct* democracy at the heart of the governance of research (Pimbert, 2009).

Embracing transdisciplinarity and methodological pluralism in research

It is now increasingly recognized that complex environmental and social phenomena, behaviours and dynamics often cannot be understood, nor solutions to societal challenges found, without fundamental changes in how research is carried out. As long

as four decades ago, De Rosnay (1975) was arguing that science and society need to take a macroscopic as opposed to a microscopic view of phenomena, embracing transdisciplinary approaches. Jean Piaget (1972) and the International Center for Transdisciplinary Research had previously introduced the concept of transdisciplinarity to describe ways of knowing that stress the fundamental unity of all knowledge beyond disciplines (Nicolescu, 1994, 2008). Transdisciplinary research thus works simultaneously *between* the disciplines, *across* the different disciplines and *beyond* each individual discipline. Transdisciplinarity embraces the hybrid nature of knowledge production (Bernstein, 2015; Latour, 1987, 1993), and responds to the need to integrate 'both the science of parts and the science of the integration of parts' (Holling, 1998).

Fundamentally pragmatic and relational, transdisciplinary inquiry is directed towards finding integrated solutions to complex and critical environmental and social challenges (MacGregor, 2014). In addressing messy (Gharajedaghi, 2011) and wicked societal problems (Rittel and Webber, 1973; Xiang, 2013), it stresses the evolutionary potential of the present as well as adaptive innovations based on new forms of collective intelligence that bring different knowledges together. Transdisciplinary research simply cannot be done from within the narrow boundaries of single disciplines and in isolation from society as this will only generate partial solutions based on specialized and therefore incomplete knowledge. It requires instead the engagement of all relevant academic disciplines and 'ordinary' citizens in the identification of issues and research priorities, the framing of research questions and the execution of the research, including the interpretation, dissemination and uptake of findings. Deeply participatory, this transdisciplinary approach to knowledge creation calls for the meaningful involvement of all relevant actors, academic and non-academic, in the co-design, co-production, co-validation and co-dissemination of research, in a joint effort to address common and complex problems.

Transdisciplinarity is not a new science. It is an emerging new methodology for doing science *with* society. As such, transdisciplinary ways of knowing emphasize the importance of methodological pluralism to integrate different traditions of knowledge and multiple sources of evidence. Novel mixes of methodologies are needed to dismantle boundaries between disciplines, disrupt knowledge hierarchies, foster intercultural dialogue between different knowledge systems, remove siloes around disciplinary turfs and co-produce knowledge with different social actors. The methodological landscape encompasses quantitative, qualitative and transformative research methods which can be appropriately combined to construct knowledge, policies, organizational cultures and practices (Bergmann *et al.*, 2013; Gibbs, 2015; Haire-Joshu and McBride, 2013; Pohl and Hirsch Hadorn, 2007; Reason and Bradbury, 2008; Scholz and Tietje, 2002). For example, the contributors to this volume *collectively* point to a range of methodological approaches that can help contest harmful myths about people-environment interactions and economics as well as construct knowledge for food sovereignty, agroecology and biocultural diversity:

- A simultaneous analysis of social *and* environmental history, combining structural and agency-focused analysis of change across space and time. In this

context, methodological designs focus on micro-scale understandings, endogenous conceptions and local experiences of social and environmental change, emphasizing community rights, participation, people's agency and everyday forms of struggle and resistance to ecological destruction and social exclusion (Chapters 4 and 5; Peet and Watts, 2004; Forsyth, 2004).

- A focus on how international, national and local sets of practices interact and interlock with each other – to reveal their interconnections and how they might be mutually constitutive at different scales as determinants of innovation. Multiple layers of politics that extend from the local to international levels are examined here along with how public and corporate policies are dialectically linked with ecological and social dynamics in the construction of gendered knowledge on people and the land (Chapters 1, 2, 4 and 6; Adger *et al.*, 2001; Walker, 2006; Harcourt and Nelson, 2015).

- Mapping these processes and the role(s) of different actors relies on a multisited ethnography that (1) contextualizes a locality in its wider national and global contexts; and (2) helps do research at different sites to explore their connections and relations, by following stories, following people, following finance and following networks across them (Chapters 2, 5, 6 and 7; Soyini Madison, 2012).

- Methodological pluralism and the complementary use of participatory, quantitative and qualitative methods e.g. combining gender sensitive methods for historical and social analysis, ethnographic methods, quantitative tools from the natural sciences along with decolonizing research methods that build on local knowledge, analysis, diverse perspectives and cosmovisions[13] (Chapters 3, 4 and 6; Salas *et al.*, 2007; Smith, 2012).

The construction of holistic knowledge for food sovereignty, agroecology and biocultural diversity depends on such methodological diversity and complementarity. However, the co-creation of knowledge by scientists and peasant farmers should increasingly be part of a participatory process driven by a transformative logic of changing society – rather than just interpreting it. More specifically, a transformative methodology is required to frame and firmly locate transdisciplinary practice in an *overarching,* flexible, open-ended, participatory and iterative process of action and reflection. Transformative methodologies typically include methods from Action Research, Participatory Action Research (PAR), Artful Inquiry, Participatory Video (PV) and Participatory Learning and Action (PLA) (Box 8.7) and decolonizing indigenous research methodologies (Chilisa, 2012; Smith, 2012).

BOX 8.7 TRANSDISCIPLINARY AND PARTICIPATORY METHODOLOGIES: SOME EXAMPLES

Action research is a participatory process concerned with developing practical knowing in the pursuit of worthwhile human purposes. It seeks to bring

together action and reflection, theory and practice, in participation with others, to generate practical solutions to issues of significance concerning the flourishing of human persons, their communities and the wider ecology in which we participate (adapted from Reason and Bradbury, 2008). Moreover, like participatory action research (PAR), action research involves a whole range of powerless groups of people – the exploited, the poor, the oppressed, the marginal – as well as the full and active participation of the community in the entire research process. The subject of participatory action research originates in the community itself and the problem is defined, analyzed and solved by the community. The ultimate goal is the radical transformation of social reality and the improvement of the lives of the people themselves. The beneficiaries of the research are the members of the community. The researcher is a committed participant and learner in the process of research, i.e. a militant rather than a detached observer (modified from Hall, 1992, 1997).

