Scaling-up Sustainable Development Initiatives: A Comparative Case Study of Agri-Food System Innovations in New York, Senegal, and Brazil

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Abstract

To effectively implement the 2030 Agenda for Sustainable Development, decision-makers at different levels of government worldwide will have to get a handle on three key challenges: learning from Global North and South initiatives in tandem, taking stock of social innovations alongside technological fixes, and nurturing grassroots sustainable development initiatives next to, or in place of, top-down corporate and government projects and interventions. Current scientific literature and grant-making institutions have often reinforced the compartmentalized fashion in which we learn and draw policy lessons from North/South, social/technical, and bottom-up/top-down sustainable development initiatives, including local food system innovations. The strategic levers for global sustainable development lying in-between are thus left out. This paper addresses this omission by concurrently examining North and South American as well as Sub-Saharan African sustainable development initiatives in the domain of city-regional food systems through the prism of theories of socio-technical transitions.

Our analysis provides insights into how grassroots innovations in profoundly different socioeconomic and geographic contexts are driving system-wide transformations and transitions toward climate adaptation, resilience, and sustainability in the agri-food system. New forms of agriculture and alternative urban-rural linkages developed in the New York metropolitan region are examined together with innovations put forward by the Brazilian Landless Movement (MST), and the Ecovillage Movement of Senegal. We focus specifically on how the former is delinking from agribusiness and transitioning to agroecology, and how the latter is constructing alternative forms of grassroots sustainable development, drawing from West African village life and new green technologies. We discuss the implications of these transitions for multiple domains of sustainable development, with an emphasis on the relationship between ecological and public health and social equity. The joint analysis of the three cases offers also lessons on the key factors that have enabled grassroots innovations to scale up as well as the unique features of each transition pathway. The findings of this paper would be of value to scholars, government officials, and community groups engaged in transitioning agri-food systems to sustainability and interested in the processes of change that have allowed budding innovations to stabilize and scale up.

Keywords: sustainable development, alternative agri-food networks, transition theories, grassroots innovations, socio-technical systems, agroecology, ecovillages, social movements

1. Introduction

Why can some sustainable development projects scale-up and others cannot? Sustainability transitions are difficult as socio-technical systems like energy, transport, housing, and agri-food are stabilized by lock-in mechanisms that relate to sunk investments, behavioral patterns, vested interests, infrastructure, subsidies, and regulations. Sustainability transitions imply the transformation of these wider technical, social, and economic systems and occur through the emergence, alignment, and scaling up of radical socio-technical innovations.

This research seeks to shed light on the multi-level factors that contribute to the effective scaling up of sustainable development projects. Our goal is to identify possible transition "levers," at multiple levels of community food systems and in multiple sociotechnical domains, that may be used to support and guide the effective scaling up of sustainable development initiatives. The aim of this paper is thus to provide theoretically-informed practical recommendations for policymakers seeking to steer community-based sustainability transitions and reform food system governance through, rather than despite of, grassroots innovations. To effectively implement the 2030 Agenda for Sustainable Development, decision-makers at different levels of government worldwide will have to get a handle on three key challenges: learning from Global North and South initiatives in tandem, taking stock of social innovations alongside technological fixes, and nurturing grassroots sustainable development initiatives next to, or in place of, top-down corporate and government projects and interventions

Socio-technical transition studies focusing on community-driven transitions are still limited. There is, however, a growing body of work focusing on "grassroots innovations" and their contribution to different facets of sustainable development (Seyfang and Haxeltine 2012; Hielscher, Seyfang, and Smith 2013; Monaghan 2009; Kirwan et al. 2013; Seyfang and Longhurst 2013; Smith and Seyfang 2013; Seyfang and Smith 2007; Feola and Nunes 2014). Given that, to implement the 2030 Agenda for Sustainable Development and the 17 SDGs, top-down approaches would hardly suffice or even be appropriate, who should be in charge of sustainable development transitions is a question in need of urgent investigation. Unsolved dilemmas regarding role of different societal domains – government, market, civil society, and all intermediary organizations in between – as well as the relationships between efforts to scale up sustainability innovations in Global North and South countries warrant new approaches to the study of grassroots innovations.

To fill this gap in current sustainability research, we undertake a comparative case study, exploring sustainable development efforts from the Global North and Global South that are transforming wider technical, social, and economic systems. The first case we examine is the Brazilian Landless Movement's (MST) transition to agroecology (ecologically informed sustainable agriculture) focused in the South of Brazil. A group of MST cooperatives have developed one of the most extensive systems of agroecological production globally. The second case we present is the New York City's food movement – a vast and heterogeneous movement of movements which, over the past two decades

has advocated for food justice, health equity, environmental sustainability, and fairer labor practices throughout the urban food environment and the food chain more broadly. Lastly, in our third case, we focus on the Ecovillage Movement of Senegal, which is constructing alternative forms of grassroots sustainable development by drawing from West African village life and new green technologies.

