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DANS **MONDES EN DÉVELOPPEMENT** VOLUME 199-200, ISSUE 3, 2022, PAGES 361 À 384
ÉDITIONS **DE BOECK SUPÉRIEUR**

ISSN 0302-3052

ISBN 9782807398207

DOI 10.3917/med.199.0365

Article available online at

<https://www.cairn-int.info/revue-mondes-en-developpement-2022-3-page-361.htm>



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Transforming food and agriculture: Competing visions and major controversies

Michel PIMBERT¹

Two contrasting models of development seek to radically transform food and farming today. The first focuses on modernizing and sustaining capitalism through the promotion of the Fourth Industrial Revolution (4IR) in food and agriculture. The second emphasizes food sovereignty and agroecology. The paper highlights some of the main controversies and challenges associated with each of these two approaches. Several of the most contested developments within ecological, discursive, economic, and political domains are identified as major drivers of transformation today.

Keywords: Food and agricultural transformation, Fourth Industrial Revolution, agroecology, food sovereignty

Classification JEL: N5, D7, F0, F5

Transformer l'alimentation et l'agriculture : conceptions concurrentes et principales controverses

Deux modèles de développement opposés cherchent aujourd'hui à transformer radicalement l'alimentation et l'agriculture. Le premier se concentre sur la modernisation et le maintien du capitalisme à travers la promotion de la 4e révolution industrielle (4RI) dans l'alimentation et l'agriculture. La deuxième voie de transformation met l'accent sur la souveraineté alimentaire et l'agroécologie. Cet article met en évidence certaines des principales controverses et défis associés à chacune de ces deux approches de la transformation du système agroalimentaire. Plusieurs des développements les plus contestés dans les domaines écologique, discursif, économique et politique sont identifiés comme des moteurs majeurs de transformation aujourd'hui.

Mots-clés : transformation alimentaire et agricole, 4e révolution industrielle, agroécologie, souveraineté alimentaire

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Many citizens, scientists, and businesses believe that decisive actions are urgently needed to transform agri-food systems to limit climate change, biodiversity loss, hunger and malnutrition. Bold new developments for sustainable agri-food transitions are being proposed in the North and global South. However, these developments are often rooted in different economic models, technological paradigms, cosmovisions, and actor networks.

This paper starts by briefly describing two contrasting models of development that seek to radically transform food, farming, and land use today. The first focuses on modernising and sustaining capitalism through the promotion of the 4th Industrial Revolution (4IR) in food and agriculture. The second emphasises systemic change through food sovereignty and agroecology. The paper highlights some of the controversies and challenges associated with each of these two contrasting approaches to agri-food system transformation.

1. PATHWAYS TO TRANSFORMATION

1.1 *The 4th industrial revolution for food and farming*

An increasing number of corporate and financial actors seek to solve today's multiple agri-food system crisis by developing and using new technologies that are part of the Fourth Industrial Revolution. The Fourth Industrial Revolution (4IR) is characterized by a fusion of technologies that blurs the lines between the physical, digital, and biological domains. It is argued that these disruptive technologies could help distribute food, wealth and data, reduce hunger and waste, and empower farmers (Voegelé, 2018). The technology is already here to radically transform production, processing, distribution, consumption, and waste management. For example in the UK, about 4.5 metric tons of spring barley have been harvested from the world's first robotically tended farm in 2017. Everything from start to finish — including sowing, fertilizing, collecting samples and harvesting — has been done by autonomous vehicles (drones, robots..) on the farm (Pultarova, 2017). Similarly, hundreds of blue and grey robots have been designed to collect food items for distribution in Amazon's new generation of giant warehouses (LaFranz, 2021). It is also anticipated that flying robots replace living bees to pollinate crops.

Agri-food systems are now increasingly seen to be “ripe for technology disruption” (WEF, 2018). For example, the *System Initiative on Shaping the Future of Food Security and Agriculture* of the World Economic Forum is currently supporting agricultural transitions in 21 countries through partnerships catalysed by the New Vision for Agriculture (NVA) initiative. The NVA is driven by ministers, CEOs, farmer leaders, civil society, international organization leaders and

other key stakeholders collaborating on over 100 value-chain projects in Africa, Asia and Latin America. The NVA initiative supports “innovation ecosystems” to drive accelerated progress and innovation on the ground. The new 4IR aims to re-engineer agri-food systems by using a package of ‘12 transforming technologies’, - including precision agriculture to “optimize the use of agricultural inputs and water”, genetic editing, internet of things, renewable energies, big data and robots, and nutrigenetics for personalized nutrition.

Public-private sector partnerships and significant private sector funding are driving research and development in these areas. Like previous industrial and green revolution technologies, this ‘package of 12 transforming technologies’ is designed for linear food systems and value chains linked to global markets. It heavily relies on western science and the transfer of technology model of agricultural research and innovation. Not least, political and economic power is concentrated in the hands of the increasingly small number of corporations that design, produce, sell, and have a monopoly control over the ‘12 transforming technologies’ protected by patents and other intellectual property rights. Moreover, the spread of automated, delocalized and informatized production and commercialization of food is supporting the increasing financialisation of the global food system (Right to Food and Nutrition Watch, 2018). Financial markets play an increasing role within food systems with the significant growth in the sale and purchase of financial products linked to food commodities and the digitalisation of agriculture. Agricultural commodity futures markets replace real economy factors as the main drivers of food prices and their volatility. Financial markets also transform agricultural resources such as land and genetic data by turning them into financial assets for sale.

