Innovating locally for global transformation

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Food system transformations: Social movements, local economies, collaborative networks
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Chapter Six:

Innovating locally for global transformation: Intermediating fluid, agroecological solutions. Examples from France, USA, Benin, and South America

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1. Introduction

One of the societal grand challenges that countries around the world face today is the need to move towards more sustainable agri-food systems in order to be able to meet to the food, feed, fibre and energy needs of a growing population, in a world of finite resources (FAO 2011; Conway 2012). The 'feeding 9 billion by 2050' discourse (Fouilleux et al. 2017) dominates international conversation where the terms of debate are shaped around how and what to intensify sustainably (cf. Elzen et al. 2011; Levin et al. 2012; Garnett et al. 2013). On the one hand, research institutes and biotechnology companies are repositioning themselves to provide wide-scale access to technologies based on advanced biological and genetic knowledge in order to sustainably intensify monoculture farming systems under the conditions of climate change (The Montpellier Panel 2013; FAO 2016). On the other hand, there is increasing research that argues for ecological intensification and diversification of production systems (Badgley and Perfecto 2007; FAO 2007; IPES-Food 2016; UN 2017). These studies, based on ecological and farmer-led research, demonstrate not only that agroecology can feed the world, but that there is a present need to reduce pesticide use in order to protect both human and ecosystem health. Currently, innovations in sustainable agriculture are often occurring where these two regimes of knowledge and technique meet, yet there remain concerns about the responsibility[1] of these responses with respect to other societal grand challenges such as food security (Garnett et al. 2013). For the above reasons, sustainable agri-food systems provide an emerging political space for incremental and institutional innovations (Busch 2012; Grin et al. 2010) and as such, offer intriguing empirical terrain for understanding how knowledge, inscribed in specific technologies (particularly standards and business models), emerges, circulates, standardizes and stabilizes into innovative configurations.

[1] Responsibility must be understood both in terms of taking responsibility and being held accountable for actions. Responsibility can also be thought of as responsiveness, which refers to collective responsibility (how individuals become responsive to each other) and ethical choices in practice.

The socio-technical transitions literature has focused on sustainability (e.g., Grin et al. 2010; Markard et al. 2012) and the epistemic controversies of agronomic knowledge (Sumberg and Thompson 2012) that provide directionality to actors' efforts to transition from one type of socio-technical system to another. According to Geels (2004), a socio-technical system is a better way to think about how innovations in material, cognitive and organizational techniques (another way to think about technology) takes place. This is because it considers each technology to be embedded in socio-cultural, political, scientific, technological and economic (user and market) regimes. These regimes can be thought of as the rules and institutions that govern action in any particular sector. According to Geels (2010), transitions take place when novelties leave their niche environments and disrupt the regimes that govern their use. However, this is not a streamlined process. The literature that explores transitions to sustainability tells us that systems are faced with oppositional pressures from path-dependencies and socio-technical lock-ins; innovations must de-link from existing pathways so to re-direct them or create new ones (Geels et al. 2016) and their regulation must likewise accommodate multi-layered hybridity (van Zwanenberg et al. 2013). While early studies traced historical transitions, recent advances focus on the 'anchoring' of technologies, networks and institutions (Elzen et al. 2012) where linking novelties with existing structures and institutions is precarious. These advances offer a means to look more deeply at what are often referred to as local processes, but that are functioning at a meso-scale of engagement between niches and regimes. Specifically, there is an important role for new forms of markets in these innovation processes that intermediate between actors, technologies and geographic spaces (Callon 1992; Loconto and Barbier 2014).

In this article, I explore innovative markets that have been developed by different actors around the world to effectively kick-start the sustainability transition process within specific geographic locales. I focus on the innovative modes of organizing, which are what bring different types of actors together to share old knowledge and create new knowledge that can resolve existing socio-economic and environmental problems and offer new pathways towards sustainability. The focus of this book is on global problems and the local solutions that are offered as means to begin addressing them. This chapter contributes to the discussion as the local solutions explored here offer ideas on where to begin addressing some of the problems in the global food system, specifically in terms of public policy support and partnerships among societal actors. The core thesis of this chapter is that by exploring how different types of actors begin to rewrite how they are supposed to engage with each other, often with the help of intermediary actors whose role is to facilitate the fluidity of interaction, novel forms of organising emerge. These new forms of organisation govern the local transformations in food systems, yet they are nonetheless based on globally circulating knowledge about what can and should be sustainable in a food system. Based on empirical data collected between 2013 and

2018 in 21 countries across 5 continents[2], this article argues that the innovations needed for food system transformation must begin with local engagement. This local engagement, however, cannot and should not be disentangled from the concerns of global food systems as the circulation of knowledge is fundamental to actors' ability to innovate locally.