Artful inquiry enhances the transformative practices of action research by cultivating the imagination, non-verbal, holistic and embodied experiences (Seeley, 2011). Artful knowing is 'learning by doing, cultivating the body and the senses as explicit seats of knowing, being concerned with the evolution of society, ecosystems and consciousness knowing' (Seeley and Thornhill, 2014).

Other participatory systems of inquiry include decolonizing research methodologies (Smith, 2012), Participatory Learning and Action (PLA Notes, 2002) and Social Analysis Systems for collaborative inquiry and social engagement (Chevalier and Buckles, 2008).

This overarching transformative methodology provides the context in which both quantitative research methods (empirical experiments, mathematical modeling, Geographic Information Systems – GIS, statistical methods etc.) and qualitative methods (ethnography, interviews, surveys, discourse analysis etc.) are combined in specific sequences with participatory methods (PLA, VIPP, citizens' juries etc.) to construct knowledge(s) for food sovereignty, agroecology and biocultural diversity. When respectfully inclusive of different cosmovisions and knowledge systems, this transformative process is 'a participatory way of knowing that transcends the dichotomies of man-nature, subject-object or mind-matter, which are so ingrained in the Western mind and form the bedrock of object thinking' (Holdrege, 2013). Knowledge integration is key in this participatory process: finding appropriate ways and means of integrating theoretical, practical and political knowledge as they emerge. As discussed above, this entire participatory process of transdisciplinary inquiry should also be based on principles of cognitive justice (Santos, 2014; Visvanathan, 2005); be bottom-up and subject to deliberation to question underlying assumptions; and rely on extended peer communities of scientists and peasant farmers to validate knowledge *in situ* (Ravetz, 2006), and expand knowledge democracy (Hall and Tandon, 2015).

It is encouraging that more universities and donors are declaring their interest and commitment to transdisciplinary approaches to education and research (Hirsch Hadorn *et al.*, 2008; Mauser *et al.*, 2013; Van Breda and Swilling, in press). Transdisciplinary research is also increasingly mentioned today in new funding calls put out by the European Union (EU), national research councils, NGO donors and foundations. However, there are major structural constraints to the widespread adoption of transdisciplinarity and participatory knowledge creation in higher education and research. These are described below.

Lack of expertise within academia

Transdisciplinary co-inquiry is about transgressing boundaries (Nowotny, 2006). As such, it creates challenges for university departments that have historically been engaged in relatively specialized education and research. Building internal capacity to 'walk the talk' of transdisciplinarity first requires recruiting more staff familiar with its theory and practice. Second, the uptake and spread of transdisciplinarity in universities and research centres also requires a large-scale effort to re-orient, re-skill and train currently employed researchers and teaching staff – both in the natural and social sciences as well as the arts and humanities (Gibbs, 2015). Much of this internally directed educational effort in universities and research institutes would need to focus on reversing enduring systemic biases against the knowledge of women, indigenous peoples, under-represented ethnic groups and other disadvantaged groups such as the lesbian, gay, bisexual and transgender (LGBT) community. For example, the training and re-orientation of researchers in transdisciplinary approaches and methodologies would necessarily have to focus on how gendered knowledge interacts with class, caste, race, culture and ethnicity to shape processes of ecological change, access to and control over resources and the multi-scalar dynamics of food systems and land use in which women play central roles (Mollett and Faria, 2013; Rocheleau *et al.*, 1996; Harcourt and Nelson, 2015). Gendered relations of ecologies, economies and politics would have to be systematically explored through at least three complementary lenses: (1) gendered science, including local knowledge on food, agriculture and environment (Keller, 1985; Harding, 1991, 2006; Lederman and Bartsch, 2001); (2) gendered rights and responsibilities, including the right to food and nutrition (Agarwal, 1995; Rocheleau *et al.*, 1996; Bellows *et al.*, 2016); and (3) gendered environmental and food politics (Merchant, 1992 and 1996; Saunders, 2002; Harcourt and Nelson, 2015).

Education for professional re-orientation is a pre-requisite for a decisive shift from well-established research traditions (mono-disciplinarity, inter-disciplinarity and multi-disciplinarity) to a new paradigm that embraces transdisciplinarity, methodological pluralism and peoples' knowledge. Internal capacity building is also required to nurture the more respectful attitudes and behaviours needed to work with subaltern groups and 'ordinary' citizens (Bainbridge *et al.*, 2000); to decolonize knowledge and research methodologies (Smith, 2012); as well as to reject racism and sexism (hooks, 2000) in universities and the production of knowledge. This is

essential because most universities and research institutes continue to be dominated today by a culture that is primarily white, upper-middle class and male.

> When people from communities that have previously been excluded are asked to take part in research – even participative research – they are seldom able to do so on equal terms … A person's race, class, gender, sexuality, health status or disability, a lack of formal training, or a different mode of expression, can all prevent their insights from being accepted as potentially valid. The expertise people gain from life experience is routinely ignored by professionals, even those whose job it is to engage with such people.
>
> *(People's Knowledge Editorial Collective, 2017)*

Indeed, perhaps the biggest challenge today is to go beyond an emerging shallow practice of 'transdisciplinary research' that *only* includes well-known tribes of 'trusted' disciplinary scientists, towards natural and social scientists engaging and working with peoples' knowledge in all its diversity. For both ethical and practical reasons

> all citizens on earth deserve to be as significantly involved in judgments about future developments in agriculture as possible, in ways that historically they have never been. Under these circumstances of participation and deliberation, the need is for the academy to engage *with* the citizenry and not just work for it or on it or extend out to it.
>
> *(Bawden, 2007)*

Inappropriate definitions of 'research excellence'

A less obvious but equally important pre-requisite for change is the need for new definitions of 'research excellence' that can allow transdisciplinarity to thrive. 'Excellence is the holy grail of academic life' (Lamont, 2009), as evidenced by the proliferation of 'excellence frameworks'.[14] Excellence, as most research frameworks define it, focuses on the ability of scholars to publish in prestigious international journals, their ability to gain external grants and other metrics of scholarly output including research impact. Measures of 'excellence' achieved are then used to rank and reward universities for the quality of their research – high scoring universities receive more government funding.

