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Small-scale farmer innovation

Susan H. Bragdon
Chelsea Smith

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A note about Food and Sustainability at QUNO

The Food & Sustainability programme of the Quaker United Nations Office addresses the complex and intertwined issues of trade and innovation policy and how they relate to poverty, hunger and food insecurity. We look at these issues with a particular focus on small-scale farmers, including fisherfolk, forest dwellers and pastoralists, a critical yet largely unheard voice in trade and innovation policy-making. Our work is collaborative, providing the space where it is safe to think, share and explore creative alternatives to a food system that does not work for the majority of the world's population.

Half the world's food today is produced by 1.5 billion small-scale farmers. The figure is higher for food produced in the non-industrialized world -- up to 80%. Small-scale farmers are stewards of biodiversity; they maintain, adapt, improve and distribute plant varieties. The agricultural biological diversity they enhance and develop provides a major contribution to health and nutrition. They find ways to deal with new pests and disease. They are also active players in critical ecosystem processes, developing and adapting ideas for nutrient cycling, effective water use and the maintenance of soil fertility, both traditional and from elsewhere. Who could be better placed to help the world cope with global environmental change and feed the world than over a billion small-scale farmers living, working and experimenting on the front lines of change? Our work aims to ensure that trade and innovation policy are supportive of, and do not undermine, the critical role of small-scale farmers in providing local and global food security and the resilience we will need to facing ever-increasing environmental change.

For more information please contact:

Susan H. Bragdon
Representative, Food & Sustainability
shbragdon@quno.ch

Table of Contents

I. Introduction

This policy brief consolidates lessons learned from an in-depth literature review on small-scale farmer (SSF) innovation systems and a two-day expert consultation on the same topic, hosted in Geneva by Quaker United Nations Office (QUNO) in May 2015.[1] The key message is that SSF innovation systems are unique relative to more 'formal' agricultural innovation systems,[2] which inspires a reconsideration of the types of policies that are put in place to encourage innovation in agriculture.

SSF innovation systems are unique in the following ways:

- The scope of what is considered innovation is much broader than the development of new tools and techniques for improving farm productivity, profitability or sustainability.
- Farmers innovate through informal networks of social and economic relations.
- Farmers are driven to innovate for a multitude of reasons, which include, but go well beyond, opportunities to participate in commercial markets.

Conventional strategies for encouraging innovation in agriculture tend to focus on creating incentives for private sector investment, most commonly by creating strong intellectual property rights regimes, ensuring open access to markets and increasing technology adoption rates among farmers. Alternative strategies may be more appropriate and effective in nurturing the innovation that happens on farm, driven by farmers.

This policy brief is part of QUNO's work highlighting the importance of on-farm innovation and bringing SSF to the forefront of international policy dialogues on agricultural trade and intellectual property rights. The intention is not to prescribe particular

1 A report of the meeting can be found at: http://quno.org/resource/2015/11/small-scale-farmer-innovation-systems-review-literature

2 'Formal' innovation systems are comprised of public, private and philanthropic entities, and partnerships thereof, with the mandate of improving agriculture through the advancement of science and development of technology. There is less a strict dichotomy than a continuum between 'formal' and on-farm innovation systems; however there is value in focusing attention on the less formalized end of the spectrum, as alternative conceptions of innovation need to be represented in policy discussions on innovation in agriculture.

policies, but rather to raise and address questions surrounding how national and international policy frameworks affect innovation at farm level. The process QUNO engages in is collaborative with the goal of empowering small scale farmers and organizations that represent them in the development of policies that support SSF innovation and contribute to resilience, food security and rural livelihoods.

II. The importance of small-scale farmer innovation

Small-scale farmers, including fisherfolk, forest dwellers and pastoralists, contribute between 50 and 70 percent of the global food supply.[3] Small-scale farming systems are characterized by their relative size, reliance on family labour and low use of external inputs, and

3 FAO (2014). The State of Food and Agriculture. Innovation in Family Farming. Rome: Food Agriculture Organization of the United Nations.