2. Reframing Innovation: From technology to knowledge about techniques

There is an assumed linear path for innovation that begins with invention (usually associated with an individual, heroic male inventor), follows through technology and product development and design, and ends with commercialization. Following this logic, individual scientists and companies invent, with state investment through R&D funding (patent registration). The private sector commercializes and develops products. The public sector distributes the benefits to all people (to prevent poverty), extension diffuses the new technologies and more broadly, the State manages environmental and social impacts of technology and innovation. Here, civil society is a watchdog that calls out bad technologies or bad practices while the majority of the people are consumers, producers, employees and voters (but not innovators).

However, there is significant evidence of innovation as multi-actor networked paths, rather than linear paths. Based on studies in new and emerging technologies as well as information technology and appropriate technologies, a number of scholars have differently named these phenomena where innovation has become a collective endeavour, with inventors and users collaborating and sharing ideas and information. These have been referred to alternatively as user innovation (von Hippel 1976); co-inventor networks (Breschi and Malerba 2005); open innovation (Chesbrough 2003); open source (Raymond 2001); participatory design (Schuler and Namioka 1993); community innovation (van Oost et al. 2009); upstream engagement (Macnaghten et al. 2005); mid-stream modulation (Fisher et al. 2006); Constructive Technology Assessment (Rip et al. 1995); cooperative research (Kleinknecht and Reijnen 1992); democratising innovation (von Hippel 2005; Felt et al. 2007); responsible innovation (Guston 2006); responsible research and innovation (von Schomberg 2013; Stilgoe et al. 2013); social innovation (Stirling 2008); and grassroots innovation (Smith and Seyfang 2013). Thus, if the process of innovation is not linear, can it also embrace novel uses of old technologies?

One of the most useful innovations has been the 'power tiller'[3] that can be seen in just about every country around the world. What is important about this technology though, is that it is

[2] Research was conducted by the author and with partners in the following countries: Benin, Brazil, Bolivia, Colombia, Chile, China, France, India, Indonesia, Kenya, Namibia, Nigeria, Mozambique, Peru, Philippines, Senegal, Tanzania, Thailand, Trinidad and Tobago, Uganda, United States. We use case examples from only 5 of these countries for this chapter. The full case studies can be found in the following publications: Loconto et al. 2018; Loconto et al. 2016; FAO, forthcoming 2019.

[3] A power tiller – also known as a rotary tiller, a rototiller, an 'iron buffalo', a cultivator, or rotavator – is essentially a set of discs that turn to cut the soil. They are attached to a small engine (typically a 4-stroke engine with between

not used in the same way everywhere, it is a fluid technology (de Laet and Mol 2000). While it was created to enable a single (male) farmer to mechanically till his small fields and thus replace the hoe or the use of animal traction, the use that farmers around the world have found for it often is not restricted only to tilling. The small motor attached to two wheels creates the perfect small-scale engine for hauling a range of humans and objects; thus, expanding its use from the field to the market as it provides farmers the ability to expand their activities from farming into transporting – thus creating more income streams in rural areas. Moreover, the power-tiller meets its users in myriad ways. Because it is not an expensive machine, it can be purchased outright, but it was also introduced through leasing schemes whereby the machine can be rented for a few hours or days at a time. Farmers can also share a machine and either sell or exchange their tilling services. Thus, what was originally thought of as a simple technology turned into knowledge about a range of techniques that famers apply to their use of the machine. This example is indicative of how we need to shift our thinking from technology as a material/technical fix towards a way of knowing a range of practices – which implies that we can change them.