However, transdisciplinary research that works with farmers and other citizens is usually unrecognized and/or under-valued by research excellence frameworks and their metrics. This is partly because the fetishization of 'excellence' in research encourages conformity rather than a transformative shift to transdisciplinary co-inquiry that is inclusive of diverse forms of people's knowledge. By restricting the *types* and *styles* of scholarship, the rhetoric of 'excellence' effectively marginalizes transdisciplinary and participatory ways of knowing in academia:

> a focus on 'excellence' impedes rather than promotes scientific and scholarly activity: it at the same time discourages both the intellectual risk-taking required to make the most significant advances in paradigm-shifting research … It encourages researchers to engage in counterproductive conscious and unconscious gamesmanship. And it impoverishes science and scholarship by encouraging concentration rather than distribution of effort.
>
> *(Moore et al., 2017)*

According to these authors, 'administrators captured by neo-liberal ideologies, funders over-focused on delivering measurable returns rather than positive change, governments obsessed with economic growth at the cost of social or community value …' (Moore *et al.*, 2017) are partly responsible for this obsession with metrics-driven excellence. But this is not the only reason:

> the roots of the problem in fact lie in the internal narratives of the academy and the nature of 'excellence' and 'quality' as supposedly shared concepts that researchers have developed into shields of their autonomy. The solution to such problems lies not in arguing for more resources for distribution via existing channels as this will simply lead to further concentration and hyper-competition. Instead, we have argued, these internal narratives of the academy must be reformulated.
>
> *(Moore et al., 2017)*

New definitions of 'excellence' are needed to allow transdisciplinary knowledge and ways of knowing to thrive. The following transformative actions seem particularly relevant here:

1. Within the academic sphere, instilling a prefigurative politics. This could help to (a) position all academic knowledge as situated (Haraway, 1988); (b) demonstrate the liberatory potential and impact of participatory and transdisciplinary approaches for the co-production of knowledge – and their direct relevance for effectively addressing major societal and environmental crises; (c) actively engage in research that seeks to 'understand better, change, and re-enchant our plural world' (Fals Borda, 2001); and (4) emphasize the transformative effects on theory of 'having our ideas critiqued by social movements live and direct' (Mason, 2013).
2. Broadening out and opening up the entire research and development cycle to farmer and citizens' direct participation – from setting national research priorities and deciding on budget allocations to risk and impact assessments. Reversing the current democratic deficit in R&D goes hand in hand with what is required for the practice of a post-normal science in a fast-changing world (Funtowicz and Ravetz, 1993). Uncertainty has indeed become the norm in political and environmental affairs and 'normal' puzzle-solving science is utterly inadequate as a method for solving the great social and environmental

crises of our times. Post-normal science recognizes that the facts are uncertain, values are often in dispute, stakes are high and decisions are urgent. Its core ideas include an 'extended peer community' and the recognition of a diversity of legitimate perspectives on every issue. In particular, extended peer communities of farmers and other citizens can no longer be relegated to second class status, and people's knowledge can no longer be dismissed as 'unscientific', inferior or bogus (see Ravetz, 2006).

3. Adopting much broader criteria of excellence, validity and quality to assess the process of knowledge creation and its outcomes. Final objective answers and so-called 'research excellence' matter far less than processes of emerging democratic engagement. And 'scholarly detachment, creating knowledge that denies or suppresses our embodied, connected being in the world, seems ill suited to the issues of our times' (Marshall and Reason, 2007). One important criterion of quality could focus on the extent to which researchers' self-reflective practice and reflexivity are alive and disciplined. Marshall and Reason (2007) describe this process as 'taking an attitude of inquiry' and suggest that it is enabled by the following qualities: curiosity; willingness to articulate and explore purposes and values; humility; developing a sense of self-irony, playfulness and lack of ego attachment; participation; living research as an emergent process; and a radical empiricism that relies on multiple sources of evidence. Another criterion for quality and validity is whether or not a process of knowledge creation has opened up new communicative spaces for democratic inquiry to take place. The process of constructing knowledge for food sovereignty, agroecology and biocultural diversity thus aims to 'shift the dialogue about validity from a concern with idealist questions in search of truth to concern for engagement, dialogue, pragmatic outcomes and an emergent, reflexive sense of what is important' (Bradbury and Reason, 2000).

Disabling donor practices

Another challenge relates to the culture and practice of donors (EU commissions, governments, NGOs, foundations etc.). For example, participants at the FAO Regional Symposium on Agroecology for Europe and Central Asia highlighted the mismatch between EU Horizon 2020 calls for process-oriented, multi-actor research on the one hand and, on the other, the EU's inflexible and standardized internal project management procedures based on a focus on quantitative outputs, logical frameworks and other simplistic assumptions about complex and fast-changing realities. Participants at the FAO Symposium on Agroecology spoke about the urgent need to reverse the deep mismatch between donors' twenty-first-century aspirations for transdisciplinary research and their outdated twentieth-century project administration and financial management practices.[15]

However, current donor attempts to 'reform the system for the twenty-first century' remain deeply problematic and wedded to a top-down culture of command and control. For example, the UK's Department for International Development

(DFID) argues that it makes sense for it 'to take a tougher, more business-like approach by *requiring results up front before payment is made.* Better sharing of risk in this way will drive value for money as partners become more incentivised to deliver' (DFID, 2014, my emphasis). According to the Secretary of State, 'DFID is … becoming a world leader in pioneering innovative Payments by Results (PbR) programmes for tackling complex development problems' (DFID, 2014). Chambers has analyzed the perversities of PbR – including its misfit with complexity, unpredictability, flexibility and adaptability (Chambers, 2014). He laments that it provides incentives to do shoddy work by focusing on what the numbers demand instead of local ownership, empowerment and long-term sustainability. These donor practices fundamentally undermine participation and transdisciplinarity in research and development.