A farmer in Cuba. Photo credit: Ben Kucinski/Flickr

also the sheer diversity of farm management practices and livelihood strategies employed within each to suit local environmental and socio-economic conditions. The majority of agrobiodiversity[4] is also actively maintained, used and developed by small-scale farmers, which provides the foundation for all future innovation in crop breeding.[5]

Farmers adapt their farm management practices and actively enhance agrobiodiversity to suit changing conditions. This describes the majority of agricultural innovation that has taken place since the beginning of agriculture.[6] With intimate knowledge of their natural landscapes, farmers continually conduct experiments and observe subtle changes over time. They integrate new varieties and technologies into their management practices, blending knowledge systems, and make decisions based on cultural preferences and local contexts. Women play particularly important roles in on-farm innovation relating to conservation and nutrition.

"More evidence-based research is required to highlight the contributions of innovative farmers in terms of food security, livelihood improvement and agroecosystem resilience."

In the context of intensifying environmental pressures associated with climate change, increasing market volatility, and decreasing public sector investment in agriculture, SSF's capacity to innovate in absence of outside intervention is ever-more important for achieving global food security.

Not all innovation that happens on-farm necessarily or in every case yields socio-economically and environmentally sustainable outcomes. However, farmers' experimentation and innovation in response to changing conditions inherently creates greater diversity. On the whole, greater diversity contributes to resilience within the global food system, i.e. greater responsiveness to

4 Agrobiodiversity encompasses plant and livestock diversity (both wild and domesticated) at the genetic, species and ecosystem levels, as well as its human component, cultural diversity.
5 Smith, C., Elliott, D., and Bragdon, S.H. (2015). Realizing the right to food in an era of climate change: The importance of small-scale farmers. Geneva: Quaker United Nations Office.
6 Sanginga, P.C. (ed.). (2009). Innovation Africa: enriching farmers' livelihoods. Earthscan.

changing conditions and adaptability to environmental or socio-economic shocks.

Importantly, focusing on SSF innovation does not exclude collaborative research efforts. Experts during the QUNO consultation emphasized the synergistic relationship between 'formal' sector actors, particularly public research institutions, and small-scale innovation systems.

Box 1: Small-scale farmer innovation goes largely unrecognized

Despite the importance of on-farm innovation, it is not widely recognized in academia or international fora. Innovation in agriculture is most commonly associated with the development and transfer of technologies to farmers (innovation for farmers), or, more recently, farmers' participation in research and development projects to improve the relevancy and usefulness of its outputs (innovation with farmers). Innovation that is small-scale farmer-driven is not well documented and remains invisible within conventional innovation studies.[1]

Efforts to measure farmers' innovation in absence of outside intervention are in their infancy.[2] There is also limited evaluation of the quality of support currently available to innovative SSFs, as it is increasingly difficult to isolate farmers' capacity to innovate as global organizations play an increasingly visible and powerful role in participatory research (innovation with farmers).[3] More evidence-based research is required to highlight the contributions of innovative farmers in terms of food security, livelihood improvement and agro-ecosystem resilience.

1 Beckford, C., Barker, D., and Bailey, S. (2007). Adaptation, innovation and domestic food production in Jamaica: Some examples of survival strategies of small-scale farmers. Singapore Journal of Tropical Geography, 28: 273–286.
2 Läpple, D., Renwick, A. and Thorne, F. (2015). Measuring and understanding the drivers of agricultural innovation: Evidence from Ireland. Food Policy, 51: 1–8.
3 Olwig, M.F. (2012). Multi-sited resilience: The mutual construction of "local" and "global" understandings and practices of adaptation and innovation. Applied Geography, 33: 112–118.

III. Small-scale farmer innovation in practice

What is considered innovation?

Innovation systems take different forms depending on a variety of factors including, for example, the country in which are located, whether agriculture is capital intensive and there is high consumption of inputs, and whether farmers have access to such resources.[7] Around the world SSF live and work under a variety of socio-economic, political and environmental conditions. Differences in resource endowments and access rights, labour relations, and religious and ethnic affiliations contribute to inequality in terms of power relations, livelihoods and food security both within and between communities.