Whilst these technological innovations represent a truly fundamental rupture with previous agricultural practices, they show a remarkable historical continuity with the logic of capitalist accumulation. The 4IR innovation ecosystems not only have the potential to increase profits for corporations and investors. They can also be designed to enhance managerial control over the labour process. As the great apologist for industrialism, Andrew Ure, wrote in 1835, ‘...when capital enlists science in her service, the refractory band of labour will always be taught docility’ (Ure, 1835). Indeed, the history of industrial agriculture shows that technology has been consciously used to discipline labour and counter industrial militancy.

Corporate visions for the future essentially conform with – rather than transform - the dominant agri-food regime because they are primarily based on principles of uniformity, centralisation, privatisation, concentration of power, control and coercion.

1.2 *Food Sovereignty and Agroecology*

Throughout the world, global peasant and social movements are mobilizing to build and strengthen agroecology as the pathway towards more just, sustainable, and resilient food and agriculture. These actors are claiming agroecology as a bottom-up construction of knowledge and practice that needs to be supported – rather than led – by science and policy.

At the heart of agroecology is the idea that agroecosystems should mimic the biodiversity levels and functioning of natural ecosystems. Such agricultural mimics, like their natural models, can be productive, pest-resistant, nutrient-conserving and relatively resilient to stresses such as climate change. Important goals of sustainability and productivity are met through agroecosystem designs that enhance functional diversity at the genetic, species, ecosystem and landscape levels. Agroecological methods used include genetic mixtures, crop rotations, intercropping, polycultures, mulching, terracing, the management of diverse micro-environments for nutrient concentration and water harvesting, agro-pastoral systems and agroforestry.

The design of biodiverse, energy-efficient, resource-conserving and resilient farming systems is based on mutually reinforcing agroecological principles (Altieri, 1995). These modern principles of agroecology have their roots in the rich collective knowledge, practices, ecological rationale, and cosmovisions of indigenous and peasant agriculture(s) (Pimbert et al., 2021; Gliessman, 2015). Throughout history, farmers collectively harnessed their knowledge to generate sophisticated agricultural and land-use systems in Africa, the Americas, Asia, and Oceania before the arrival of the Europeans. For example, the Mayas developed systems capable of feeding large and concentrated populations in the Americas (Ford and Nigh, 2015).

In the 1990s, agroecology as a scientific discipline widened its focus from the farm plot to the whole food system. A focus on the ‘ecology of food systems’ (Francis et al., 2003) allowed for critical exploration of alternative food networks that re-localize production and consumption (e.g. short food chains and webs, local food procurement schemes...).

Over the last 30 years, peasant organisations and social movements have argued for a transformative agroecology based on a redesign and diversification of the agroecosystem as well as its integration with re-territorialized local and regional markets. They reject an agroecology which promotes ‘input substitution’ approaches that maintain dependency on suppliers of external inputs and commodity markets, and which leave untouched genetically uniform monocultures and linear food chains (Rosset and Altieri, 2017). And they emphasize the indivisibility of agroecology as a

science, a practice and social movement in the context of food sovereignty². Speaking at the 2015 International Forum on Agroecology in Nyéléni (Mali), the farmer leader Ibrahima Coulibaly made this clear: *‘There is no food sovereignty without agroecology. And certainly, agroecology will not last without a food sovereignty policy that backs it up’* (www.agroecologynow.com/video/ag/, Nyéléni, 2015).

Agroecology as an integral part of food sovereignty is thus based on principles of diversity, decentralisation, distributed power, dynamic adaptation, and democracy. Agroecology for food sovereignty is fundamentally distinct from the selective incorporation of some agroecological practices within a productivist agriculture that essentially conforms with the dominant agri-food regime (Levidow et al., 2014).

When faced with similar processes of co-optation, advocates of food sovereignty emphasise a radical transformation of the system for autonomy, mutualities of care, and democracy. Proponents of food sovereignty are not aiming for ‘inclusion’ in existing political structures and the dominant culture. Instead, they strive to transform the political order in which they operate.

Anderson et al. (2019) have shown that large-scale agroecological transformation for food sovereignty depends on more inclusive democracy and justice in six key areas, or domains: access to natural ecosystems, including land, water, and seeds; systems of economic exchange and markets; knowledge and culture; social networks and local organizations; discourses; and equity, gender, and diversity. Rather than provide a comprehensive analysis of each transformation domain, the following sections highlight instead some of the most contested issues and battlegrounds that are shaping the development of food and agriculture today.

2. DISCOURSES ON MODERNITY: A FUTURE WITH OR WITHOUT LIVING LABOUR?

Discourses on what is desirable in society are key in shaping development for food, farming and land use. Always value-laden, discourses offer a normative framework that guides policy and technological choices. They also help legitimate institutional and technical choices and their subsequent impacts on society and the environment. Discourse—the ways in which language is used to frame debates, policy and action—is thus a critical domain in shaping transformations in food and agriculture. Control over which discourse(s) prevail is a highly contested and strategic focus for advocates of food system transformation.

² The concept of ‘food sovereignty’ was first put forward internationally by La Vía Campesina at the UN Food and Agriculture Organization’s World Food Summit in 1996 (Desmarais and Nicholson, 2013).