Professional reversals and organizational transformation

Transdisciplinary co-inquiry calls for power reversals and new roles for research, donors and development professionals. In essence, people – their knowledge and the diverse environments that sustain them – become central, instead of university research centres, government departments, scientific peer groups and the narrow 'research excellence metrics' used to evaluate academic papers and their impacts.

> Professionally, this means putting people before things … Bureaucratically, it means decentralizing power, de-standardizing and removing restrictions. In learning, it means gaining insight less from 'our' often out-of-date knowledge in books and lectures, and more from 'their' knowledge of their livelihoods and conditions which is always up-to-date … In behaviour, it means the most important reversal of all, not standing, lecturing and motivating, but sitting, listening and learning.
>
> *(Chambers, 1993)*

These reversals in roles and locations all require a new professionalism with new behaviours, concepts, methods and values (Pretty and Chambers, 1993). The challenge is to make the shift from the old professionalism to the new (Table 8.2).

A significant shift to a new professionalism and participatory praxis for transdisciplinarity requires profound transformations in the governance, culture, operational procedures and reward structures of research organizations and their donors. This is the major conclusion of a substantial body of studies on how to institutionalize people-centred processes, mainstream gender justice, enable transdisciplinary approaches and embed participation and self-organizing processes in bureaucracies and research institutions (Arnold and Cole, 1987; Bainbridge *et al.*, 2000; Calas and Smircich, 1997; Clegg *et al.*, 2006; Crozier and Friedberg, 1977; Goetz, 1997a, 1997b; Guijt and Shah, 1998; Laloux, 2016; Macdonald *et al.*, 1997; Mauser *et al.*, 2013; Pimbert, 2004; Rao and Stuart, 1997; Wheatley, 2006).

TABLE 8.2 Changing professionalism from the old to the new

	From the old professionalism	*To the new professionalism*
Who sets priorities?	Social and natural scientists, as well as other professionals, set priorities for research and development. They are in charge of decisions on research priorities – but only within the framework and boundaries defined by donor agencies, research council funds, government bureaucracies and corporations that fund research.	Peasant farmers and other citizens set priorities, including upstream strategic priorities for public research. Scientists sometimes work together with citizens to do this. But on other occasions indigenous peoples, peasant farmers and other citizens are the ones who decide priorities for public research *after* listening to the specialist knowledge of different scientists and other knowledge holders (food consumers, farm workers, government officials etc.). They then carefully deliberate on the pros and cons of possible research priorities. In this latter scenario, scientists are invited as resource people, and they provide information which farmers and citizens use to decide research priorities and resource allocations.
Science, knowledge and methods	Scientific method is reductionist and positivist, with a strong natural science bias; a complex world is split into independent variables and cause-effect relationships; scientists' categories and perceptions are central.	Peoples' knowledge and transdisciplinary approaches are key; scientific method is holistic and post-positivist; local categories of knowledge and perceptions are central; disruption of knowledge hierarchies; subject-object and method-data distinctions are blurred.
Strategy and context of intervention	Professionals know what they want; pre-specified project design or research plan; top-down approach. Information and results are extracted from controlled situations and communities; context is independent and controlled – blueprint-oriented.	While clear about the need for sustainable food systems and biocultural diversity, professionals working with farmers do not know where research projects will lead; they are engaged in a living, emergent and open-ended learning process that cannot be fully pre-determined. Understanding and focus emerges through interaction; context of inquiry and intervention is fundamental – process-oriented.

(continued)

TABLE 8.2 Continued

	From the old professionalism	*To the new professionalism*
Assumptions about reality	Assumption of singular, tangible reality.	Assumption of multiple realities that are socially constructed.
Relationship between actors involved in the process	Professionals control and motivate from a distance; they tend not to trust people (farmers, food workers, indigenous and rural people etc.) who are simply the object of inquiry or intervention.	Professionals engage in close dialogue; they attempt to build trust through joint analyses and negotiation; understanding arises through this engagement, resulting in more power-equalizing ways of knowing based on cognitive justice.
Mode of working	Single disciplinary – working alone.	Multidisciplinary and transdisciplinary – working in self-organizing groups that include scientists and other knowledge holders (peasant farmers, pastoralists, men and women etc.). External researchers and extension agents shift to new roles that facilitate and support local people's analysis, deliberations and production of knowledge.
Attitudes to food & agricultural policy, technology or services	Rejected policy, technology, knowledge or service assumed to be the fault of local people or local conditions; centrally designed policy and technology first.	Rejected policy, technology, knowledge or service is a failed innovation or the outcome of faulty research and inappropriate framing assumptions; people first.
Career development	Careers are inwards and upwards – as practitioners get better, they become promoted, take on more administration and spend less time in the field and with local communities.	Careers include outward and downward movement – professionals stay in touch with action at all levels and spend time with local communities and social movements.

Modified from Pretty and Chambers (1993) and Pimbert (2009).

This multifaceted literature on organizational change offers important insights for citizens, social movements and policy champions who seek to democratize, decolonize and re-orient public research and donor support for food sovereignty, agroecology and biocultural diversity. For example, mutually reinforcing and simultaneous actions are required to fundamentally change organizations that produce social, environmental, economic and technical knowledge. This transformation must be systemic and encompass academic cultures, the self-image of researchers

and academics, teaching pedagogies, research agendas and methodologies, organizational cultures, operational procedures and the roles that universities and research institutes play in society (Bainbridge *et al.*, 2000; Pimbert, 2009). Some of the key levers for democracy and organizational transformation for transdisciplinarity in public research and education are listed below:

- Diversify the governance and the membership of budget allocation committees of public sector planning and research institutes to include representatives of diverse citizen groups and axes of difference (age, gender, age, race, ethnicity, disability, sexual orientation etc.). Establish procedures to ensure transparency, equity and accountability in the allocation of funds and dissemination of new knowledge.
- Encourage shifts from hierarchical and rigidly bureaucratic structures to 'flat', self-organizing, flexible, and responsive organizations.
- Redesign practical arrangements and the use of space and time within the workplace to meet the diverse needs of women, men and older staff and to help them fulfil their new professional obligations to work more closely with peasant farmers and other citizens (timetables, career paths, working hours, provision of paternity and maternity leave, childcare provisions, mini sabbaticals, promotion criteria etc.).
- Build the capacity of technical and scientific staff in the participatory skills, attitudes and behaviour needed to learn from citizens (mutual listening, respect, gender sensitivity, empathy etc.), decolonize research methodologies and engage in self-organizing horizontal processes.
- Provide capacity-building and experiential learning for staff to develop their ecological literacy and skills in agroecology as well as their political knowledge about cognitive justice, food sovereignty and biocultural diversity as a basis for self-determination.
- Reverse gender biases, colonial attitudes, racism and neo-Malthusian environmental crisis narratives in the ideologies and disciplines animating research organizations and their projects.
- Ensure that senior and middle-management positions are occupied by competent facilitators of organizational change with the vision, commitment and ability to reverse gender and other discriminatory biases in the ideologies, disciplines and practices of the organization.
- Promote and reward management that is consultative and participatory rather than hierarchical and efficiency-led, as well as command and control management styles based on a culture of blame.
- Establish incentive and accountability systems that are equitable for women and men, and do not discriminate based on race, ethnicity, age, disability or sexual orientation.
- Provide incentives and high rewards for staff and members of organizations to experiment, take initiatives and acknowledge errors as a way of learning-by-doing and engaging with the diverse local realities of citizens living in rural and urban areas.

- Encourage and reward the use of gender disaggregated and socially differentiated indicators (e.g. by class, age, race, ethnicity etc.) in monitoring and evaluation to enhance social justice, fairness and inclusion – both within organizations and in their external interventions.

In sum, far reaching and fundamental changes in organizations are necessary so that their *ethos*, policies, programmes, operational procedures, resource allocations and ways of working facilitate gender inclusive participation and transdisciplinarity in R&D; nurture attitudes grounded in empathy, respect and solidarity; and develop skills in ecological literacy that are needed for the local adaptive management of agroecosystems and diverse biocultural landscapes (Chapter 3 and 4; Borrini-Feyerabend *et al.*, 2007; Pimbert 2009).

Protecting public research

The following section briefly identifies some strategic actions that could help protect higher education and research from corporate capture, privatization and the commodification of knowledge.

Job security in university education and research

Despite the fact that they are among the most highly skilled and prestigious professions, university teachers and researchers are increasingly faced with the consequences of low-paid, insecure work. For example, *The Guardian* recently revealed the extent of casual labour and job insecurity among UK universities:

> Academics teaching or doing research in British universities will typically have spent years earning doctorates or other qualifications, yet more than half of them – 53% – manage on some form of insecure, non-permanent contract. They range from short-term contracts that typically elapse within nine months, to those paid by the hour to give classes or mark essays and exams.
> *(Chakrabortty and Weale, 2016)*

Strikingly, the richest British universities rely the most on insecure academic workers with fixed short-term contracts. For example, 70% and 68% of teaching staff are on insecure contracts at the universities of Birmingham and Warwick respectively. The universities of Birmingham, Edinburgh, Oxford and Warwick have the largest share of frontline teaching staff on short-term flexible and insecure contracts (Chakrabortty and Weale, 2016). In France, there are currently 60,000 doctoral students and most will be on casual contracts, low pay and periodically unemployed once they have obtained their PhDs and are on the job market (Trublet, 2016). This increasing casualization and spread of poverty-line pay in universities has also been the trend in the USA: 76% of academics are now on casual contracts with little job security, and growing numbers are even on food stamps (O'Hara, 2015).

Job insecurity is an integral part of the neoliberal university project, 'marked by the decline of the humanities and social sciences, cuts in public financing, enfeeblement of faculty and student roles in governance, increases in tuition fees, reductions in tenured faculty and increasing use of adjunct professors' (Heller, 2016b).

The casualization of the academic workforce is increasingly widespread and seriously undermines the quality of education and research in universities. Lack of job security militates against the changes in attitudes and behaviours needed for transdisciplinary co-inquiry – it promotes conformity to established research traditions and their cognitive routines (Trublet, 2016). Similarly, it is difficult to see how universities can re-invent and transform themselves for participatory and transdisciplinary ways of knowing when so many academic staff experience job insecurity, stress, low morale, lack of recognition and low pay (Weale, 2016). Chronic job insecurity in a climate of hypercompetition heightens the challenge of maintaining scientific integrity and makes it more difficult to 'incentivize altruistic and ethical outcomes, while de-emphasizing output' (Edward and Roy, 2017).

As both the products and victims of the capitalist division of labour, academic workers will probably need to engage in joint action with citizens and social movements to reverse these debilitating trends. However, the moral and political goal here

> is not the highest possible professional standards of a few specialists but, instead, the general progress and diffusion of knowledge within the community and the working class as a whole. Any progress in knowledge, technology and power that produces a lasting divorce between the experts and non-experts must be considered bad. Knowledge, like all the rest, is of value only if it can be shared.
>
> *(Gorz, 1976)*

Safeguards against the corruption of science by corporations

Intellectual suppression, competitive 'cognitive capitalism' and institutionalized bias in the halls of science significantly constrain the possibilities of an open and disinterested inquiry (Chapters 1, 2 and 5 in this volume; Heller, 2016b; Roger, 2013). This is particularly evident in the case of researchers assessing the risks of genetically modified organisms (GMOs) for public health and the environment, for example. When Berkeley plant geneticists Ignacio Chapela and David Quist uncovered the transgenic contamination of maize landraces growing in remote regions of Mexico and reported it in *Nature* in November 2001, they were subjected to vicious attacks and intimidation resembling the Pusztai[16] episode in Britain. Attacks and smear campaigns were orchestrated from within their own department, aided and abetted by Monsanto. Chapela was refused tenure by his university at the end of 2003 (Mantell, 2002; Rowell, 2003).[17]

More widely, industry uses its power to vilify, marginalize and reject scientists whose experimental results contradict the central dogma of molecular biology. As Barry Commoner says: 'The fact that one gene can give rise to multiple proteins …

destroys the theoretical foundation of a multibillion-dollar industry' (Commoner, 2003). This corporate censorship of science is likely to worsen if a new wave of mega-mergers goes ahead in the seed industry: just three global seed corporations would be able to exert unprecedented control over what scientists can publicly say and write about their research in plant genetics and synthetic biology.[18]

Several actions can help insulate research from corporate abuse and capture. For example, the Union of Concerned Scientists (2012) has identified key areas where governments (national, regional and municipal) can act more to protect science against undue corporate influence and corruption, including protecting scientists from retaliation and intimidation; reforming the regulatory process; and strengthening monitoring and enforcement. Similarly, the work of the *Fondation Sciences Citoyennes* in France shows how researchers and citizens can organize and act against the enclosure of public research by corporations and systematic attacks on whistle blowers (see http://sciencescitoyennes.org).