More significantly, however, the innovation literature reminds us that invention is not ordinarily the action of only one individual, but the result of a collective process, 'a journey' (Van de Ven 1999). "An innovation occurs when new ideas, new technical devices or new forms of organisation meet their users" (Joly 2011). Therefore, "innovation is not simply a technology (or a technical object), it must be the reorganization of institutions, organizations, value chains, businesses to enable actors to innovate on their own terms" (Felt et al. 2007). This means that innovation is not simply a new technology, but a new way of doing things.

This same line of reasoning applies to the notion of the market as only the commercialization phase of an innovation process. Instead, we must reconsider the dynamic linkages between innovations and markets. Markets do not serve only to commercialize new products, rather, they are: "the collective devices that allow compromises to be reached, not only on the nature of goods to produce and distribute but also on the value to be given to them" (Callon and Muniesa 2005). The diverse economies literature (Gibson-Graham 2008) focuses on the possibilities for performing new economic worlds by organising enterprise, labour, property, transactions, and finance in alternative ways. Alternative agri-food networks (Goodman et al. 2012; Gritzas and Kavoulakos 2016) are used as examples of how there are alternatives that are constantly emerging, capable of valuing food according to social relations that capture shared understandings (of a community) about the nature, norms, purposes and boundaries of the circulation of that value (Gibson-Graham et al. 2013). In my previously published study (Loconto et al. 2016) of 15 cases of innovations in linking sustainable producers with markets

10-20 horse power) that runs on gasoline, a handle bar and wheels. There are also a range of attachments that can be added to the engine, which enables the use of the engine for a variety of tasks.

from around the world we found that the re-organization of rules and the re-allocation of responsibilities between actors of a particular local initiative provide space for innovation through markets. We call these institutional innovations (Hargrave and Van De Ven 2006), which we define as new situations of interaction according to revised rules, not necessarily new knowledge (or technologies; Loconto et al. 2016). Here, I follow interactionist approaches in sociology (cf. Carr 1945; Znaniecki 1963; Latour 2005) that focus analytical attention on the dynamic relations between actors and the meanings that emerge from these interactions in order to understand innovation as a revaluing of the social relations between production and consumption.

3. Innovating for transitioning to an agroecological future

The recent IPES Food (International Panel of Experts on Sustainable Food Systems) report (2016) clearly outlined the current challenge that we are facing as we try to transition towards an agroecological future. On the one hand, micro-scale farms that produce purely for subsistence cannot meet the growing needs for healthy and diverse diets around the world; while on the other hand, the large-scale, input-intensive, monoculture production systems are not sustainable given the negative environmental, social and economic impacts on the planet. The challenges of climate change are too great for these two systems to remain opposed to each other – both need to move towards diversified agroecological systems. Agroecological food systems can improve productivity both in small-scale and large-scale systems by allowing the agricultural practices to better respond to natural cycles. They can improve livelihoods durably and provide food to local, regional and international markets that meet consumers' preferences for healthy, tasty and culturally appropriate food (Loconto et al. 2018).

Embarking down these transition pathways is a daunting task. There are multiple social, economic, technological and other variables from which to shape locally appropriate strategies that might overcome the challenges of both reducing reliance on high-input models of agriculture and on moving out of purely subsistence models. Gliessman (2015) has proposed four levels of transitions to agroecology that begin with adjustments to conventional agricultural production and end in total system reconfiguration, particularly in terms of how products are marketed and exchanged.[4] Yet each farm and community of farmers begins from a different starting point and along their paths towards sustainability they encounter challenges

[4] The levels are: "Level 1: Increase the efficiency of industrial and conventional practices in order to reduce the use and consumption of costly, scarce, or environmentally damaging inputs. Level 2: Substitute alternative practices for industrial/conventional inputs and practices. Level 3. Redesign the agroecosystem so that it functions on the basis of a new set of ecological processes. Level 4. Re-establish a more direct connection between those who grow our food and those who consume it. Level 5. On the foundation created by the sustainable farm-scale agroecosystems achieved at Level 3, and the new relationships of sustainability of Level 4, build a new global food system, based on equity, participation, democracy, and justice, that is not only sustainable but helps restore and protects earth's life support systems upon which we all depend." (187-88)

from all corners of the socio-technical regimes within which they are embedded. For example, elsewhere (Vicovaro et al. 2016), I have discussed some of the challenges encountered by actors innovating in transitions to sustainable food systems. These can be summarised as the following six groups of challenges:

1. **Gaining access to sustainable inputs** (e.g., seeds, fertilizers, bio-pesticides and labour) is often a challenge for a variety of reasons: 1) farmers do not have the scale necessary to produce enough sustainable inputs on-farm, 2) farmers are not yet fully integrated to be able to close all of their nutrient cycles on their farms or 3) because farmers have very little purchasing power to source off-farm sustainable inputs (such as seeds, productive materials and tools, and labour) due to the cost of the latter.
2. **Satisfying consumer demand in terms of quantity and availability all year long,** because yields decrease in the transition to agroecological production systems and products are not available all year round as many farmers rely on seasonal rains. This is often a challenge for small farmers who do not have enough production to meet the quantities their consumers demand or alternatively large farmers who are not yet diversified enough to meet the variety of consumer food needs. Logistics are also extremely important for creating the new connections between producers and consumers, but the state of current infrastructure poses numerous obstacles for producers.
3. **Providing quality guarantees to consumers**. Determining what qualities consumers want is not easy and being able to provide the information that consumers need to choose the quality that they are seeking is a challenge. The lack of trust between consumers and producers is found across the board and it takes time to build the trust needed to create long-term trading relationships. Sometimes public authorities can help by sponsoring education, labelling and certification schemes, but in some countries the public authorities are also not trusted to provide the guarantee.
4. **Finding the right balance between costs and prices.** How to account for the real costs of sustainable production and how to negotiate prices with different types of buyers and consumers? This is the age-old problem of market making and adding sustainability criteria to all aspects of the food system makes this balance even more difficult to find. True cost accounting, or even more simply farmer knowledge of the real costs of production, are attempts to rebalance price calculations. However, consumers are also used to cheap food, which makes it difficult to renegotiate the price of food.
5. **Strengthening the capacity of farmers** both in terms of sustainable farming practices and in terms of market knowledge because improving the ability to negotiate value is fundamental. A large part of this is figuring out how to ensure dissemination of the basic agroecological principles and confer consistency of practices. In addition, knowledge and access to information is the very first step for improving farmers' power in market

relations, but this is often not enough. Market advantage usually is also a result of strategic timing in the use of knowledge, which requires both experience and often protected spaces of exchange (e.g., with a dedicated group of consumers or government subsidised markets).

6. **How to make these systems sustainable and attractive to the next generation?** We are all faced with the phenomenon of youth exit from agriculture. A number or groups have seriously been thinking about how innovative systems might be better able to attract youth to agriculture. These initiatives try to counter the modernisation movement that focused on reducing the 'burden' of agriculture by reducing the need for knowledge and collective innovation in communities (through investment in technological solutions that reduced the need for labour). Returning to the hand hoe is not a sustainable labour solution to the global problem of rural exodus, but there is a need to create rural spaces that offer opportunities for youth to live well and prosper.

As the above six challenges illustrate, the issues that actors are encountering on their individual pathways to sustainability are symptoms of problems of inequity and power imbalances of the global food system. Rural exodus often comes from the lack of infrastructure in rural areas that better link the rural and urban populations. This same lack of infrastructure makes food transport difficult and causes food losses and quality issues that make customers mistrust local food system actors and opt for imported or industrially produced food. The global domination of input industries means that alternatives are not only difficult to find in poorly connected communities, but that they are also not even explored in local research institutes (cf. Vanloqueren and Baret 2009). While these are indeed major challenges, they can also provide opportunities for innovation as resolving problems in pragmatic ways often opens food systems up to the entry of new actors and recourse to new types of knowledge. The solutions that are proposed are often alternatives to mainstream activities. The following section illustrates some instances of how food system actors are innovating within their local situations with fluid organizational technologies – rather than purely technological fixes.

4. Cases of innovations in local agroecological systems

During the participatory research that informs this chapter, we became aware that some groups of diverse actors (from public, private and civic sectors) around the world are overcoming these challenges by introducing new ideas, new technologies and different ways of working together. Elsewhere, I explain how these activities are aptly described as institutional or organizational innovations (Loconto et al. 2016) since they are novel ways of organizing and governing interaction that are formalised through long-term processes of collaboration. These types of experiences have been important in highlighting where innovations are emerging within agroecological systems.