Since the birth of rural capitalism in England in the 16th century, - and even more so with industrial capitalism -, small and family farmers have been labelled unproductive, not economically viable, lazy, and not worthy of support (Thompson, 1991). Jim Handy has shown how the ‘almost idiotic wretchedness’ of peasants has been imagined and institutionalized in eighteenth- century Britain and in the global South during colonialism and twentieth-century development (Handy, 2009). Apart from blaming peasant farmers for their predilection to have too many children, political and economic elites also dismissed peasants for not being sufficiently enamoured with consumption – they stifle economic development because their needs are far too easily met.

In capitalist, socialist, and communist nation states, the dominant discourse on modernising development envisions having less people living of the land. It encourages an exodus of people from rural areas to work in industry and urban-based trade and services (Mendras, 1984). Historically, labour-saving agricultural technologies and enclosures of the commons have combined with agricultural policies to exclude people from agri-food systems. The dominant discourse on modernity and progress continues to create the conditions for a systematic economic genocide of the peasantry throughout the world.

In France for example, the latest census report of the Ministry of Agriculture shows that over 100 000 farms have stopped their economic activity over the last 10 years (AGRESTE, 2021). As farmers and farms have declined in numbers, land and capital is concentrated into larger and larger farm holdings. Many of the remaining 389 000 farms are heavily indebted and have difficulty surviving. Most notably, 10 000 French farmers *per* year leave farming before reaching retirement age – i.e. one third of the total number of farmers who quit farming every year. Young people are unable to enter farming or find it hard to do so. Retired farmers receive a very small pension. A French inter-ministerial study identified the reasons for this deep crisis. First, banks refuse to give loans; farmers have a lack of cash and they are unable to reimburse money borrowed for farm investments (agricultural machinery in particular). Second, the impacts of multiple crises (climate change, illnesses, market volatility....) are increasingly debilitating: “*Farm enterprises are less and less able to absorb impacts of two consecutive years of crisis*” (ASP, 2016). Third, adverse conditions such as isolation (geographical and social), lack of recognition, insufficient income for long day’s work and rising cases of suicides – the third cause of farmer death after cancer and cardio-vascular problems (ASP, 2016). Despite the dire human costs of this model of agricultural development, the solutions offered to address these crisis are more of the same. President Emmanuel Macron recently announced in his plan « France 2030 » that his government will invest 2 billion euros in 4IR agriculture. Consistent with the dominant discourse on modernity – and the commercial opportunities it creates for powerful actors -, the French government is championing a

digitally interconnected agriculture, with drones, intelligent robots, joysticks, and the use of gene drives in uniform landscapes monitored by 5G technology. The more triumphant 4IR proponents already anticipate that as few as 170 000 farmers will be able to produce all the food France needs in the next 5 to 10 years.

These radical agri-food system transformations in France prefigure similar developments in Africa, Asia, the Americas, and Europe (WEF, 2018; Smith, 2019; Ramdas, 2022). 4IR technologies are set to massively replace living labour with the dead labour of machines. In this disturbing context, many farming communities often echo Karl Marx's observation: *Capital is dead labor, which, vampire-like, lives only by sucking living labor, and lives the more, the more labor it sucks* (Marx, 2009).

However, the idea that small-scale producers and indigenous peoples as a group are bound to disappear reflects just one vision of the future: it is a political choice that relies on specific theories of change that is rejected by social movements working for social justice, agroecology and food sovereignty. Throughout the world, peoples (especially youth) are affirming other visions on how to live with, and care for, the land and their communities. Their pluralistic visions of modernity increasingly reject the commodification of nature and social relations (Rist, 2011). Their alternative discourses focus on the creation and maintenance of "the good life"—concepts and practices such as *buen vivir* or *sumak kausai* in Latin America, ecological *swaraj* in India, de-growth in Europe (Latouche, 2011) and feminist subsistence perspectives (Mies and Bennholdt Thomsen, 1999). In this reimagined pluriverse (Kothari et al., 2019), ideas, discourses and practices reconnect individuals with nature and help rebuild diverse agri-food systems embedded in local ecologies and economies. All these discourses put living labour at the heart of food system transformation. Not the dead labour of capital but the productive and reproductive labour of men and women as well as the labour of nature (Salleh, 2017). As such, life-centric discourses for transformation are incommensurable with the hegemonic view of industrial modernity.

3. TRANSFORMING KNOWLEDGE AND WAYS OF KNOWING

The choice of research priorities – by and for whom, why, and for what purpose – is key for re-inventing agri-food systems now confronted with unprecedented social and environmental crisis. This transformation domain is highly contested today because radically different knowledge(s) are needed for each of the contrasting agroecological and 4IR models of food and agriculture.

Most universities and research institutes 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, 2016). Corporations and large financial investors control more and more the directions and products of research in the social and natural sciences, as well as in the humanities. Funding priorities, private-public sector partnerships, 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 to neo-liberal food policies and trade agreements (Pimbert, 2018). Based on what is mostly reductionist science and the top-down transfer of technology model, conventional Research and Development (R&D) is well suited for advancing the technical innovations of the Fourth Industrial Revolution for food and farming.