More generally, increased government funding for public research is necessary to reverse the privatization and corporate capture of higher education and research. Additional public funds are also needed to generate the kinds of knowledge and liberatory technologies (*sensu* Bookchin, 1986) that can significantly expand the realm of freedom by reducing peoples' dependence on commodity markets controlled by corporations. For example, the potential of agroecological research to develop more autonomous food systems can only be realized if supported by much more public funding than it has received to date (see Chapters 1 and 2; Union of Concerned Scientists, 2015). After decades of neglect by government spending, whole areas of science urgently need new funds to recruit additional people with appropriate skills – from taxonomists who can identify the natural enemies of pests for use in biological control programmes, soil biologists able to develop knowledge-intensive agroecological methods for soil fertility management and carbon sequestration, to eco-linguists who can help understand how language encodes the stories that society is based on (ideologies, framings, metaphors, evaluations, identities etc.). The FAO's publication *The State of Food and Agriculture 2016* warns that 'achieving the transformation to sustainable agriculture is a major challenge … available finance for investment in agriculture falls well short of needs … The time to invest in agriculture and rural development is now' (FAO, 2016a).

Reclaiming universities as a commons for knowledge democracy

Ensuring that the cultural, intellectual and other resources of universities are accessible to all members of society – and are held in common[19] – is key for knowledge democracy. Stories of peoples' struggles to regain control over the commons and the production of knowledge can inspire and offer new models for the governance, re-structuring, organizational practices and roles of higher education and research. Past and present initiatives by peasant farmers, unemployed youth, casual labour and other citizens to recuperate factories, urban land for food production and abandoned workplaces in the Americas, Africa, Asia and Europe show how

knowledge and wealth can be produced differently, with citizens in charge (Dion, 2016; Duchatel and Rochat, 2008; Sitrin, 2006; Sitrin and Azzelini, 2014; Zibechi, 2010; *Cooperativa Integral Catalana*, https://cooperativa.cat/en). For example, in war-torn Syria and south-east Turkey, Kurdish men and women are putting into practice their demands for autonomy and democratic confederalism (Öcalan, 2011) by creating a region-wide web of villages and municipal councils through which they can govern themselves. In this 'stateless democracy' Kurdish communities are formulating their own laws, creating their own parliament and building their own universities and capacity for research (New World Academy, 2015; TATORT Kurdistan, 2013). The Lucas Aerospace workers' plan for socially useful production is another emblematic example of how citizens can reclaim control over the production of knowledge (Box 8.8).

BOX 8.8 THE LUCAS AEROSPACE PLAN FOR SOCIALLY USEFUL PRODUCTION IN THE UK

Faced with the prospect of massive job redundancies, the employees of Lucas Aerospace developed their own plan for the re-structuring and re-conversion of their workplaces from arms manufacture to socially useful production. Published in 1976, the Alternative Corporate Plan of Lucas Aerospace proposed radical alternatives to closure in manufacturing – from the production of appropriate technology for community needs, the development of skill enhancing human-centred technology, to participatory design and industrial democracy (Cooley, 1982; Smith, 2014; Wainwright and Elliott, 2017). About half of Lucas' output supplied military contracts which depended on public funds, as did many of the company's civilian products. Workers argued for state support to go instead to more socially useful products. Lucas employees argued they had the *right* to socially useful production instead of redundancies. The Lucas plan was based on employees' careful collective assessment of the diversity of workers' knowledge, skills, work organization, machinery and economic options. Most notably, the workers' reconversion plans contested established hierarchies of knowledge and valued plural knowledge, including peoples' experiential and tacit knowledge. The Lucas workers wanted to 'demonstrate in a very practical and direct way the creative power of "ordinary people"' (Cooley, 1982).

Through their alliances with wider social movements (radical science, environmental, feminist and peace movements), the Lucas workers' concept of socially useful production increasingly emphasized not only jobs, but also democratic control and direct participation in R&D and the design of technology for social need and environmental sustainability (Cooley, 1982). Conversations with community development activists helped deepen awareness that socially usefully production had to be guided by the needs identified and defined by local communities, including the most economically deprived.

For example, a Coventry workshop brought together grassroots community groups and Lucas shop stewards committees 'to explore the links, in concept and in practice, between industry and the community, the economy and the state, production and consumption, home and work' (Coventry Workshop, 1978). The movement that emerged sought more direct control for workers, communities and citizens in R&D and production processes. With the support of progressive city councils (e.g. Greater London Council – GLC), a number of Technology Networks were created as part of an industrial strategy committed to socially useful production. The GLC created the Greater London Enterprise Board (GLEB), with Mike Cooley appointed as its Technology Director after he had been sacked by Lucas Aerospace for his activism. As Adrian Smith recalls,

> Technology Networks aimed to combine the 'untapped skill, creativity and sheer enthusiasm' in local communities with the 'reservoir of scientific and innovation knowledge' in London's polytechnics. Hundreds of designs and prototypes were developed, including electric bicycles, small-scale wind turbines, energy conservation services, disability devices, re-manufactured products, children's play equipment, community computer networks, and a women's IT co-operative. Designs were registered in an open access product bank. GLEB helped co-operatives and social enterprises develop these prototypes into businesses.
>
> (Smith, 2014)

The Lucas plan and the wider initiatives it inspired 'came up against trade union, government and management institutions stuck in the command and control mentalities of the 1950s, and the power of the movement was destroyed by Thatcher's onslaught against the unions and radical local government in the 1980s' (Wainwright, 2009). However, the underlying ideas of the Lucas plan for socially useful production are still relevant today.