While agroecological farmers mostly source their inputs from their own production systems, through individual or community farmer-to-farmer exchanges or in agro-dealers, we also found examples of innovation in input markets (Loconto et al. 2018). This means that farmers are increasingly returning to methods of fertilization, seed stock and pest management that rely upon greater farmer knowledge of natural cycles and can be developed without reliance on agrochemicals that are often more expensive and less effective against pests that have developed resistance. For example, Agri Load is a small tech start-up company (2 young founders/employees) who are competent in information and communication (ITC) and Drone technology in Western France. Their business model is to provide pest management services directly to farmers. Using small drones, they can deliver natural predator eggs exactly where they are needed in farmers' fields. For example, some of their clients are maize farmers who have some fields of their farm infested by corn borers. Using the drones that the two young engineers adapted to their needs, they can deliver 2 800 eggs of natural predators deposited throughout the infected fields. Once hatched, the predators live for 3 days and will eat the larvae of the corn borer. The farmers pay Agri Load for this service, which costs 55€/ha of treatment. According to one farmer interviewed by the local press, it is the "same price as a powdered agrochemical product, but without the waste of time."[5] In this case, the used of integrated pest-management has opened up the possibility for small, youth initiated enterprises to be formed in rural areas.

In San Francisco, Recology, Inc. is 100 percent owned by its employees and by creating compost from urban waste it has helped San Francisco to divert 77 percent of its trash from landfills. In addition, Jepson Prairie Organics, a subsidiary of Recology makes four compost blends for more than 200 vineyards in Northern California who buy the blends and use them to feed the soil. Here we see the creation of not one, but a number of social enterprises being formed in a regional agroecological territory.[6] We can explain the innovation system that has since developed to be a result of actors who developed fluid technologies of interaction that could solve their problems and meet their sustainability concerns.

Since its founding in 1985, the Songhai Centre in Benin Republic has been investing in a rural transformation strategy, which they call 'green rural cities' (Agossou et al. 2016). It is a well-established regional training, production, processing, research and development centre for sustainable agriculture that takes a holistic approach to linking producers and consumers in local and national level markets for 'organic' labelled products. The Songhai integrated production model (crop, livestock, aquaculture and biogas production) provides a practical rural transformation strategy by incorporating three key sectors (production, processing and

[5] Alix Demaison, "Un drone pour protéger ses parcelles agricoles", Ouest France, accessed July 8, 2020. http://www.ouest-france.fr/bretagne/morbihan/un-drone-pour-proteger-ses-parcelles-agricoles-4357375

[6] "Welcome to Recology", Recology Waste Zero, accessed July 8, 2020. http://www.recology.com

services) of the economy into a network of five regional training, production, processing and service centres across the country (Kétou, Kinwédji, Savalou, Parakou and Zagnanado). Each regional centre acts as a hub for a network of ex-trainees who are selling their production to Songhai's processing centres. No link functions without a relationship to one or more of the other links and the satellites are governed through a centralised, hierarchical, chain of command that permits horizontal linkages between network members. There is a central procurement and marketing service that organizes the procurement of raw materials for processing and the sales of processed products from the Porto Novo hub. However, each satellite is also responsible for local sales of their fresh produce and artisanal processed goods: 54% of the value of finished products was internal to the network and 46% constituted product sales with a value of US$ 7,040,540, of which the off-farm sales of finished products accounted for US$ 2,579,830 in 2014 (Agossou et al. 2016). The Songhai centre trades only in organic products and enforces its own internal standards for organic agriculture via its training program and through its internal quality control system for the traceability of its products. Over its lifetime, the Songhai Centre has benefited about 152,000 people across Benin and has created a network of over 200 partners around the world, through which it maintains strong international and multidimensional relationships that contribute to the investment in this model.