In this context, the main challenge for 4IR proponents is to consolidate the privatisation of R&D and - above all - ensure that its benefits mainly flow to corporations and their shareholders. Along with strong intellectual property rights, this is being done by introducing a set of legal rules to protect investors’ rights in the context of the World Trade Organization (WTO) as well as in bilateral investment treaties and clauses of free-trade agreements. These ‘trade and investment agreements’ have already given private corporations with extraordinary and powerful tools to assert and defend their commercial interests. 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. Such provisions increasingly undermine the capacity of states to maintain policies, laws and practices protecting human rights, *including the freedom indispensable for academic research*.

In sharp contrast, counter-hegemonic practices by peasant networks, indigenous peoples, pastoralists, and social movements seek agroecological transformations 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. 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. As briefly outlined below, this is a huge historical challenge.

Constructing knowledge(s) for food sovereignty and agroecology entails reversing top-down research and the hegemony of scientism, as well as the commodification of knowledge. It also means reversing the current democratic deficit in the governance of R&D by enabling more direct citizen control over the priorities 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 that 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 (Pimbert, 2018).

In practice, there are two complementary approaches to construct knowledge(s) for transformative agroecologies and food sovereignty. The first one is *grassroots innovation and self-managed research*. Decentralised self-organising research and grassroots innovation play an important role in social movements working for food sovereignty and agroecology. 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 that enable the production of knowledge in the many 'living campuses' where farmers derive their livelihoods. Grassroots innovation and self-managed research are based on several mutually reinforcing processes including: education for critical consciousness and place-based learning; horizontal peer to peer learning for the production of collective knowledge; building extended peer communities to validate and protect collective knowledge; plural ways of knowing (experiential, local, tacit, feminine, phenomenological...); and strengthening local organisations to scale out grassroots research and innovation to more people and places.

Self-organised research and grassroots innovation networks usually span large geographical areas. For example, the Campesino a Campesino (CAC - Farmer to Farmer) is a grassroots movement that originated in the early 1970s in Guatemala and spread through Mexico, Nicaragua and Cuba. By building local capacity, autonomy, and empowerment, the CAC process has generated effective site-specific agroecological solutions as well as non-hierarchical communication for social change throughout Central America and the Caribbean³ (Pimbert, 2018).

The second approach focuses on *democratising public research institutions* with a view 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 peoples' participation and agency throughout the entire research cycle – from deciding upstream strategic research and funding priorities to the co-production of knowledge and risk assessments. As detailed elsewhere (Pimbert, 2018), deep fundamental changes are needed in research institutions, including putting citizens at the heart of decision making in research; embracing transdisciplinarity and

³ Other examples include MASIPAG in the Philippines and the Réseau Semences Paysannes in France (See Pimbert (2018) and references therein).

methodological pluralism; protecting public research from privatisation; and shielding research from corporate abuse and capture.

Worldwide, agroecological research currently receives a minuscule percentage of the total public funding for agricultural R&D, - the lion's share continues to support industrial agriculture (Delonge et al, 2016; Pimbert et al., 2018). Redirecting substantial public funds for the decentralised and distributed co-creation of knowledge by peasant farmers, indigenous peoples, and consumer-citizens is key for widespread agroecological change and food sovereignty.

4. TRANSFORMATION FOR ECOLOGICAL SUSTAINABILITY AND RESILIENCE TO CLIMATE CHANGE

The need to transform agri-food systems for ecological sustainability and climate resilience is increasingly accepted by different actors. The World Economic Forum's 4IR aims "to explore new ways to feed an expanding populace, to use technology and innovation to provide nourishment without harming the planet"⁴. Agroecologists talk of healing the metabolic rift (Foster and Clark, 2020) between humans and nature. Some of the challenges and controversies associated with each of these two development pathways are briefly discussed here.

4.1 *Finance for Nature-based Solutions*

Mobilising global finance to combat climate change and biodiversity loss is a key priority for champions of 4IR in food and agriculture⁵. COP 26 in Glasgow reaffirmed the need to tackle climate change and biodiversity loss together by using clean and green finance. According to the UN special envoy for climate action and finance "*the Glasgow Financial Alliance for Net Zero (GFANZ) was created to meet enormous investment needs that could total over \$100 trillion over the next three decades. Bringing together over 250 financial institutions responsible for \$80 trillion in assets and anchored in COP's Race to Zero, GFANZ is the gold standard for financial sector commitments to sustainability*" (Carney, 2021). However, most of the finance now been made available is to support

⁴ <https://www.weforum.org/topics/agriculture-food-and-beverage>

⁵ The initiative for Lowering Emissions by Accelerating Forest finance (LEAF) was promoted at COP26 by a coalition of governments, multinational companies and NGOs. Several corporations involved in the development of 4IR technologies are main supporters of LEAF - including Amazon, Bayer, Unilever, Nestlé, and Walmart. <https://leafcoalition.org>

mitigation measures. Much less funding has been earmarked for adaptation to climate change and biodiversity loss (IPCC, 2022).

To access funding, companies and investors must produce net zero plans. Carbon credits can be generated by projects that reduce or remove greenhouse gas (GHG) emissions, such as afforestation. This allows buyers to compensate for, or neutralize, any continuing emissions they have while moving to net zero. By 2021, over 1,600 companies had committed to science-based targets. In theory, a mix of emissions reductions and carbon credits allow companies to compensate for their ongoing emissions, including through Nature-based Solutions⁶ (NbS) such as reforestation and adoption of greener renewable energy systems.