Insights from these social experiments can help re-invent universities and democratize research for the common good. However, lessons learnt and underlying principles have to be carefully adapted to each specific historical context and its possibilities. They cannot simply be copied from one place to another. Re-inventing universities as the commons will require wide-ranging deliberations and dialogues between academic workers, researchers, grassroots peasant networks and other citizens. As stated by Robin Hahnel:

> The goal is clear enough: We must convince a majority of people that ordinary people are perfectly capable of managing our own economic affairs without capitalist employers or commissars to tell us what to do. We must convince a majority of people that groups of self-managing workers and consumers are capable of coordinating their own division of labor through participatory, democratic planning, rather than abdicating this task to the

market system or central planners. But how this goal will be achieved, and how people will be prepared to defend necessary changes from powerful, entrenched, minority interests who will predictably attempt to thwart the will of the majority, will vary greatly from place to place. All that can be said about it with any certainty is that in most places it will require a great deal of educational and organizing work of various kinds, given where we are today.

(Hahnel, 2016)

Conclusion

One of the clearest demands of the food sovereignty movement is for peasant farmers, indigenous peoples, pastoralists, fishers and other citizens to exercise their fundamental human right to decide their own food and agricultural policies (Nyéléni, 2007; Nyéléni, 2015). This implies that the construction of technical and policy related knowledge for food sovereignty, agroecology and biocultural diversity should be actively shaped by food producers and consumers. A two-pronged approach to democratizing the production of transdisciplinary knowledge has been proposed in this chapter: (1) strengthening horizontal networks of grassroots self-managed research and innovation; and (2) fundamentally transforming and democratizing public research institutions and universities. Depending on context and history, one approach may be favoured over another. However, when these two approaches are used in complementary and mutually reinforcing ways this can significantly expand democracy and the construction of knowledge for food sovereignty, agroecology and biocultural diversity.

In each pathway for transformation, contesting and constructing knowledge depends on subverting hierarchies of knowledge – erasing the boundaries between peoples' knowledge and the disciplinary knowledge of the natural and social sciences as well as the arts and humanities. This transdisciplinarity implies participatory ways of knowing that give the least powerful actors more significant roles than before in the production and validation of knowledge. Power-equalizing processes in the co-construction of transdisciplinary knowledge are indeed central to the two transformative pathways described here, and they include a politics of cognitive justice, reversals from normal professional practice, organizational change, *diálogos de saberes* and intercultural dialogues, the strengthening of local organizations for autonomous learning and action, and citizens' direct democratic control over research priorities and resource allocations for the construction of knowledge(s).

Given the inherently conservative nature of states and the professional-managerial class, it is perhaps wishful thinking that academics alone can contest and transform the dominant culture of cognitive capitalism in universities and research institutions. In practice, activist researchers and critical scholars, grassroots networks of peasant innovators, as well as citizens and wider social movements will have to work together to exert the countervailing power needed to democratize research and construct knowledge for food sovereignty, agroecology and biocultural diversity. Moreover, transforming knowledge depends on many different actors engaging in

large-scale counter-hegemonic practices for at least two other reasons. First, knowledge broadly reflects and reinforces specific power relations and worldviews in any society. Deep social change is often needed for the emergence of new knowledge paradigms. Secondly, while clearly vitally important, new knowledge alone will not lead to the widespread adoption of food sovereignty, agroecology and biocultural diversity. Deeper-seated political and economic changes are necessary throughout society, including policies that can reverse the ongoing economic genocide of family farmers as well as provide the time and material security which food producers and other citizens need to fully engage in participatory democracy.

The approaches to knowledge construction described here must therefore be seen as part of a wider process of transformation that seeks to invent a new modernity based on plural definitions of human well-being and an active citizenship that can fundamentally democratize economic, political, ecological, social and cultural realms (Bookchin, 2005; Fotopoulos, 1997). For example, given the scale of today's democratic deficit, new political structures are required to combine localism with interdependence for co-ordinated action across large areas for food sovereignty, agroecology and biocultural diversity. One option is democratic confederalism, which involves a network of citizen-based (as opposed to government) bodies or councils with members or delegates elected from popular face-to-face democratic assemblies, in villages, towns and neighbourhoods of large cities. When combined with an education for active citizenship, these confederal bodies or councils become the means of interlinking villages, neighbourhoods, towns and agro-ecological regions into a confederation based on shared responsibilities, full accountability, firmly mandated representatives and the right to recall them if necessary (Bookchin, 2015; Öcalan, 2011). Citizens can thus participate in a direct and democratic way in the decentralized and distributed production of post-normal knowledge that is now needed for the local adaptive management of ecosystems and economies in today's context of rapid change and uncertainty. Mainstreaming the construction of knowledge for food sovereignty, agroecology and biocultural diversity ultimately depends on these deeper transformations for direct democracy, freedom and justice.

Notes

1 Transformation is the creative re-visioning and fundamental re-design of whole systems. It involves 'seeing things differently', 'doing better things' and re-thinking whole systems on a participative basis. It is a form of triple loop learning (Senge, 1990) which asks the deeper 'underlying why' questions and focuses on underlying paradigms, norms and values that frame and legitimize the purpose of knowledge, policies, organizations, technologies and practice. As such transformation sharply differs from reform (second loop learning) and from adaptation and maintenance of the *status quo* (accommodation, first loop learning).
2 In this chapter, I use the term 'farmer' interchangeably with '*campesino*' and 'peasant'. Small-scale food producers – farmers, artisanal fisherfolks, pastoralists, forest dwellers, hunters and gatherers – provide the food to the majority of the world population. They also constitute the largest group of 'economically active people'. About 40% of all

working people are small-scale farmers – peasants – and around 43% of the agricultural labour force in developing countries are women (FAO, 2016a).