Critically, innovation is both a process and an output. Innovation happens through social interaction and is cumulative in nature, as individuals and communities build off one another and strategically adapt new tools and techniques to suit their particular circumstances.

SSF innovation includes:

1. Technical and institutional innovation. Technical innovation refers to the development of new varieties, tools and techniques, most commonly associated with the term innovation.[8] Institutional innovation refers to changes in relationships among actors, both within communities and between farmers and supporting actors. Institutional innovation can increase the scale of impact of technical innovation by facilitating the spread of innovation over larger areas,[9] or help achieve long-term impact of technical

7 Coudel, E. (ed.) (2013) Renewing innovation systems in agriculture and food: How to go towards more sustainability? Wageningen Academic Publishers.

8 The HoneyBee Network in India has documented more than twenty thousand examples of technological innovation by small farmers, women and artisans across India and beyond (see Gupta, A.K., Sinha, R., Koradia, D., Patel, R., Parmar, M., Rohit, P., Patel, H., Patel, K., Chand, V.S., James, T.J., Chandan, A., Patel, M., Prakash, and T.N., Vivekanandan, P. (2003). Mobilizing grassroots' technological innovations and traditional knowledge, values and institutions: articulating social and ethical capital. Futures, 35: 975–987.)

9 Röling, N. (2009). Pathways for impact: scientists' different perspectives on agricultural innovation. International journal of agricultural sustainability, 7(2): 83-94.

innovation by creating the conditions necessary for their sustained use, such as resource management and conflict resolution mechanisms, or producer cooperatives to help mitigate risks associated with production.[10] Institutional innovations are commonly low-cost and low-risk, but are not always recognized by formal sector researchers and scientists.

2. The application of local (traditional) knowledge to changing circumstances. Local knowledge includes insights, wisdom, ideas and perceptions, as well as environmental and ethno-botanical knowledge and an understanding of the history of what has worked under what conditions.[11] Rather than a static collection of ways of being and doing, it is a dynamic collection of know-how, practices and skills. Local knowledge exchanged through networks is selectively applied and modified by farmers facing unique and changing circumstances.[12] This process allows people to cope with immediate problems and develop pragmatic and contextually relevant solutions.[13]

3. The maintenance, use and development of agrobiodiversity and farm management practices. Diversity allows farmers to mitigate risk (e.g. by diversifying their resource base) and facilitates adaption to changing conditions (e.g. by changing which crops and varieties are cultivated, where they are planted and at what time). Examples of how farmers innovate through the use and development of diversity include:

- The introduction of new varieties into home gardens;
- Participation in informal seed exchange networks, seed fairs and community seed banks;[14]

10 Wettasinha, C., Waters-Bayer, A., van Veldhuizen, L., Quiroga, G. and Swaans, K. (2014). Study on impacts of farmer-led research supported by civil society organizations. Penang, Malaysia: CGIAR Research Program on Aquatic Agricultural Systems. Working Paper: AAS-2014-40.

11 Beckford, C. and Barker, D. (2007). The role and value of local knowledge in Jamaican agriculture: Adaptation and change in small-scale farming. Geographical Journal, 173(2): 118–128; Thrupp, L.A. (1989). Legitimizing Local Knowledge: From Displacement to Empowerment for Third World People. Agricultural and Human Values (Summer): 13-24.

12 Waters-Bayer, A., Wettasinha, C. and van Veldhuizen, L. (2007). Prolinnova: building partnerships to enhance local innovation processes. Working Paper 16.

13 Smith, A., Fressoli, M., and Thomas, H. (2014). Grassroots innovation movements: Challenges and contributions. Journal of Cleaner Production, 63: 114–124.