However, the term NbS is controversial because it is loosely defined and can mean very different things to different people. NbS are highly contested, with many advocates defining 'Nature-based Solutions' to suit the activities they would like to see funded or implemented. The term 'Nature-based Solution' is also controversial because some of its most enthusiastic supporters are large oil companies, agri-business corporation, governments of wealthy countries with high GHG emissions, and industries responsible for much of the social and ecological crisis of our planet. Much of the controversy comes from the inclusion in nature-based solutions of actions to offset GHG emissions or actions that destroy nature in one area (through mining, infrastructure, etc.) and which are 'offset' by investment in creating, maintaining, or restoring natural or 'modified' systems elsewhere.

For example Nestlé, the world's largest food company, is one of the worst corporate GHG emitters outside of the energy sector. In December 2020, Nestlé launched its "Net Zero Roadmap", committing to reduce its emissions by 50% by 2030 and to "net zero" by 2050⁷. Most of these emissions occur in its supply chain, especially in the sourcing of dairy and commodity crops (coffee, palm oil, sugar, soybeans, etc). Nestlé's annual supply chain emissions are roughly double the total emissions of its home country, Switzerland. Nestlé's climate mitigation plan is indicative of the direction of travel of the agri-business industry post COP 26. First, Nestlé's climate plan does not involve a reduction in its sales of foods based on dairy, meat and other highly-emitting agricultural commodities. Nestlé's climate plan is instead based on a projected growth of 68 per cent for both its sourcing of dairy and livestock products and of commodity crops between 2020 and 2030. Second, Nestlé

⁶ The term 'Nature-based Solutions' refers to a range of possible responses to the need for mitigation of, and adaptation to, climate change. The term was further defined in 2016 by the International Union for the Conservation of Nature (IUCN) to mean: "*actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*".

⁷ <https://www.nestle.com/sites/default/files/2020-12/nestle-net-zero-roadmap-en.pdf>

claims that this growth in production will be more than compensated by the deployment of climate-friendly technologies and changes to farming practices among its suppliers (e.g. adoption of agroforestry, agroecology and regenerative practices to capture carbon on farms and forest lands...). Third, Nestlé's stated ambition to offset 13 MT CO₂ a year of emissions with "nature-based solutions" would require zoning off or planting trees on at least 4.4 million hectares of land *every year*. This will generate a massive land grab for forests and farmlands, particularly in the global South (GRAIN, 2021).

As the 4IR in food and agriculture gains momentum in a context of climate emergency and the 6th mass extinction of biodiversity, dozens of big agri-business polluters like Nestlé, Unilever, Danone, and Yara are now making "net zero" pledges, mainly to satisfy the public relations needs of the financial players that fund them. However, these corporate strategies are deeply problematic:

- Offsetting GHG emissions against NbS elsewhere postpones the real reductions in emissions needed now.
- It is a transfer of responsibility for reducing emissions to the poorest countries in the world and away from wealthy countries and corporations who - by offsetting their emissions - *avoid any significant reductions in their levels of production and consumption*.
- As they attract more finance from banks and backing from governments, corporate-led NbS are triggering a massive new wave of land and resource grabs from local communities, mainly in the global South.
- Without guarantees for full respect and protection of land, territorial and resources rights as well as Free Prior Informed Consent (FPIC) of local communities, NbS and net zero plans will increase biodiversity loss and GHG emissions as well as instability, food insecurity, migrations and conflicts.

It is in the utmost interest of companies benefiting from these financial schemes to maintain the illusion that green funds work for people and planet. Debunking corporate greenwashing is thus essential for accountability. However, climate justice will ultimately depend on citizens taking back full democratic control over the funds, territories, and governments that are captured by 4IR corporations and investors.

4.2 *Healing the metabolic rift*

Agroecology and food sovereignty strive to reverse the fundamental contradiction between capitalism's drive for a controllable uniformity and nature's thrust for ever more diversity and differentiation. From an environmental perspective, this essentially means bringing back biodiversity into re-territorialised agri-food systems and enabling the capture of large amounts of GHG for storage in the vegetation and soil.

Agroecological practices conserve biodiversity. Many indigenous and peasant land-use practices create mosaics of agricultural areas and patches of wild biodiversity at multiple scales (Perfecto et Vandermeer, 2017) in parts of Africa, Asia, Americas and Europe. This “natural matrix” model sustains a variety of habitats and micro-environments as well as a diversity of cultivated and wild species, many of which are edible and often key for the provision of ecosystem functions such as pollination. These territories conserve a huge amount of biodiversity, sequester carbon, and are *de facto* governed by indigenous and local communities who derive food and livelihoods from them (Pimbert and Borrini-Feyerabend, 2019).

The shift from industrial uniformity to living diversity is further enabled by a transformative agroecology that re-territorializes production, distribution and consumption within decentralized circular systems that mimic natural ecosystems at different scales—from individual farm plots to entire cities. This re-territorializing of agri-food systems echoes the proposals of the Russian anarchist geographer Peter Kropotkin (1898) for an agrarian-industrial mutualism, in which most economic activities are re-localized in villages mixing agricultural and industrial elements, where production is controlled by those directly engaged in it. Kropotkin’s ideas on how to overcome the spatial inefficiencies of capitalist production and generate synergies between small-scale industry and agriculture are particularly relevant today. For example, they might be applied to the design of shorter supply chains that are less vulnerable than global value chains to the massive disruptions caused by pandemics (UNEP, 2020).