3 *Dalit*, meaning 'oppressed' in Sanskrit, is the name of castes in India which are 'untouchable'. These are social groups confined to menial and despised jobs.

4 In Inca mythology, *Pacha* means the different spheres of the cosmos. In the Quechua language, *Pacha* is often translated as 'world', and it includes the sky, the sun, the moon, the stars, the planets and constellations (*Hanan pacha)*; the tangible world where people, animals and plants all live (*Kay pacha*); and the inner world associated with the dead as well as with new life (*Ukhu pacha*).

5 Post-normal science is the sort of inquiry in which the facts are uncertain, values are often in dispute, stakes are high and decisions are urgent. Central to post-normal science is the idea of an 'extended peer community' and the recognition that there is a plurality of legitimate perspectives on every issue (see Ravetz, 1971; Funtowicz and Ravetz, 1994).

6 Strictly speaking, organizations are not the same as institutions. Institutions are 'the humanly devised constraints that shape human interaction … they structure incentives in human exchange, whether political, social or economic … Institutions reduce uncertainty by providing a structure to everyday life … Institutions include any form of constraint that human beings devise to shape interaction' (North, 1990). Land tenure rules and other rules regulating access, use and control over natural resources are examples of institutions. Although they embrace them, institutions are not organizations; they are best understood as a set of informal and formal rules that are administered by organizations. Organizations are thus 'groups of individuals bound by some common purpose to achieve objectives' (North, 1990). Organizations operate within the framework – the rules and constraints – set by institutions. Examples include government departments or local beekeeper associations which administer sets of formal and informal 'rules of the game'.

7 In India, women's '*sanghams*' seek to create a space where women can talk about their problems, share their worries and seek advice. As women's associations, *sangham* groups play a key role in building the confidence, respect and freedom of women for *dalit* and other marginalized people. In Buddhist teachings, the word '*Sangha*' means a group. Being part of the *Sangha* with '*Sangham saranam gacchami*' is about taking refuge in that which is good, virtuous, kind, compassionate and generous.

8 In the European Union, for example, there were 8 million farms in the 12 member states that made up the EU in 1990. Ten years later – after the accession of three additional member states (Austria, Finland and Sweden) – the EU had lost 1.4 million farms, reducing the total in 2000 to 6.6 million farms (Choplin, 2017). Overall, the number of European farmers is decreasing every year by about 2%, though falls of more than 8% were registered between 2002 and 2003 in the Czech Republic, Hungary, Poland, Slovenia, Slovakia and the UK. There is also a negative demographic trend in Europe: currently only 6% of farmers are under the age of 35 across the EU, and 34% of all farmers are over 65 years old (CEJA, 2011). In France, where the percentage of the active working population in agriculture decreased from 30% to 3% over a period of 50 years, 10,000 farmers per year leave farming before reaching retirement age – i.e. one third of the total number of farmers who quit farming every year, according to a recent interministerial study. The reasons for leaving farming in France are the same as for many other countries worldwide, including banks refusing to give loans, lack of cash, inability to reimburse money borrowed for farm investments and farm enterprises being less and less able to absorb impacts of two consecutive years of crisis (ASP, 2016).

9 UNORCA is the National Union of Autonomous Regional Peasant Organisations. It is a national network of 1,400 Mexican *campesino* and indigenous farming organizations representing 200,000 producers in 27 Mexican states. UNORCA is also a member of La Via Campesina: http://unorcamexico.org/author/unorcaeditor.

10 For example, see Levidow (2008) for a discussion on shortcomings of government-controlled citizens' juries in four European countries.

11 For example, see the film *Imagining Research for Food Sovereignty* (http://www.excluded-voices.org/st-ulrich-workshop-democratising-agricultural-research-food-sovereignty-and-peasant-agrarian-culture), and the video films posted on www.excludedvoices.org/video and www.agroecologynow.org.

12 In April 2018, four West African farmers involved in the deliberative process to date will travel to London to ask the UK Government and British taxpayers to de-prioritize AGRA in its overseas aid and support instead research on agroecology for family farming in Africa.

13 A cosmovision is a particular way of viewing the world or of understanding the universe.

14 For example, the UK's Research Excellence Framework (http://www.ref.ac.uk/about), the German Universities Excellence Initiative (https://www.wissenschaftsrat.de/en/about.html) and the Excellence in Research for Australia (www.arc.gov.au/era).

15 The UN Food and Agriculture Organization (FAO) and the Government of Hungary hosted the *Regional Symposium on Agroecology for Sustainable Agriculture and Food Systems in Europe and Central Asia* from 23 to 25 November 2016 in Budapest (Hungary). Comments on donors' research support were made during the session on 'Research, innovation and knowledge sharing for agroecological transition' (Module 3). See: www.fao.org/europe/events/detail-events/en/c/429132.

16 Arpad Pusztai was a senior scientist from the Rowett Institute in Aberdeen, UK. In the summer of 1998, he told the British public that feeding young rats GM potatoes appeared to harm them. Dr Pusztai lost his job, his research group was disbanded, and a gag order was placed on him. The Royal Society – the top society of scientists in the UK – issued a hasty official report discrediting Pusztai's findings (Randerson, 2008).

17 Following widespread public protest, the University of Berkeley (California) reversed its decision and finally decided to grant tenure to Dr. Ignacio Chapela in 2005.

18 At the time of writing, three mega-mergers in the agri-chemical industry are simultaneously underway around the globe, namely (1) ChemChina's takeover of Syngenta; (2) Bayer CropScience's acquisition of Monsanto; and (3) Dow Chemical Company (Dow) and E.I. du Pont de Nemours and Company (DuPont). If these mergers are approved by EU and US regulators, only three corporations will control nearly 60% of the world's commercially marketed seeds, nearly 70% of the chemicals and pesticides used to grow food and nearly all of the world's GM crop genetic traits (Vidal, 2016).

19 Michael Hardt argues that our choices are not limited to businesses controlled privately (private property) or by the state (public property). The third option is to hold things *in common* – where resources and services are produced, distributed and controlled democratically and equitably according to peoples need (Hardt, 2011).

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