This comparative analysis of grassroots sustainable development initiatives calls attention to the coevolution of the different niche, regime and landscape pressures and the shared transition levels in each case. We identify crosscutting themes that point to important dimensions of sustainability transitions in each case. We conclude with a systematic summary of the main lessons learnt and outline a set of key recommendations for government officials and policymakers who wish to leverage the innovations emerging from grassroots social movements.

2. Theoretical framework

Radical transformations of systems of provision – such as food, water, and transportation – are best understood as the outcome of both social and technological innovations. Neither engineers alone nor policymakers or non-expert citizens can singlehandedly shift an infrastructure to a more equitable or sustainable regime of operation. Rather, it is the concurrent interplay, and alignment, of changes in multiple societal domains that can, under certain circumstances, bring about radical system transformation. Technological innovation examples such as cellular phones and personal computers are well known as are social innovations such as microcredit loans, sharing economies, community-owned renewables, and food cooperatives. We argue that both social and technological innovations are fundamentally socio-technical, and that this view is essential if we are to steer, rather than simply react to, socio-technical transitions in the near future.

But what helps innovations endure, scale up, and transform mainstream institutions, infrastructures, and social norms? Transition theories such as the multi-level perspective (MLP) (Geels 2002; Geels 2005) provide some cues into that. The strength of this perspective lies, in fact, in the integration of social and technical understandings of sustainability transitions and the emphasis on multiple levels of stability, or path-dependency, of a socio-technical system. In brief, according to the MLP, socio-technical *regimes*, which are locked in and stabilized through mainstream infrastructures and institutions, can change when there is an alignment between a disruption (e.g., climate change, peak oil, obesity, economic recession) in the *landscape*, the highest level of system stability, and the level of *niches* of grassroots innovations which offer solutions to such disruptions and a promise for a reinstated stability. We extend the MLP framework by embedding it in a spatially informed understanding of political economy, while simultaneously focusing on the agency of the collectivities constructing sustainable development initiatives.

3. Research methods

We utilize qualitative data collection and analysis research methods to gain an in-depth understanding of each case and conduct a comparative analysis. We conceived each of the cases as exploratory case study (Yin 1994). The MST and Senegalese Ecovillage Movement cases rely on ethnographic research including visual ethnography, photo-

elicitation techniques, filming and participant observation. The New York City food movement case relies primarily on secondary data sources and the analysis of peer-reviewed articles, government reports, and policy evaluations by nongovernmental organizations. Unstructured interviews with academic experts, government officials, and practitioners provided further insights into the key issues and turning points in each transition process. The extended MLP framework guided the transition analyses and thematic coding and analysis methods were used to identify shared themes across the cases. The final set of themes, or transition levers, were identified through discussion between the two authors and comparison of intermediate findings on each of the three cases.

4. Cases overview

MST agroecological cooperatives

From its modest roots in Southern Brazil, the *Movimento dos Trabalhadores Rurais Sem Terra* (Landless Rural Workers Movement, or MST) gradually grew into the largest nationally based social movement in Brazilian history and is widely recognized as the most organized, dynamic, and influential mass movement in Latin America today (Kay 2001, Robles 2001, Branford and Rocha 2002, Karriem 2009). Through organizing landless families to occupy unproductive agricultural land, the MST has pressured Brazilian governments into enacting the Constitution and redistributing more than seven million hectares of unproductive agricultural land on which one and a half million members are now growing food (Karriem 2009).

The MST has developed some of the largest scale agroecological systems on the planet. MST cooperatives have used agroecological techniques to delinked from agribusiness and banks, produce more food at a higher quality and lower cost, and recuperate their soils. Perhaps most notably is The *Grupo Gestor de Arroz* (Rice Management Group) in the South of Brazil, which has created several intertwined cooperatives bringing together 501 families, across 16 municipalities, who are cultivating rice using diverse agroecological methods. The democratically owned and managed *Grupo Gestor* stores, processes, packages and markets an estimated 500,000 sacks of rice per year, over 5513 hectares in several regions of the state of Rio Grande do Sul. In addition to internal organization (including building large scale food processing plants), at the core of the scaling up of the *Grupo Gestor* has been the construction on institutional markets, which the Movement has worked to create at every scale through agreements and through policy. The Grupo Gestor provides 1000’s of livelihoods and provides food for families, the region, government institutions around the Country, and for global export. They have built a large scale, horizontal and democratic food system, demonstrating that agroecological methods are an effective option for peasant farmers to stay on the land and feed their regions. While there are numerous agroecological settlements and cooperatives in the MST, here we focus on the *Grupo Gestor* in the context of the wider Movement.