The building blocks for circular systems based on an agrarian-industrial mutualism do exist, and include enhancing functional biodiversity, ecological clustering of industries, recycling, and localized production and consumption. Circular systems that combine food and energy production with water and waste management not only increase the sustainable use of biodiversity over time and space. They can also reduce greenhouse-gas emissions as well as ecological and material footprints, while maintaining a good quality of life through controlled processes of de-growth in consumption and production. A shift from linear systems to circular ones that mimic natural cycles by re-localising production, processing, distribution, consumption, and waste management can also create jobs and income (Jones et al., 2012). Re-localising agri-food systems partly depends on the creation of local mills, micro-dairies, small abattoirs, workshops for mechanics and carpenters, fablabs, community-based and artisanal food processing units. Public investments in these areas can create livelihoods that reduce outward migration to cities and help regenerate strong local economies. This vision of transformation aims to regenerate society and nature by replacing capitalism with *“an ecological society based on non-hierarchical relationships, decentralised communities, eco-technologies like solar power, organic agriculture, and humanly scaled*

industries — in short, by face-to-face democratic forms of settlement economically and structurally tailored to the ecosystems in which they were located” (Bookchin, 1990).

5. ECONOMIC TRANSFORMATION

«Some critics make the mistake of proclaiming that development has failed. It hasn't. Development as historically conceived and officially practiced has been a huge success. It sought to integrate the upper echelons, say ten to forty per cent, of a given third world population into the international, westernized, consuming classes and the global market economy. This it has accomplished brilliantly » (George and Sabelli, 1994).

The current model of economic development works well for industrial food and farming. Free trade and other economic innovations favoured by transnational corporations and financial investors continue to fuel today's historically unprecedented concentration of wealth by a tiny minority of hyper-rich individuals. At the time of writing, the hyper-rich comprise less than 100 people who own and control more wealth than 50% of the world's population (Beaverstock and Hay, 2016). Several 4IR leaders are part of this rich club of global players. Collectively, their strategic priority is to ensure that economic rules do not constrain their activity in any way, and allow instead for continued private accumulation as well as the externalisation of social and environmental costs.

In sharp contrast, a fundamentally different economics is needed for widespread sustainability transitions based on agroecology, circular economy models, and re-territorialised food systems. This is because there is a direct relationship between the huge increases in productivity achieved through the use of automated technology, digitalisation, bio-science applications, re-engineering and downsizing, and the permanent exclusion of high numbers of workers from employment throughout the industrial food system and its related sectors (energy, manufacturing, etc). This erosion of the link between job creation and wealth creation calls for a much fairer and more gender equitable distribution of productivity gains through a significant reduction of wage work. It also calls for alternative forms of economic organisation that provide opportunities and local autonomous spaces for the generation of use values rather than exchange values. Last, but not least, a transformed economics for people and the planet needs to holistically integrate productive labour with the reproductive labour of care of both women and nature. The challenge is to re-imagine economics *outside* of capitalism and patriarchy.

5.1 Economic re-distribution to support the right to food for all

A number of innovations have helped improve access to healthy food and have created market opportunities for producers in short food chains and

territorial food systems (CSM, 2016). For example, Public Procurement Schemes in countries as diverse as Brazil, Denmark, and Italy have sourced locally produced seasonal food to supply canteens of schools, hospitals, and prisons. Organic food procurement policies such as those implemented in Rome have had « the power to create an 'economy of quality' that can deliver the economic, environmental, and social benefits of sustainable development » (Sonnino, 2009).

Similar approaches are now required on a much larger societal scale to ensure that the right to food of each citizen is met regardless of age, gender, race, and wealth. A large social demand for nutritious food can provide game changing economic incentives and markets for old and new entrants to farming. One of the more promising proposals to substantially increase the number of farmers on the land - and simultaneously end food poverty and reliance on food aid⁸ - is to establish a national social security system for food. According to the proponents of the scheme in France⁹, every month each citizen would receive a fixed amount of money to eat healthier food (about 150 Euros per week and per person). Like the national health insurance, the '*sécurité sociale de l'alimentation*' would be a universal system funded by contributions. The total budget of the social security for food is estimated to be around 120 billion Euros in France. The exact modalities of the social security contributions are still being worked out, but could be linked with income and salary levels. Through deliberative processes similar to Citizens' Assemblies (Pimbert, 2022), citizens could co-decide how social security for food (SSF) funds are to be used for the production of adequate quantities of healthy foods (contracted products) in each different territory.

Public initiatives for a SSF overseen by citizens offer real opportunities to improve the food and nutritional security of *all* people in society. At the same time, they can also provide remunerative work for well over a million farmers in a country like France (L'Atelier Paysan, 2021). Agroecological farming would thus receive the support it needs to shift from its current marginalised status and go to scale by providing dignified livelihoods to farmers and food artisans.

Moreover, by providing strong economic incentives for the spread of biodiversity-rich, organic agroecological farming, a SSF can have huge public health benefits. For example, species-rich agroecological farming can increase dietary diversity and thereby improve human health by encouraging species-rich gastrointestinal microbiomes (Heiman et Greenway, 2016).