The innovations in connecting smallholders to markets and re-localising markets for agroecological products are strategies aimed at diversifying the types of exchanges, the quantity of market channels (an average of 8.3 per initiative) and ensuring fair prices for both producers and consumers (Loconto et al. 2018). A French national randomised survey conducted in 2013 found that 42% of respondents purchased a product in a '*circuit court*' (short food supply chain) during the preceding month, with a food basket worth 25€/week.[7] This is a trend that is emerging around the world with specific local variations. In the Grabels[8] market (Food Assemblies), a research-municipality-producer-consumer led initiative developed a color-coded labelling system (Ici.C.Local)[9] to identify labels for the different distances the products travelled and they reduced competition between producers by ensuring the diversity of products for sale (Chiffoleau and Loconto 2016). Another French initiative « La Ruche qui dit Oui! »[10] is using the internet to link-up local producers and consumers in a way commonly known as food assemblies. The model works as follows: The supplier produces and transports food to a locality temporarily "let" to them (café, cultural or community center) for the 2-hour

[7] "Circuits courts : qu'en pensent les français ?", Great, accessed July 8, 2020. http://www.gret.org/2014/06/circuits-courts-quen-pensent-les-francais/

[8] A small town within the Montpellier metropole in Southern France.

[9] Translation: Here is Local, accessed July 8, 2020. http://iciclocal.fr/

[10] Translation: The Bee-hive that says Yes, also known as Food Assemblies, accessed July 8, 2020. http://www.laruchequiditoui.fr

long "assembly". The supplier travels only if a minimum chosen amount is ordered. The Ruche-Manager (the person who organises the local pick-up point) finds diverse suppliers, communicates to potential local customers, manages assemblies (weekly), organizes events and manages the Ruche mini-website. The Ruche-Mama (the central management for the website of the whole initiative) manages payments and overall website design, assists and selects Ruche implementation, offers tech-support and communicates socially and institutionally. Finally, the customer orders online and collects produce on the day of assembly. The Ruche model can now be found across Western and Southern Europe. These two examples demonstrate how actors are changing the rules of distribution, which combined with information technology (labels and the internet) are enabling consumers to become more engaged with producers.

In this final set of examples, we can trace strong linkages between innovative organizational rearrangements that are revitalizing traditional knowledge and techniques related to farming and cooking. In Colombia, Familia de la Tierra (FdlT) in Bogotá is linking gourmet cuisine and tradition in a collaboration between the National University, Psychiatric Hospital, producers, the Culinary School and 17 gourmet restaurants to rehabilitate 'lost' native varieties (beans, yacón; Nieto 2016). With more than ten years of experience, the FdlT network is a private Colombian initiative of agroecological production and processing that takes a holistic approach to strengthening agroecological production systems through marketing management and promoting local and ecological products such as tomatoes, maize, beans, pumpkins and potatoes. The network integrates 20 social organizations of agroecological producers from across Colombia and includes about 100 peasant and indigenous families in different regions and territories. The initiative began with the idea of taking on and confronting the political, socio-economic and environmental challenge that producers face in the transition from conventional agriculture practices to ecological ones. The FdlT model places importance on the value of work in the production and conservation of native seeds; the production of organic fertilizers (research and testing of new organic inputs); agroecological food production; processing into speciality products; marketing; and, more recently, research projects (participation in projects with universities and national and international institutions). The business philosophy focuses on making the work of family farming visible and generating awareness in producers, consumers and other intermediaries about agroecological practices. FdlT promotes the idea that integrating agroecological products into daily marketing and consumption practices will not only generate good health but will also encourage alternative consumption practices that are in line with the environmental and social dimensions of the food system (coherence between what consumers want and what they do, solidarity with small farmers, etc.). The decentralized organization of the FdlT network redefines the concept of a food chain formed by separate links where traders gain the greatest margins. Instead, the economic system must be reorganized into a cyclic and integrative system whereby all actors

benefit from exchanges with others and where farmers can be engaged in a range of activities in the food system (Loconto et al. 2018).