14 Community seed banks are stores of seed

- The use of wild and indigenous foods and medicines in novel ways;
- The use of traditional food preservation, storage and processing techniques to meet food safety standards and enter into new markets; and
- The practice of culinary traditions, new gastronomic traditions and local food culture movements.[15]

4. Adaptation to environmental and socio-economic stresses. Adaptation is closely related to innovation. It is an ongoing, incremental process whereby communities respond to changing socio-economic, technological or environmental conditions.[16] Climate change and environmental degradation are major drivers of on-farm innovation, particularly among the poor living in marginal areas whose livelihoods depend on natural resources.[17]

5. The adaptation of 'modern' technologies to suit specific local needs. Farmers continually experiment with goods, services and technologies developed elsewhere to make them more suitable to local contexts.[18] Formal sector scientists have often underestimated the time, resources and expertise required to discriminate among technology options (e.g. by performing field trials) and adapting technologies to suit local conditions, resource endowments and preferences.[19] New technologies that are not widely adopted may be inferior to existing techniques or unsuitable in a particular context.[20]

managed and operated by farming communities and made available to farmers for payment, through exchange, for ceremonial purposes or during times of shortage or emergency. 'Stores' range from physical storehouses to networks of seed savers across large geographical regions.

15 Howard, P., Puri, R., Smith, L. and Altieri, M. (2008). A Scientific Conceptual Framework and Strategic Principles for the Globally Important Agricultural Heritage Systems Programme from a Social-ecological Systems Perspective. Rome: Food and Agriculture Organization of the United Nations.

16 Amaru, S. and Chhetri, N.B. (2013). Climate adaptation: Institutional response to environmental constraints, and the need for increased flexibility, participation, and integration of approaches. Applied Geography, 39: 128–139.

17 Rodima-Taylor, D., Olwig, M.F., and Chhetri, N. (2012). Adaptation as innovation, innovation as adaptation: An institutional approach to climate change. Applied Geography, 33: 107–111.

18 Sanginga 2009

19 Waters-Bayer, A., van Veldhuizen, L., Wongtschowski, M. and Wettasinha, C. (2009). Recognising and enhancing processes of local innovation. In Sanginga, P.C. (ed.).Innovation Africa: enriching farmers' livelihoods. Earthscan: 239-254.

20 Chambers, R., Pacey, A. and Thrupp, L .A. (eds) (1989). Farmer first: farmer innovation and agricultural research. Intermediate Tech-

Flood irrigation in extreme environments. Photo credit: Richard Allaway/Flickr

Why do small-scale farmers innovate?

Farmers are driven to innovate by a multitude of factors, including:

1. Risks:

- Environmental unpredictability and intensifying environmental pressures such as drought and soil nutrient depletion.
- Market volatility.
- Subsidized agricultural imports driving down local prices.
- Food insecurity, malnutrition and food safety concerns.

2. Opportunities:

- New opportunities for income generation such as new markets for high value crops or opportunities to participate at points further along in agri-food value chains through processing and marketing.
- The availability of infrastructure such as storage facilities.
- The availability of resources to experiment and access to affordable credit.

3. Socio-cultural factors:

- The desire for social recognition and status within communities.
- The desire to keep local food

nology Publications, London; Thrupp 1989.

cultures and culinary traditions alive.
- Curiosity, propensity to experiment and other personal attributes such as age, gender and education.

Climate change is recognized as a significant driver of small-scale farmer innovation. The FAO reports that agricultural systems everywhere are vulnerable to climate change, and that production is particularly under threat in areas near the equator.[21] Climate change will push farmers to adjust crop selections, crop rotations and planting times.[22]

Environmental degradation may also motivate farmers to innovate and spread their innovations relating to land rehabilitation and adaptation in order to gain public recognition for their efforts, and to prove that environmental degradation is not inevitable nor irreversible.[23] Soil degradation and water eutrophication and depletion are likewise pushing farmers to adopt more resource-efficient farming practices.[24]

Some innovators, self-identifying as part of a larger process of social transformation based on creativity and solidarity, innovate in response to perceived social injustice.[25]

New market opportunities may encourage more resource-endowed farmers to innovate in ways that enable them to participate in commercial markets.[26] But markets will not stimulate innovation among the less resource endowed SSF and at minimum require complementary measures targeted at poor farmers, such as support for small agro-