New York City food movement

The New York City food movement – a vast and heterogeneous movement of movements which, over the past two decades has advocated for food justice, health equity, environmental sustainability, and fairer labor practices throughout the urban food environment and the food chain more broadly. While the city’s food system is far from

having radically transitioned to sustainability, it has effectively been reconfigured – both in institutional and physical infrastructure terms. Today, New York City has a dedicated Mayor's Office for Food Policy, has released over twenty different reports on food policy-related matters (Freudenberg et al. 2018), issues yearly food metrics reports, and has made the right to free lunch accessible to all public-school students in the city. The city has also witnessed the scaling up of many innovations in its local food system: it has more than 900 food producing gardens, over a dozen rooftop farms, more than 140 farmers markets (with more than half in high-poverty neighborhoods), a pilot curbside food scraps collection program already reaching to over 1 million people, a network of more than one thousand upstate farmers engaged in sustainable watershed management practices, and is in the processes of developing its first regional food hub.

Senegalese ecovillage movement

The Senegalese Ecovillage Movement brings together hundreds of villages in a heterogenous network that seeks community-led development by taking the best of West African Village life and combining this with green technologies and recuperation of soils and forests. Movement leaders assert they have flipped the Northern ecovillage model on its head, saying that West African villages already have strong community, cooperation, and spiritual systems that link them to nature - but that they need green technologies. The Movement began in the traditional fishing village of Yoff in coalition with the Ithaca Ecovillage and the third international EcoCity Conference which was held there in 1995. Through the internal successes of what became EcoYoff, the ecovillage framework began to spread organically to villages in ecologically diverse regions of Senegal. Government officials, including a President, took note in the early 2000's and launched the Ministry of Ecovillages (which later became the National Agency for Ecovillages (ANEV)) with the project of transitioning half of the country's 28,000 villages into ecovillages. With this institutionalization, funds from the UNDP and other international donors became available, creating a split in the Movement. The complex network now has a wing linked to the government and a wing focused on grassroots community led development (although also linked with international donors). Although the goal of 14,000 villages remains distant, hundreds of villages are adopting aspects of the African ecovillage model, often in coalition with ANEV or NGO's, creating one of the most successful grassroots development efforts on the continent. The model is spreading to neighboring countries such as Mali and DRC.

Villages have developed projects as diverse as: solar power grids; extensive permaculture gardens; biogas and solar cookers not reliant on scarce wood fuel; reforestation; reintroduction of dry crops such as millet, and; water pumps and tanks that extend growing seasons. According to the UNDP (cite), in at least one ecovillage, years of outmigration have reversed as young people return to new opportunities in villages.

5. Results

The cross-case thematic analysis led to the identification of eleven main crosscutting themes which we argue offer insights into possible levers for socio-technical transitions to sustainability.

Reframing innovations as political tools

A key tenet in the MLP on transitions is that regime actors perceive the radical niches of innovation as advantageous and consequently take action to transform current institutions and practices. This need for compatibility between mainstream and innovative practices poses a paradox but is also a key lever for transforming entrenched sociotechnical systems such as energy, food, and housing. Successful transition initiatives in each of the three cases examined have been able to take advantage of this by effectively reframing the social benefits (or the challenge) their innovation is a means to addressing.

MST (Landless Rural Workers Movement): The MST has challenged the assumption that large-scale, chemical intensive industrial agriculture is the only, or the most efficient way to feed the world – and that the peasant farmer is outmoded. Through their practice they posit that the peasant farmer is the best steward of the land for intergenerational use, and that agroecological cooperatives such as the *Grupo Gestor* can provide high quality, low cost food for their regions, provide livelihoods, and recuperate the earth. Agroecological methods are referred to as technologies which intensify soil, social and political capacities. The MST has reframed agroecology as a *political tool* for peasants to stay in the countryside. Hannah Wittman (2008, pp 120) has theorized the MST project as Agrarian Citizenship, in which 'political participation, local food production, and environmental stewardship redefine the ongoing constitution of the relationship between land, state, and rural society'.