In Trinidad & Tobago, the Brasso Seco Tourism Action Committee (TAC) engages in continuous investment, new ideas, new products, new events in order to value old traditions, thus bringing the market into their community (Waithe 2016). The Brasso Seco community first developed their TAC with Government support in 1997 by organizing an annual festival of indigenous cuisine that is still celebrated today. Over the years, the Brasso Seco Paria TAC increased their activities through the creation of eco-tourism. More recently, they began a process of rehabilitating an abandoned coffee and cocoa plantation and started an agrotourism initiative. Subsequently, an agrotourism facility was set up to provide lodging in the community for tourists, enabling direct interaction between members of the community and tourists, who brought a market into the community by participating in local traditional events like the food festival and the traditional 'cocoa dance' that is a 'old' technology (human feet) used to grind the cocoa beans, and purchasing local food products. Innovation in the Brasso Seco community is driven largely by three factors: 1) the need for the villagers to earn money, 2) a communal desire to preserve the rural agro-heritage and 3) the will to increase local productivity through youth participation and entrepreneurship. To date, the majority of income earned by the Brasso Seco TAC is derived from agroforestry and agritourism and the community activities ensure there are employment opportunities in the community. The community focused business model developed by Brasso Seco TAC shares benefits fairly and enables all villagers to exchange products.

Finally, in Bolivia, there has been a multi-level public policy approach to promote the use of participatory guarantee systems (PGS) to ensure sustainable agricultural practices, registration of these PGS with the Food Safety Authority and the acceptance of the PGS certificate for inclusion in school feeding programs (SFP) that source traditional products directly from local farm families that practice traditional camelidos/quinoa production systems (Chambilla Silva and López 2016). In Tarija province, the system works as follows. The SFP is framed in the Complementary School Feeding Programme (ACE [*Alimentación Complementaria Escolar*]) and its management is the responsibility of the municipality and its local and regional governments. This means that each municipality defines its ACE according to available resources, food availability, nutritional requirements, geographic location and other factors. This is the case in Yunchará municipality where 100 percent of schools have access to ACE. It provides breakfast and lunch for 38 schools and had more than 1 380 final beneficiaries in 2015. The local government has prioritized school feeding and the reduction of malnutrition – malnutrition in the municipality over the last few years has been reduced by 15 percent. The government has started to use local procurement with products derived principally from local small producers and processors in support of efforts to promote quality, freshness and accessibility. The

principal local products in Yunchará are *api* (traditional Bolivian drink from the central valley based on ecological purple maize); *tojorí* (traditional *altiplano* drink made from maize); amaranth and broad bean cakes; and a chocolate and milk drink made from broad beans (*Nutrihaba*; Yunchará is the only Bolivian municipality that processes broad beans into these kinds of product). Other products are quinoa, flour, *charque* (dry llama meat), honey, oil, sugar and rice. The government has managed to improve children's food not only with dried and processed food but also with fresh fruit and vegetables. In 2015, 80 percent of schools were supported by ecological gardens that supply them with vegetables. Inputs were also given to about 30 families with children at school for the production of chickens and eggs, and for family gardens. Families in Yunchará are also helped to use and consume products: they are given menus and have technical assistance in nutritional aspects that help them to cook food better and use fruit and vegetables that are acceptable to students (Loconto et al. 2018).

As these examples demonstrate, innovation through new market channels and networks is an effective way to develop and strengthen agroecological systems. Such innovation is often about identifying leverage points within the wider agro-food system and configuring appropriate interventions (socio-technical, economic, ecological and cultural) in order to ensure its sustainability. In order to enable local actors to make changes in their systems from their different vantage points we need to support a more holistic vision of the agro-food system. A circular economy is not only the idea of a local, closed or protected system (cf. Gregson et al. 2015) – but it is the facilitation of interactions that enable the knowledge, goods and services to circulate within networks of actors and markets so that all resources are used to the most sustainable extent possible.

5. The future of innovating in food systems transitions

So how then can we innovate in food systems transitions? Beginning in 2013, FAO and INRA have been convening a group of innovators – or innovation intermediaries – from across more than 20 countries. During the initial study, the analysis highlighted the catalytic role of innovation intermediaries, who are people or organizations that take up a new role within the system, stimulate learning processes and change the rules and routines of themselves and other partners (Loconto et al. 2016). These actors created the innovative linkages between production and consumption that were mentioned in the above cases and were highly influential in stimulating and maintaining system changes over time. The learning that the research team developed through this process was that while these actors are innovating in their own local contexts, in order to scale up their efforts so that others can join them on the pathway toward more sustainable food systems they needed to have opportunities to learn from other innovation intermediaries working in very different contexts (and in different countries) and with different means to support their work to try to develop advice, or tricks of

the trade, regarding organizational aspects that have proved challenging in navigating system change.