21 FAO (2015). Climate change and food systems: global assessments and implications for food security and trade. Rome: Food Agriculture Organization of the United Nations.
22 FAO 2010?
23 Reij, C. and Waters-Bayer, A. (eds.) (2014). Farmer innovation in Africa: A source of inspiration for agricultural development. Routledge.
24 Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., and Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. Science, 327(5967): 812-818.
25 Miranda, I., Lopez, M. and Soares, M.C.C. (2011). Social technology network: paths for sustainability. Innovation and Development, 1: 151-152; Smith et al 2014.
26 Tittonell, P. (2014). Livelihood strategies, resilience and transformability in African agroecosystems. Agricultural Systems, 126: 3–14. It is also worth exploring how the engagement with markets, particularly global markets may affect agricultural biological diversity and the nutritional-status of the farmers and how markets may need to be regulated or complementary measures passed to mitigate adverse effects.

enterprise development, rural credit systems, physical infrastructure, communications and human capital.[27] In addition, farmers face increasing production costs and decreasing product prices, as well as increasing price volatility in the market, all factors that may limit the potential for markets as an innovation-stimulator.[28] Small-scale farmers ability to innovate also tend to be disadvantaged within inequitable food chains and lack the freedom or choice to opt out of dominant food systems or choose quality inputs.[29]

It is noteworthy that farmers' resource endowments and other personal circumstances fluctuate and different factors influence their decisions at different times. Small-scale farmers that undergo contractions of their natural, financial and human resources are increasingly vulnerable to risk factors, undergo loss of social capital, and are forced to liquidate their capital assets and reconfigure their livelihood strategies.[30]

How do small-scale farmers innovate?

Informal social and economic networks are based on trust and reciprocity.[31] Trust among farmers can increase cooperation, lower transaction costs, increase bargaining power within the market and allow groups of individuals to share in the risks associated with experimentation and adopting new innovations.[32] There is some evidence that SSF innovation is positively correlated with the strength of intra-community relations,[33] particularly in absence of formal sector support

27 Wettasinha et al 2014; Ashby, J., Heinrich, G., Burpee, G., Remington, T., Wilson, K., Quiros, C. A., Aldana, M., and Ferris, S. (2009). What farmers want: collective capacity for sustainable entrepreneurship. International Journal of Agricultural Sustainability, 7(2): 130-146.
28 Dogliotti, S., García, M.C., Peluffo, S., Dieste, J.P., Pedemonte, A.J., Bacigalupe, G.F., and Rossing, W.A.H. (2014). Co-innovation of family farm systems: A systems approach to sustainable agriculture. Agricultural Systems (126): 76–86; Beckford and Barker 2007; de Schutter, O. (2014). Final report: The transformative potential of the right to food. United Nations Human Rights Council: Geneva. A/HRC/25/57.
29 de Schutter 2014.
30 Tittonell et al 2014
31 Coudel 2013; Wu, B. and Zhang, L. (2013). Farmer innovation diffusion via network building: A case of winter greenhouse diffusion in China. Agriculture and Human Values, 30: 641–651.
32 van Rijn, F., Bulte, E. and Adekunle, A. (2012). Social capital and agricultural innovation in Sub-Saharan Africa. Agricultural Systems, 108: 112–122.
33 Wu and Zhuang 2013

Box 2: Different drivers for different actors

The private sector is driven by financial incentives, pursued most commonly through intellectual property rights and licensing agreements,[1] although the role of IP in encouraging innovation in agriculture is the subject of increasing debate.[2] The vast majority of private sector investment in R&D is dedicated towards technologies, crops and traits that serve farmers in industrialized countries and ensure adequate returns on investment, and is rarely intentionally pro-poor.[3]

The public sector may help farmers become 'market ready' and help mitigate risks faced by the poorest and most marginal groups in society. But public sector investment in agriculture has been in decline since the late 1970s due to an ideological shift in belief that agriculture is best served by the private sector.[4] Public agricultural research organizations face pressure to take on roles more traditionally associated with that of the private sector – generating revenue and promoting market-driven investment in R&D and extension services.