NYCFM (New York City Food Movement): Many of the successes of the New York City food movement are attributable to the timely and effective reframing of the key issue at stake and how it links to the highest priorities on the mayoral agenda. Examples include the reframing of urban agriculture as a tool for social justice (Reynolds and Cohen 2016), environmental and nutrition education, and green infrastructure for climate resiliency; the re-envisioning of farmers markets as a tool for community development and public health; and sustainable regional farming as a tool for safeguarding the city's drinking water. The reconceptualization of food as an urban system and of food justice goals as part of the responsibilities of local government are arguably two of the most consequential shifts in narrative.

SEN (Senegalese Ecovillage Movement): This Movement has reframed the notion of ecovillages coming from the global north – and in the process also reframed ideas of West African rural development. The Movement seeks community-led development by taking the best of West African Village life, and combining this with green technologies and recuperation of soils and forests. Movement leaders assert that Northern ecovillages are often focused on creating community and ecologically viable worldviews and spiritual systems. African villages, they argue, already possess these social and cultural resources, and seek to bring in 'clean modern technologies to uplift living conditions' (interview with Ousmane Pame, July 2016) while recuperating the environments upon which villages depend. Leaders report that the holistic framework of ecovillages is highly resonant with West African traditional worldviews, and provides an effective tool for development that respects traditional village culture while opening to the world and introducing technology.

Openness to experimentation

Transitions are complex, coevolutionary processes defying any attempt to plan and implement them in a linear fashion. Successful grassroots innovations and movements, as those discussed in this paper, have been able to circumvent this challenge by remaining open to new ideas and experimentation and timely making adjustments in response to changing socioeconomic and political conditions, or internal struggles.

MST: Early in the Movement's history, MST leadership implemented cooperatives based on the Cuban Model of agricultural modernization, cultivating monocultures with investment into machinery and chemical inputs. Many early settlements failed, due to high costs and increasing debt on equipment and chemical packages, difficulties in accessing markets and credit, and soil deterioration. A grassroots rebellion in the Movement forced the leadership to adopt more open-ended approaches, with settlements taking initiative and following multiple pathways towards effective production and livelihoods (Karriem 2009). Through successful experiments at the settlement level, and later regional level with the *Grupo Gestor,* agroecology emerged as one of the most effective new pathways, and was adopted as a pillar of the Movement in 2000. The open-endedness of agroecology itself, which proposes the holistic engagement of constellations of social and ecological relationships, has provided a fluid and agile tool for innovation and scaling up.

NYCFM: In New York, examples of the openness of food system entrepreneurs and policymakers to experimentation include pilot initiatives to test different models of curbside composing, demonstration urban farms at a public housing sites, forging new links between local farmers and preschool centers, nutrition assistance call centers, and online school food programs enrollment. Examples in the nongovernmental domain include developing alternative, healthy school food meal deliveries (e.g., Red Rabbit), pop-up drop-off sites for food scraps (e.g., Lower East Side Ecology Center), green jobs for youth through green roof construction (e.g., Green Bronx Machine), youth-managed farmers markets (e.g., GrowNYC), and the conversion of industrial buildings' rooftops into food-producing farms (e.g., Eagle Street Rooftop Farm).

SEM: The ecovillage framework was initially adopted by a village being surrounded and subsumed by Dakar which had been sprawling since at least the 1970's, to defend livelihood and culture. This framework set the foundations for innovative responses, outside of both traditional village modalities as well as mainline development pathways. Village leaders express how the ecovillage model provides a framework to engage the interrelations of culture, economy, technology and environment, to promote materially and culturally better ways of living over the long term. The ecovillage framework they say is not prescriptive, but orients innovative approaches to protracted problems. For example, the ongoing issue of food insecurity is being addressed the village of Mbackombel through installing solar powered micro grids. Among numerous other benefits, this grid powers pumps to store water, and thus expand the growing season, create new permaculture gardens, reforestation, and fish ponds. It also frees up young girls charged with getting water to go to school.

Partnerships and coalition building

Coalition building is essential for the alignment and scaling up of niches of innovation. Links between participants with different powers and roles across government and

market institutions are also key for the translation of niches' value in terms that can be seen as advantageous by mainstream actors in the socio-technical system.

MST: MST settlements, and the Movement as a whole, realized early on that they needed partnerships to survive politically and physically – as a movement challenging existing patterns of private property with direct links to the colonial era. The development of the agroecological systems of the *Grupo Gestor* has been accomplished through partnerships with universities, agronomists, religious organizations and other organic farmers, among others. Beyond this, creating new markets required partnerships with city and state governments, other social movements, and technical support. The MST was a founding member of the global network Via Campesina, the world's largest social movement. Via Campesina has transformed global debate on food and agriculture, introducing democratic principles. Their idea of food sovereignty asserts the rights of peoples to define and control ecologically sound food systems, rather than the demands of international commodity markets and corporations.