⁸ In France 5,5 million people relied on food aid in 2019, before the COVID-19 crisis. In the UK, the Trussell's Trust latest report on the *State of Hunger* reveals the extreme poverty faced by people at food banks going into the pandemic, with just £248 a month on average to survive on after housing costs. That money needs to cover energy and water costs, council tax, food, and other essentials (Trussell Trust, 2021).

⁹ <https://securite-sociale-alimentation.org>

A Social Security for Food based on agroecological production would ensure that the poorest sections of society can access healthy nutritious food, as part of their fundamental right to food. However, this right needs to be actively claimed by organised citizens because agro-business and pharmaceutical corporations have a vested interest in maintaining the current model of development.

5.2 *Towards economies of care*

From a food sovereignty and agroecology perspective, peasant farmers, indigenous peoples, and citizen-food consumers need their own distinct forms of economics that minimize the need to participate in global commodity markets.

Fortunately, “more-than-capitalist economies” (Gibson-Graham et Dombroski, 2020) persist across the world. Much of the world’s economy is informal, cooperative, hidden, community-based and unwaged (Rist, 2011). Empirical examples from economic geography show how diverse economies can also include more human labour and human/non-human interdependence (Gibson-Graham and Dombroski, 2020). Although they are ignored, devalued and undermined by mainstream economic theory, these forms of economic organization offer relevant models for food sovereignty and agroecological transformations. The following are key in enabling a progressive shift to an economics of social inclusion, freedom and solidarity — based on the principle of ‘from each according to his/her means, to each according to his/her needs:

- strengthening plural forms of economic exchange that combine market activities with non-monetary forms of exchange based on barter, reciprocity, gift relations, care and solidarity. Such complementary forms of local economic exchange offer alternatives to markets solely focused on money;
- a guaranteed and unconditional minimum income for all men and women;
- a significant drop in time spent in wage-work and a fairer sharing of jobs and free time between men and women;
- wealth redistribution measures: taxing the hyper-rich and corporations as well as financial speculations to free up resources for poorer social groups and regions, and also regenerate local ecologies and economies;
- the use of alternative local currencies to retain wealth in re-territorialised economies;
- economic indicators that reflect and reinforce new definitions of well-being such as conviviality, mutual care, and frugal abundance.

Economies of care seek to combine these processes in mutually reinforcing ways for post-capitalist and post-patriarchal economics (Pimbert, 2018).

6. TRANSFORMING GOVERNANCE

Decisions on how, why, where, and for whom agri-food systems are designed and managed are critical for the future well-being of people and the planet. As such, control over governance¹⁰ is a key battleground for the transformation of food and agriculture.

6.1 *Corporate capture*

The World Economic Forum (WEF) has led recent attempts to reconfigure food system governance during the UN Food Systems Summit (UNFSS), held in New York in 2021. The UNFSS was the direct result of a strategic partnership which the UN Secretariat signed with the WEF in July 2019 (Canfield et al., 2021a). From the start, the WEF's explicit intention was to redesign global governance in ways that entrench the corporate sector through market-oriented forms of governance. Accordingly, the UNFSS adopted a model of multi-stakeholder governance backed by powerful corporate actors that could simultaneously bypass the multilateral spaces where states already come together to take decisions (Canfield et al., 2021b). The corporate dominated multi-stakeholder structure is thus intentionally designed to undermine the practices of previous UN Food Summits that were organised through multilateral institutions based on the norms of public international law through which the UN generally operates.

More recently, some of the big champions of 4IR agriculture - the World Economic Forum (WEF), the Bill & Melinda Gates Foundation, the Rockefeller Foundation, the EAT commission, market-friendly NGOs like the World Wide Fund for Nature, and corporations including Unilever, Nestlé, Tyson, and Bayer - have encouraged the development of multi-stakeholder platforms in food systems (Chandrasekaran et al., 2021). Actors promoting 4IR technologies have an explicit agenda to 'reset' global governance in the tradition of 'stakeholder capitalism' which deepens the concentration of agro-industrial power and sidelines multilateral structures of accountability (Montenegro de Wit et al., 2021).

¹⁰ The governance of food and agriculture is defined here as the set of political, social, economic and administrative rules, processes and systems that determine the way decisions by the various actors are taken and implemented for the design and management of agri-food systems. Governance also includes the rules and processes through which decision-makers are held accountable locally, nationally and internationally.

In sharp contrast, transformations for food sovereignty and agroecology require deeply democratic and inclusive forms of governance at local, national and global levels. Existing governance models can be revived and reimagined. More radical experiments in direct democracy are also possibilities. For example, the reform of the UN Committee on World Food Security (CFS) prompted by the 2007/2008 food price crisis established a strong precedent for what might be called ‘inclusive multilateralism’. This unprecedented reform in the UN « *was not the outcome of a technocratic drawing board exercise or governmental dictat but of two decades of mobilization and networking by small-scale producers and other social constituencies, from local to global levels* » (McKeon, 2021). Civil society and social movements are full participants in the CFS. However, decision-making is reserved for governments, who can be held accountable. Further mobilisation by *La Via Campesina* and social movements could strengthen this more inclusive multilateral governance model, and help limit the power of corporate-led multi-stakeholderism in food governance. At the same time, there is an urgent need to rebuild food governance for radical democracy *from the bottom up* – from the local to the global.