While most work must be done in each specific context, the 2016 FAO study on institutional innovations found that there is a very important role for policy makers in facilitating the emergence of these types of innovations. What is needed is a paradigm shift where numerous elements of agri-food systems are realigned along innovative pathways towards more sustainable production and consumption patterns. Specifically, the following six 'Re-s' of policy support that can (re)value agroecology across many different contexts and levels are good starting points for catalysing agroecological transitions.

1. **Re**cognize existing agroecological markets by facilitating the registration of agroecological farmers with trade and food safety authorities according to appropriate standards
2. **Re**vise input subsidy schemes to include agroecological and biological inputs (or remove subsidies altogether) and provide financial incentives for creating small-scale agro-enterprises
3. **Re**form research and extension programs in order to include agroecology and enable more flexible collaboration and experimentation with producers, private and civic actors
4. **Re**invest in agriculture through public procurement from agroecological producers by adapting the procurement protocols to the local realities of agroecological production (e.g., informal trading relations)
5. **Re**create public spaces for agroecology by providing public facilities that can be used to host farmers' markets, fairs and festivals for agroecology
6. **Re**search, via participatory methods, the innovative markets for agroecology and sustainable agriculture in order to better understand how they contribute to sustainable agriculture and food systems

6. Conclusions

Based on the recent research presented in this article, it is clear that markets for agroecology exist. We find them nested in territories where they take diverse forms and promote diversification of production and consumption. They are innovative and focus on closing the gaps between the concepts of rural and urban populations and between producers and consumers that have been built through modernization processes. These innovations are based on trust and direct relationships between producers and consumers. They experiment with different ideas and there is a snowball effect to these experiences where new outlets and new stakeholders are brought into the networks. While consumers are increasingly becoming aware of the benefits of agroecology, there is a need for more information for both producers and consumers on what agroecology is, why indigenous seeds are important and the benefits of

agroecology for both producers and consumers. Therefore, these innovative models include knowledge sharing and education among producers, consumers and intermediaries. There are nonetheless challenges, particularly related with food safety regulations, which are very difficult to meet because they are not suited to the reality of agroecological farmers, social innovation or innovative markets.

Around the world we are beginning to collect data that demonstrates actors' capacities to reach Gliessman's (2015) 4th level of transition. This means that we have documented closer relationships between producers and consumers across a range of activities in agri-food systems. We also see that there are spill-over effects into the development of sustainable lifestyles for urban people, but we are not yet at the 5th level – which would be the desired paradigm shift. The experiences documented in this article demonstrated that these innovations can play a key role in local level changes that can contribute to global food system transformation and these initiatives need to be integrated into the networks that are also advocating for policy change and conservation of native seeds and landraces. Getting consumers to support this work is what is exciting about these innovations; the movement of people out of the passive role of simply consuming food towards an active role in changing how and why producers and consumers interact provides new opportunities for employment, lifestyle change, leisure and knowledge that have the possibility to defy capitalist logics (Boltanski and Chiapello 1999). However, it is important that agroecology does not become co-opted by market logics and actors that often work to distance producers from consumers, with the effect of eroding trust in the quality of goods that are exchanged (Fouilleux and Loconto 2017). Thus, care should be taken in engagement with different stakeholders and as scientists, we need to better understand the business models that are the most adapted to the principles of agroecology. Without this element, the fifth level of transition will remain elusive.

The Dutch philosopher of science, Anne Marie Mol, once wrote that: "In travelling to 'unpredictable' places, an object that isn't too rigorously bounded, that doesn't impose itself but tries to serve, that is adaptable, flexible and responsive – in short, a fluid object – may well prove to be stronger than one which is firm" (de Laet and Mol 2000). Seeking fluid, rather than solid, technologies to help us transition to agroecological food systems should be a priority for all of us. We should be actively thinking about the types of technologies and innovations that are best suited to agroecological food systems and that we should work towards ensuring that these are the ones that we promote because they will be the ones that enable us to transition to an agroecological future.

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