NYCFM: While the food movement in New York City is effectively a movement of movements and largely diverse and fragmented, partnerships have played an important role in both stabilizing grassroots innovations and influencing mainstream businesses and policies. Examples of coalitions include the NYC Community Gardens Coalition which was key in preserving community gardens threatened from development, the now defunct Brooklyn Food Coalition, the New York City Coalition Against Hunger, City Harvest and its Community Action Networks, and the NYC Agriculture Technology Collective, among others. Cross-sectoral coalitions such as the New York City Food and Fitness Partnership, a collaborative effort between City Harvest, Brooklyn Rescue Mission, and Transportation Alternatives have also been essential in scaling up school food and food access initiatives throughout the city. The City is also part of the cross-city Urban School Food Alliance (established in 2012) together with Orlando, Dallas, Miami, Los Angeles, Chicago, and Fort Lauderdale.

SEM: The ecovillage movement was born out of partnership with Northern ecovillages in the US and Europe – as well as the Global Ecovillage Network. These exchanges continue, bringing the strengths of the African and Northern experiences to bear upon each other. The Ecovillage framework was at the center of the development of several coalition organizations, including the Senegal Ecovillage Network, GEN Africa, and village led NGO's such as REDES, which coordinates the development of five regional villages. Ecovillages work with international organizations, such as the UNDP, Gaia Education, and IFAD, as well as the National Ecovillage Agency (ANEV), which is discussed below, making a new more engaged and effective relationship with the Senegalese state.

Environmental pressure and drive

MST: Most farmers and settlements transitioned to agroecology in great part as they were not able to produce on highly degraded land which was redistributed through the state and federal government. This was coupled with health complications from pesticide use (especially among children and those in the fields), the high costs of purchasing chemical inputs as well as the high cost of interest through public and private banks. These dynamics conditioned settlements to look for alternatives to improve soil health and intensify soil capacity. Agroecological techniques made it possible to recuperate

soils through soil intensification, while delinking with expensive chemical inputs and farmers report improved health conditions.

NYCFM: Social justice and environmental concerns, rather than economic development motifs, have been at the heart of most threads of the food movement in New York City as well. Derelict and dilapidated urban spaces in the late 1970s triggered community groups organizing to convert them in quality green spaces. Most recently, the deepening health inequalities between New Yorkers of different socioeconomic status have also been a central driver for food justice activists and community food system innovations such as affordable Community Supported Agriculture (CSAs) (e.g., Corbin Hill Farm) and farmers markets. Additionally, the urban agriculture movement has gained further support in the aftermath of extreme weather events (e.g., Hurricane Sandy) and risks of flooding and environmental degradation.

SEM: Villages face dire environmental conditions, which are intertwined with difficult social conditions. In the north of the Country, the Sahara is arriving where forests existed 60 years ago. Deforestation by colonial powers, villages, and companies have left impoverished landscapes. Organizations such as USAID and the Chinese Government have advocated and subsidized chemical and water intensive rice production, for sell nationally and for export, poisoning rivers and mining soils. This constellation of factors has impoverished villages and contributed to hunger, outmigration and social breakdown. A key dynamic of successful ecovillages has been recuperating the local environments on which they rely, particularly through improving and intensifying soils and through reforestation.

Affecting policy

MST: A key explanatory factor for the success of MST cooperatives in transitioning to, and scaling up, agroecological systems, has been their ability to affect and create policy at municipal, state, and federal levels. Perhaps most important has been creation of policy for institutional markets, guaranteeing large purchases of food from family farms (such as the Food Acquisition Program (PAA) discussed below), for which organizations like the Grupo Gestor are well placed to provide. The Movement has worked with state governments to transform the industrial bias of agricultural support. For example, in the State of Rio Grande do Sul, subsidies were put in place for support of organic and agroecological farming, including organic fertilizer, technical support, and infrastructure such as irrigation - and support for building local markets. The Movement also has affected state and federal educational policy, building government funded technical schools with specialties in areas such as agroecology and cooperative management.

NYCFM: Over the past two decades, the different strands of the New York City food movement have been able to reconfigure part of the local food system regime through concerted and sustained activism and coalition-building. Community groups have effectively prevented community gardens to be sold out for development in the 1990s and, more recently, the NYC Community Gardens Coalition saved nearly 70% of the community gardens which were threatened by affordable housing development. Other policy changes include the FRESH incentives for new supermarkets in underserved areas, the Zone Green amendment incentivizing rooftop greenhouses, the introduction of universal free lunch for all public-school students since 2017, the increase of the minimum wage for fast food workers, the introduction of food procurement standards for

city agencies, the ban on trans fats, and the requirement for calorie and sodium labeling for chain restaurants.