6.2. *Deepening democracy*

Citizens and social movements committed to transformative agroecology and food sovereignty generally seek to reverse the democratic deficit and exclusion that favour the interests of powerful corporations, financial investors, big farmers and technocratic research institutes. This usually requires an expansion of “direct” democracy in decision-making in order to complement, or replace, models of representative democracy in policymaking and governance.

Deeply radical, this approach to politics seeks to remake society. Strengthening citizen-controlled agri-food systems and autonomy calls for forms of political and social organisation that can institutionalise interdependence, without resorting to the global market or the central state. For example, during the Spanish civil war (1936–1939), the peasants of Andalusia and Aragon established communal systems of land tenure, in some cases abolishing the use of money for internal transactions, setting up free systems of production and distribution and creating decision-making procedures based on popular assemblies and direct, face-to-face democracy. In those parts of Spain not overrun by Franco’s troops, about three million men, women and children were living in collectivized communes over large areas (Leval, 1975).

However, a transition to large scale direct democracy poses major challenges. First, deepening democracy assumes that every person is competent and reasonable enough to participate in democratic politics. It also demands a shift in mindset and behaviour from that of passive taxpayers and voters.

Second, active citizenship and participation in decision-making are rights that have to be claimed mainly through the agency and actions of people themselves: they are seldom granted by the state or the market. Third, empowering Indigenous peoples, peasant farmers and other citizens in the governance of agri-food systems, and stewardship of the ecosystems they are embedded in (such as grasslands, forests and wetlands), demands social innovations that create inclusive and safe spaces for peoples' deliberation and action (Pimbert, 2009; Pimbert, 2022). Fourth, only with some material security and free time can men and women be "empowered" to think about the policies and institutions they want and how they can develop them. Free time is needed for people to fully engage in, and regularly practise, the art of participatory direct democracy. That demands radical reforms in economic arrangements like those listed above.

At larger spatial scales, collective action is needed to coordinate local adaptive management and governance across a wide range of agri-food systems and associated landscapes (farmlands, forests, grasslands, peri-urban landscapes and beyond). So to put people at the centre of agri-food systems and to foster autonomy, it is key to decentralize and re-distribute power in polycentric and horizontal webs, both in and between territories (Pimbert and Borrini-Feyerabend, 2019).

One option is democratic confederalism (Öcalan, 2011) and libertarian municipalism (Bookchin, 2015). This involves a network of bodies or councils made up of citizens, with members or delegates chosen by sortition (selection as a random sample) or elected from face-to-face democratic assemblies in villages, towns and neighbourhoods of large cities. Bookchin's libertarian (or confederal) municipalism is rooted in key ideas of the Paris Commune of 1871. He argued for liberated towns, cities and neighbourhoods, governed by open popular assemblies that actively confederate to challenge parochialism, encourage mutual dependence and cooperation, and build a genuine counterpower to dominant institutions. The larger and more numerous the linked confederations become, the greater is their potential to democratize and decentralize governance. For example, democratic confederalism in liberated Syrian Kurdistan has generated a web of new organizations and institutions for direct decision-making by Kurdish people: commune, neighborhood or village community people's council, district people's council, and the peoples' council (Hunt, 2021). At each of these four levels in which power flows bottom-up – from the level of the commune – there are eight commissions responsible for different areas (e.g. justice). Each commission has two spokespersons – one man and one woman. The autonomy of the Kurdish society depends on its institutions being self-organized and self-administering through small self-governing decentralized units that can confederate into larger structures for coordinated action over large areas (Öcalan, 2011). Rooted in ecological diversity, gender equality and

feminist economies of care, this anti-centrist and bottom-up approach to democratic governance is key for the regeneration of Kurdish agroecological farming and food sovereignty (Pimbert 2021).

Federating and building alliances between spaces of self-governance and bottom-up decision-making is a huge challenge for the democratic governance of agri-food systems everywhere – from local to global levels. For Brian Tokar « *Confederations of democratic communities and regions need to develop new continental and global institutions that are no longer plagued by the global power politics of the UN, the narrow commercial imperatives of the WTO, nor the technocratic managerialism of the EU* » (Tokar, 2019). Achieving widespread food sovereignty and agroecology depends on the bottom-up development of confederations for inclusive democracy.

CONCLUSION

Different visions of radical transformation are now being proposed to address the unprecedented social and environmental crisis of food and agriculture. Each vision is contested and promises sweeping changes. For example, massive corporate use of new ‘green funds’ for climate change mitigation and net zero plans will significantly expand land grabbing and undermine implementation of the United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas¹¹.

Solutions envisaged by different actors have the power to either regenerate or further destroy nature and society. Given these highly contested visions of the future, it is vital that all people—men and women—democratically decide which vision of food and farming is suited to their circumstances and wishes. A practical first step would be to facilitate many deliberative democratic processes similar to the large-scale citizens’ assemblies held in Ireland, France, Australia, and Mali in which citizens could debate and decide on major societal questions.

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¹¹ Adopted in 2018, UNDROP recognizes new human rights, including the right to land, seeds, natural resources and food sovereignty *via* agroecology, local markets, local seeds, participatory decision-making, gender justice and the transition to resilient and sustainable food systems (La Vía Campesina, 2020).

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