Public-private partnerships and philanthropic foundations increasingly dominate the field of agricultural innovation. These actors tend to be ideologically committed to the development of new technologies (innovation for farmers) and a market-based approach to achieving food security. This perspective discounts the value of innovation that yields non-monetary benefits to farmers and benefits to society at large, such as agrobiodiversity conservation.

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1 Wynberg, R. and Pereira, L. (2013). "Whose innovation counts? Exploring the interface between informal and formal innovation in seed development in South Africa." The Business School of Environmental Innovation Graduate School of Business, Cape Town.

2 See Spielmann. D.J. and Ma, X. (2015). Private Sector Incentives and the Diffusion of Agricultural Technology: Evidence from Developing Countries. The Journal of Development Studies. DOI: 10.1080/00220388.2015.1081171; and Gallini, N. and Scotchmer, S. (2002). Intellectual property: when is it the best incentive system?. In Innovation Policy and the Economy, Volume 2 (pp. 51-78). MIT Press.

3 Spielman, D.J. and von Grebmer, K. (2004). Public-private partnerships in agricultural research: an analysis of challenges facing industry and the Consultative Group on International Agricultural Research (Vol. 113). Intl Food Policy Res Inst

4 Conway, G. (2012). One billion hungry: can we feed the world? Cornell University Press.

and intervention.[34] Experts at the consultation noted that farmers rapidly integrate innovation from colleagues and fellow farmers into their own agricultural practices.

Innovation intermediaries are supporting actors that facilitate interaction among disparate or isolated farmer innovation systems, or between farmer innovators and formal innovation systems. The exact function of intermediaries depends upon their relations with all relevant actors, their legitimacy in the eyes of each group, and their financial and operational capacity.[35]

Non-governmental and civil society organizations, producer cooperatives, grassroots innovation movements, and less commonly, independent professional intermediaries, play the following roles:

- Facilitate closer cooperation between farmers and rural extension and advisory service providers and articulate the needs and demands of farmers.
- Provide farmers with information and technical expertise directly and facilitate farmers' access to market (i.e. classic extension service roles).[36]
- Help design and support participatory research and social learning processes.
- Build personal relations among actors and build and manage social networks based on trust.[37]
- Connect farmers with investors and service providers such as banks, marketing boards or supermarkets.[38]
- Handle paperwork such as farming records for certification and project funding applications.[39]
- Interpret public standards and develop technical guides for water, pesticide and fertilizer management and food safety.[40]
- Create an overarching vision regarding the scope and nature of the innovation (i.e. its role in societal transformation, poverty

34 van Rijn et al 2012.

35 Klerkx, L. and Leeuwis, C. (2009). Shaping collective functions in privatized agricultural knowledge and information systems: the positioning and embedding of a network broker in the dutch dairy sector. J. Agric. Educ. Ext. 15: 81–105; Yang, H., Klerkx, L. and Leeuwis, C. (2014). Functions and limitations of farmer cooperatives as innovation intermediaries: Findings from China. Agricultural Systems, 127: 115–125.

36 Yang et al 2014; FAO 2014.

37 Yang et al 2014; Wettasinha et al 2014.

38 Smith et al 2014; Ashby et al 2009.

39 Yang et al 2014

40 Yang et al 2014

"There has been relatively little inquiry into how innovation platforms support farmer-led innovation."

alleviation, environmental sustainability).

- Help innovators reflect upon and re-interpret their position relative to outside institutional and economic factors, i.e. provide perspective and facilitate 'systems learning'.[41]
- Bring awareness of farmers' creativity and capacity for experimentation into policy dialogues, participate in farmers' advocacy and help give farmers a voice to influence national innovation priorities.[42]

Innovation platforms are multi-stakeholder groups established to facilitate partnerships at the region, country, sector or value chain level.[43] Participants may include representatives from government, public sector agricultural R&D organizations, private companies, universities, the agri-food industry, related sectors, and farmers' organizations. Platforms have been successful in increasing interactions and building social capital among stakeholders,[44] and there is some evidence that they may help reconcile the competing directives of practicing results-based management and building greater flexibility and reflectivity into program planning.[45]

41 Klerkx, L., Aarts, N. and Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. Agricultural Systems, 103(6): 390–400.