SEM: The expansion of the Ecovillage model has been driven both through the grassroots, as well as through government initiatives which villages both inspired and participated in building. Perhaps most important was the development of the Ministry of Ecovillages, following a visit of by the Country's President to a series of ecovillages in the late 2000's. This Ministry was set up with the task to transition half the country's 28,000 villages into ecovillages. A few years later, this project was moved to a new National Ecovillage Agency (ANEV) under the environment Ministry. ANEV seeks to involve and support the villages with development assistance that villages request. This includes interventions such as implementing solar power, providing seeds, infrastructure for irrigation, and technical support.

Creating new markets

MST: Foundational for the scaling up for MST agroecological systems has been the creation of institutional markets at every scale, through direct agreement and through policy. Perhaps the most notable policy has been the Food Acquisition Program (PAA) which requires municipal governments to procure up to 30% of their food from family farms for city operations. Other institutional markets include the military, universities and prisons, and importantly the National Program for School Meals (PNAE). Some cooperatives and organizations, such as the *Grupo Gestor*, also process and package their own brands (rice, milk, sauces, etc) which are available in MST stores, grocery stores, and are exported. Farmers markets, organized in partnership with city governments and other institutions, and with other organic farmers, have emerged as critical spaces for MST farmers to gain dignified livelihoods by selling their production directly to consumers.

NYCFM: While far from replacing mainstream food production, procurement, retail, and disposal, the multiple streams of food justice activism in New York City have effectively reconfigured the market place. There are over 140 farmers markets, multiple links between the city's over 900 urban gardens and farmers markets, dozens of CSAs (including CSFs for fish), food coops, farm to preschool programs, and new regional food hubs (e.g., Lucky Dog Food Hub) now in operation. The pilot city compost collection and recycling program has also effectively been scaled up to now reach over 1 million New Yorkers. Other new businesses related to food waste, such as the recycling of used cooking oil into biodiesel have also changed the local food and energy market (e.g., TriState Biodiesel, Grease Lightning).

SEM: In many villages, recuperating soils, creating permaculture gardens, and increasing growing seasons remains the focus, within the context of food insecurity. However, women's groups particularly, as they find success with permaculture methods, are able to gain increasing income. Villager farmers are building on existing institutional markets, such as selling produce to local and regional schools. As value added enterprises are launched (discussed below), these are also creating new market opportunities.

Mobilization of women's groups

MST: Although the Movement continues be led at the highest levels disproportionately by men, women have organized effectively within the Movement to create greater gender balance. For example, all elected coordinator positions from the settlement to the national level must be composed of one man and one woman. This gender balance within movement organization has been foundational on the settlement level for experimenting with agroecological practices, which were often proposed and first implemented by women who sought to protect their families from sickness and economic hardship. One example was with the transition of a dairy operation to agroecology in the settlement COOPAVA. The first change proposed was to treat the cows with kindness, instead of with the historic rough treatment using dogs, horses and whips. Women on the settlement embraced this proposal and led the initiative. University technicians report that changing the treatment of the cows increased milk production by 25% within one month.

NYCFM: Women and women groups have been a powerful driving force behind much of the NYC food movement. Since the early days of urban agriculture with the Liz Christy community garden, the first community composting program initiated by Christine Datz (founder of the Lower East Side Ecology Center), the city (and US) first commercial rooftop farm by Annie Novak (together with Ben Flanner), the first urban farming training program in the city Farm School NYC directed by Onika Abraham (co-founded by Ursula Chanse, Lorrie Clevenger and others), the NYC Community Garden Coalition initially directed by Karen Washington who also founded the organization Black Urban Growers (BUGS), and Project EATS - Active Citizen Project founded by Linda Goode Bryant, to mention a few. Other noteworthy women-led initiatives include Hot Bread Kitchen, an ethnic breads company allowing immigrant women an opportunity to start their own businesses; La Finca del Sur - a women-led community farm in the South Bronx; and the Harvest Home farmers markets network - led by Maritza Owens.

SEM: Women and women's groups have often led the way in transforming food production in the ecovillages. For example, in the village of Djara women's groups have created extensive permaculture gardens, providing the majority of village food, while building soil health. Each garden is a mixture of collective and family plots. The men of the village continue with chemical and water intensive rice cultivation, which has had at best mixed success financially while adding to significant health problems in the village due to significant pesticides their only water sources. Many villagers report symptoms of pesticide toxicity, such as joint pain and stomach problems. Women have also used the ecovillage framework to assert women's agency in formal village life, and in making direct relationship with Northern ecovillages and NGO's.

Access to land and land tenure

MST*:* The MST was born through the desire of farmers displaced by the Green Revolution and Military Government to gain land tenure. The Movement continues to pressure governments through advocacy, occupations and politics, to fulfill the constitutional mandate to redistribute unproductive land - as well as to provide citizenship rights on the settlements, such as education, roads, electricity and healthcare.

NYCFM: Community gardens are often under pressure from more lucrative commercial and residential land uses. While the market overwhelmingly favors built-up spaces, the NYC food movement has been successful in institutionalizing a formal Garden Review Process (since 2010) that requires developers and the city to seek alternative sites for the relocation of existing community gardens (Title 56, Section 6–05). Most importantly, several community-led land trust groups like the Brooklyn Queens Land Trust (which helped prevent over 120 gardens from being auctioned in the 1990s), the Bronx Land Trust, and the Manhattan Land Trust have been essential in helping urban gardeners stay on the land. The City's Green Thumb program and the nonprofit 596 Acres have also been playing a key role in facilitating access to public land and scaling up initiatives.

SEM: The Movement began in part as resistance to land grabbing by public and private entities as Dakar expanded to encircle and subsume traditional villages. Farther away way from urban centers, most villages have access to lands, but often historically degraded by deforestation, poor farming practices and overgrazing.

Building and maintaining autonomy

MST: MST agroecological farmers and cooperatives, challenge the idea of growing food for money (and export), and then using money to buy food. High costs and poor soil quality catalyzed development of farming methods that intensify soil with what is available on settlements, and to delink from the high costs of chemical inputs from agribusiness (and the high cost of bank credit in Brazil). The MST cooperatives have sought to first build their own self-sufficiency and autonomy (soil inputs, seeds, food, etc), before extending to build wider exchanges. They argue that this provides independence and stability from varying macroeconomic conditions – as well as a core space of strength in which to act within wider social and political systems. The Movement has been successful at building capacity on the settlements, often in partnership often with sympathetic organizations, to train settlement members in areas such as accounting, machine operation and repair, and perhaps critically, political analysis.

NYC: One key dilemma as innovations scale up is how to maintain their independence from the government agencies and private companies they are trying to resist and provide an alternative to. The recent rise of a business-oriented strand of the urban agriculture movement can potentially be coopted by mainstream food businesses and community-based composting initiatives are now gradually being "phased out" via the new city-led pilot programs. Yet, changes in mainstream practices are occurring because of the pioneer initiatives were able to be first sustainable on their own. Spaces like Farm School NYC, kitchen incubators, and the new urban agriculture business incubator provide movement entrepreneurs with the skills and tools to build and maintain their autonomy.

SEM: The Senegal Ecovillage Network (GENSEN) was born out of the first ecovillages in the late 1990's. This network fell apart and the movement split into two heterogenous wings as the federal government became involved with first the Ministry of Ecovillages, and then ANEV. One part of the Movement asserts that the community-led dimensions of ecovillage development are essential, and direct government intervention weakens community agency, creating a situation that looks like other government-led development efforts. The other part of the Movement insists that Government and international aid provides access to crucial and expensive technologies (such as solar

power) and infrastructures (such as irrigation), and that villages remain agents in this relationship, participating in decisions of what interventions or resources will be provided. The Global Ecovillage Network (GEN) created GEN Africa, which has become the overarching and unifying organization to which most ecovillages may relate.

Mobilizing public institutions (while maintaining autonomy)

MST: Through occupations, advocacy and politics, the movement has been able mobilize the redistribution of land for almost a million members. This is less than the land reform initially envisioned when the movement began. They have been more successful for the *struggle on the land* mobilizing city, state and federal institutions to provide citizenship rights for settlements including schools, healthcare, roads, electricity, and other infrastructure. Many have argued the focus on the *struggle on the land* is part of what has made the MST more successful than many other landless movements around the world. The Movement has sought (and sometimes struggled) to remain autonomous while actively participating in formal politics. The MST was a founding force of the Workers Party (PT), which has held power at all levels and the majority of members continue to support. There have been numerous MST members elected to political office at local, state and national levels. In some regions, where settlements are concentrated, the MST has taken electoral control of rural towns. The Movement has struggled internally with how much to push sympathetic governments (through land occupations, etc.) and how much to work with them (building infrastructure, new markets, etc.).