42 Wettasinha et al 2014; FAO 2014.

43 Kilelu, C.W., Klerkx, L. and Leeuwis, C. (2013). Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. Agricultural Systems, 118, 65–77.

44 Nederlof, S., Wongtschowski, M. and van der Lee, F. (2011). Putting heads together: agricultural innovation platforms in practice. Development, Policy & Practice. Bulletin 396. KIT Publishers; Tenywa, M.M., Rao, K., Tukahirwa, J.B., Buruchara, R., Adekunle, A., Mugabe, J., Wanjiku, C., Mutabazi, S., Fungo, B., Kashaija, N.I., Pali, P., Mapatano, S., Ngaboyisonga, C., Farrow, A., Njuki, J. and Abenakyo, A. (2011). Agricultural innovation platform as a tool for development oriented research: lessons and challenges in the formation and operationalization. J. Agric. Environ. Stud. 2: 117–146; van Rijn et al 2012; Kilelu et al 2013.

45 Regeer, B. (2009). Making the Invisible Visible: Analysing the Development of Strategies and Changes in Knowledge Production to Deal with Persistent Problems in Sustainable Development. Oisterwijk: Boxpress; van Mierlo, B., Regeer, B., Amstel, M.v., Arkesteijn,

On the other hand, representatives pursuing their organizations' mandates may undermine the broader vision of the platform, and platforms may still not be responsive enough to new issues given practical constraints such as timelines, budgets and logical frameworks.[46] Furthermore, farmer innovation may not be recognized.[47] There has been relatively little inquiry into how innovation platforms support farmer-led innovation.

IV. Creating an enabling environment for small-scale farmer innovation

An enabling environment for farmer innovation includes formal sector interventions and policies that reflect the realities — what, why and how — of small-scale farmer innovation systems.

Formal sector innovation

First and foremost, agricultural research institutions and organizations must recognize farmers as innovators rather than solely recipients of research results.[48] Researchers, scientists and extension agents should anticipate and encourage farmers' active adaptation of new technologies to suit local conditions. Agricultural research and educational institutions must also recognize the legitimacy of traditional knowledge.[49] They may otherwise weaken the momentum of on-farm innovation by failing to build upon it or ignoring it altogether, and detract from farmers' own perceptions of their abilities, thereby limiting their innovative potential.[50]

Examples of ways in which formal sector actors may intervene within small-scale farmer innovation systems in positive ways include:

- Providing direct financial support to farmers conducting on-farm

M.C.M., Beekman, V., Bunders, J.F.G., Cock Buning, T.D., Elzen, B., Hoes, A.C. and Leeuwis, C. (2010). Reflexive Monitoring in Action: A Guide for Monitoring System Innovation Projects. Oisterwijk: Boxpress.

46 Kilelu et al 2013.

47 van Rijn et al 2012.

48 Ouagadougou Declaration (2015). "Francophone Workshop on Approaches to Farmer-Led Research and Development" (12–14 May 2015, Ouagadougou, Burkina Faso). Available at: http://www.etc-international.org/blog/wp-content/uploads/2015/05/Ouagadougou-Declaration-FIPAO-English-final.pdf.

49 Thrupp 1989.

50 Olwig 2012; Gupta et al 2003.

research.
- Supplementing farmers' research capacities (e.g. facilitating the hiring of technical experts, improving farmers' experimental design, providing information on phenomena that cannot be observed, and documenting farmers' work).
- Increasing exposure of SSF innovative capacity through innovation fairs and publications.
- Facilitating knowledge sharing using information and communication technologies.
- Supporting the establishment of producers' cooperatives to combat risk and unpredictability associated with climate change and market volatility.
- Providing incentives for agrobiodiversity conservation (e.g. facilitating linkages with markets for heirloom or landrace varieties and supporting collective marketing).
- Recognizing and promoting traditional knowledge systems (e.g. supporting cross-cultural knowledge exchange among communities facing similar challenges).
- Supporting farmers' seed systems (e.g. encouraging informal seed exchange, seed fairs and community seed banks).
- Building social capital and organizational capacity within farming communities (e.g. facilitating collective rule making, hosting skill-building workshops in group management, conflict resolution, financial management, marketing and negotiation).