NYCFM: In December 2017 New York City passed a bill (Intro 1661-A) to create the city's first centralized digital hub for urban agriculture. This is just one example of how the alignment of bottom-up innovations, in this case commercial urban agriculture companies, can mobilize institutions to change the rules. Other examples include the expansion of the universal free lunch program, achieved through joint efforts by nonprofit advocacy organizations, like Community Food Advocates, and open-minded government officials like the City's Public Advocate. Under pressure of environmental groups in the food movement, the city also recently carried out a comprehensive food system resiliency study (2016) which assessed its degree of disaster preparedness.

SEM: As discussed above, GENSEN was able to help create the world's first Ministry for Ecovillages. This achievement was recognized with the GEN meeting held in Dakar in 2014. Although government involvement remains divisive, many villages report that they are able to mobilize financial and technical resources from ANEV and other international organizations, while continuing to be community determined.

Participation in policymaking

MST: As discussed in several themes above, an important explanatory factor for the scaling up of agroecology in the MST has been their ability to participate in, and even propose policy at all scales. The Movement helped pressure social dimensions of the 1989 Constitution which legitimized their struggle. And today policies such as the PAA and PNAE have enabled a scaling of agroecological systems to regional levels. The MST voice is present in global forums through the Via Campesina and the food sovereignty perspective. the Movements success is in part due to its ability to participate in building policy that sets the stage for expanding its political and agricultural projects.

NYCFM: Many of the successes and the expansion and scaling up of local food initiatives are attributable to a blend of tactics that have enabled community food advocates to participate or affect decision-making processes. Among these are community board meetings, participatory budgeting, demonstrations, legislative hearings chaired by City Council and the state, and electoral forums as the precedent-setting 2013 Mayoral Forum on Food Policy. Recently, food justice and food access advocates testified before City Council on how to revise the city's incentives program (FRESH) for fresh and healthy food retail going forward.

SEM: The formal power structures of villages vary between elected mayors and hereditary chiefs. In both cases, villages have taken on the ecovillage framework usually with the leadership, or at least strong support of, these formal village positions. Thus, government resources are leveraged directly towards ecovillage development at the village level, as villages make this a political focus. Village leadership is also then able to formally interact with federal organs, particularly with ANEV.

6. Conclusions and Policy Recommendations

To effectively implement the 2030 Agenda for Sustainable Development, we have suggested that it is necessary for decision-makers at different levels of government worldwide to effectively engage three challenges: learning from Global North and South initiatives in tandem, taking stock of social innovations alongside technological fixes, and nurturing grassroots sustainable development initiatives next to, or in place of, top-down corporate and government projects and interventions. In this research we sought to address the question of what key levers for steering socio-technical transitions to sustainability exist and what is the scope for learning from success cases from Global North and Global South countries in tandem. We addressed these questions by exploring the accomplishments of three distinct social movements – the Senegalese ecovillage movement, MST agroecological cooperatives, and the New York City food movement. Our findings reveal that the successes of those movements in reconfiguring dominant systems of production and consumption lie in a rich amalgam of factors, which all point to the importance of movement's “soft skills” and the ability to build robust social infrastructures alongside transformations of the physical environment. Specifically, among these skills are the movement’s ability to:

- reframe the key issues at stake
- remain open to experimentation
- forge diverse cross-sectoral partnerships and coalitions
- amass political support and affect policy
- create self-sustaining new markets
- nurture and encourage women leadership
- secure access to land and land tenure
- build and maintain autonomy from mainstream systems and institutions
- mobilize public institutions to change rules and practices
- be actively engaged and participate in policymaking processes.

Recommendations

Based on the findings from our cross-case analyses, we offer a set of recommendations for government decision-makers at all scales, interested in leveraging the power of

social movements to bring about positive change and durable transitions to more equitable and environmentally sound systems and communities. In particular, we suggest that governments consider the following five strategies:

1. Where resources are scarce, Governments, instead of continuing path dependent momentum, should support movement innovation/alternatives – which are embedded and responding to local physical and cultural geographies
2. Include innovative Movements in debate/policy making
3. Support Movement autonomy, through supporting conditions for self-sufficiency. By investing first in movement self-sufficiency, this provides a foundation to nurture or strengthen innovations.
4. Support Movement Value-added ventures – even if alternatives challenge regulation or path dependencies of present system
5. Support Movement-led Policy that builds new movement capacity and innovation

Grassroots sustainable development initiatives are innovating some of the most creative system-wide transformations and transitions toward climate adaptation, resilience, and sustainability in the agri-food system. We suggest that these five broad strategies, implemented with the participation of creative grassroots social movements, embedded in local social and ecological conditions, may help catalyze the creative innovations needed to meet the 2030 Sustainable Development Goals – and indeed to create socially and ecologically resilient and sustainable forms of collective life.

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