"First and foremost, agricultural research institutions and organizations must recognize farmers as innovators rather than solely recipients of research results."

National Policy Frameworks

Not all farmers innovate for commercial reasons or monetary benefits, and not all benefit from increased connectivity with international markets. Trade policy may be part of an overarching framework that includes, for example:

- **Safeguards** (e.g. school meal programs, cash transfers).
- **Investment in rural**

infrastructure (e.g. power, roads, post-harvest storage facilities)
- The promotion of **producers cooperatives, local and regional markets, including barter markets**, and niche markets for agrobiodiverse products.
- **Financial and risk management instruments**[51] (e.g. affordable credit and insurance).
- **Farmers' participation in decision-making.**

Intellectual property rights in the form of patents and plant variety production do not drive small-scale farmers to innovate. Given the importance of informal networks for exchanging plant genetic resources and associated knowledge, it is important that intellectual property rights do not restrict this flow. Geographical indicators, open-source licensing agreements and registries for farmers' varieties may do more to encourage on-farm innovation by publicly recognizing farmers' contributions and encouraging further use.

Policy coherence is important for supporting small-scale farmer innovation:

- **Land use and planning policies** must recognize farmers' land rights and customary resource management practices, including communal ownership.
- **Seed policies**[52] that suit the unique characteristics of domestic seed sectors and are developed in consultation with farmers may support the establishment of small-scale and community-based seed enterprises and promote synergistic relationships between farmers and formal seed production and distribution systems.
- **Conservation policies** may provide incentive for on-farm agrobiodiversity conservation through payment mechanisms, employment and capacity-building opportunities in monitoring of agrobiodiversity, investment in agro-tourism and marketing campaigns.
- **Investment policies** may

51 FAO 2014.

52 Seed policies here refer to variety registration, seed quality control and seed certification systems. These systems typically require varieties to be uniform, which farmers' varieties are not. Alternative systems with differentiated standards can help support local seed systems and promote rural entrepreneurship. See: Louwaars, N.P., de Boef, W.S., Edeme, J. (2013). Integrated Seed Sector Development in Africa: A Basis for Seed Policy and Law. Journal of Crop Improvement, 27: 186–214.

encourage private companies to invest in research that benefits the poor, such as research in minor crops[53] important to local food security.

V. Concluding Remarks

In order to meet contemporary challenges in the global food system, we need to support farmers in their capacity to innovate, and to re-orientate innovation policy to suit their needs.

While small-scale farmers are often most vulnerable sections of the population and most food insecure, they have the capacity to innovate, and have since the beginning of agriculture. Nurturing this capacity means equipping farmers to more easily adapt their management practices and enhance agrobiodiversity to suit changing local conditions.

Synergy can be created between the small-scale farmer and 'formal' agricultural innovation systems when farmers' active roles in innovation are recognized and 'scientific' and local knowledge systems are bridged.

National innovation strategies that reflect the realities of small-scale farmer innovation systems may be more effective in nurturing innovation in agriculture than conventional strategies that focus on encouraging private sector investment. Aligning public policy incentives with farmers' motivations to innovate will encourage the type of innovation that yields public benefit, will promote diversity, and contribute towards a more resilient global food system.

53 Minor crops are those that are neglected within public and privately funded crop improvement efforts, such as millets, sorghum and beans, relative to staple food crops that have larger commercial markets, such as wheat and rice. Minor crops commonly contribute substantially to farmers' diets and food security.

QUNO
Quaker United Nations Office

QUNO offices:

In Geneva:
13 Avenue du Mervelet
1209 Geneva
Switzerland

Tel: +41 22 748 4800
Fax: +41 22 748 4819
quno@quno.ch

In New York:
777 UN Plaza
New York, NY 10017
United States

Tel: +1 212 682 2745
Fax: +1 212 983 0034
qunony@afsc.org

The Quaker United Nations Office

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