

Enhancing technical, organisational and institutional innovation in urban agriculture¹

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The article by Critchley *et al* (2007) presents important experiences gained in rural development programmes regarding how to support technological and socio-organisational innovation in farming systems. To what extent can such rural-based experiences be applied in the urban context? How do the specific urban conditions influence the process of innovation in urban farming systems? What are the main technological and socio-organisational challenges at hand in the urban context? In what ways can local innovation processes in urban farming systems best be supported?

This article explores such questions in order to identify key factors that influence innovation in urban agriculture and to come up with ways in which to strengthen innovation processes within it.

Agriculture under rural and urban conditions: some important differences

The role of agriculture in local livelihoods

Although rural people in most parts of the world engage increasingly in non-farm activities, agriculture remains their primary occupation and source of livelihood. Local farming and natural resource management knowledge and skills are generally passed on from elders to children. Cultural norms often define the division of tasks and responsibilities.

The origin of the people involved in urban agriculture varies widely as does the contribution of agriculture to urban livelihoods. Urban farmers can be:

- *Farming families that have gradually become absorbed by the expanding city* and often adapt their farming systems to new urban opportunities, like closeness to markets with better opportunities to collect market information and to sell directly to urban consumers or shopkeepers (either in fresh or in processed form including vending street foods). Despite these opportunities, some periurban and urban producers continue to have a 'rural outlook' and need support to utilise new markets and market channels (Arce *et al.* 2007). They can also be constrained by other, negative changes, especially loss of customary land rights, increased competition for land from speculators and industry, quarrying activities (e.g. construction sand and stones), and more regulation, control and political pressure (Mubvami *et al.* 2003).
- *Recent migrants who engage in agriculture as a (temporary) survival strategy.* They often rely on relatives and people with common origins to get access to land, or else make use of vacant public land. They often bring farming knowledge and skills from their place of origin, part of which does not apply under the urban conditions and will need adaptation.
- *Very poor and food-insecure urban households* (including female-headed households with children, HIV/Aids-affected households, young unemployed people, elderly people without a pension, etc.). These socially excluded people may engage in food production out of necessity on very small plots on – often marginal – vacant open private or public land and around/in/on their homes.
- *Low and middle class urban households* that seek to complement their incomes by engaging in agricultural activities, often on their homesteads, e.g. zero-grazing dairy units, small poultry units, tree nurseries, ornamental plants, mushrooms, etc.
- *Richer people who see good investment opportunities in agriculture* and engage in larger-scale agro-enterprises often with hired farm managers and farm workers (large poultry and pig farms, flowers, strawberries, etc.).

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The last three categories of urban producers are already urban citizens and many of them may have limited prior farming experience and skills when they start producing. Agriculture is often only a secondary or tertiary livelihood activity, alongside other employment by different family members. Typically female household members, supported by young children, carry out the major part of the agricultural work, while the male household members engage in off-farm employment. However, the reverse situation also exists, in which the woman works in an office, as a housekeeper or petty trader, while the husband takes care of the farming activities (Arce *et al.* 2004). The fact that agricultural production in urban areas is often combined with part- or full-time activities in other urban sectors means that urban household decision-making processes and strategies regarding deployment of household resources are more complicated than those for rural households.

Social context

Even though the socio-economic circumstances of rural communities are rapidly changing (Bebbington 1999), these communities continue to be relatively culturally homogeneous and stable. Networks of kinship and neighbourliness facilitate farmer organisation and intervention processes.

Urban producers on the other hand often come from diverse socio-cultural backgrounds. They live in a highly dynamic environment with strong fluctuations. Under these conditions, there is often a low level of trust between households, thereby contributing to a sense of insecurity. Theft of products is much more common in urban compared to rural areas. These circumstances make interventions and the organisation of urban producers much more difficult.

Political and institutional context

In rural areas agriculture is accepted as a legal land use category, land ownership is usually customary and, in general, there are relatively few external stakeholders to contest land rights or to contest the direction of local development.

In contrast, urban agriculture, especially in inner-city areas, is often not a legally accepted land use and is constrained by important legal restrictions (Mbiba 1999). There are also a large number of urban stakeholders with competing interests in the natural resources necessary for agriculture, and their views on local development differ widely. Public sector agricultural research and extension services normally do not serve the urban areas; but urban producers have easier access to libraries and market information and are more exposed to the extension activities of agro-chemical companies, with not always positive results.

Productive resources: access and quality

In rural areas in many developing countries, land and water resources are rarely polluted. Water availability varies highly depending on the region; but where water is available, its price is generally low. Land and labour costs, especially in remoter rural areas, are normally low. The major part of production costs consists of inputs such as seeds, fertilisers and pesticides.

Urban producers frequently work under difficult environmental conditions with land and water resources often polluted due to industrial contamination, traffic, and lack of collection and treatment of household wastes. Production close to a large population also brings along specific health risks, such as contamination of water, soils and/or products from agro-pesticides and zoonosis (Birkley and Lock 2001). In urban areas land availability and security are low and land prices are high. Water may not be easily available or constrained by high prices (piped water) or low quality (polluted rivers or insufficiently treated wastewater). The costs of commercial inputs may be lower and alternative low-cost sources of nutrients are often available (in urban organic wastes and wastewater). Labour is almost always more costly than in the rural areas and less reliable, due to the availability of alternative, if uncertain, non-agricultural employment opportunities.

Farming types and agricultural innovation

The above factors have a strong impact on the types and styles of farming that one encounters in rural and urban settings. Rural areas are dominated by rain-fed farms that produce cereals, coarse grains or

root crops or extensively raise livestock (cattle, sheep, goats). Urban and periurban “farms” tend to become specialised micro-units of intensive livestock raising and horticultural production, sometimes without the need of cultivated land (as in rooftop, hydroponic and container production).. Perishable and “special niche” products dominate, especially green vegetables, dairy products, poultry, pigs, mushrooms, ornamental plants, herbs and fish. Year-round production is common through multiple crop cycles, irrigation and use of cover.

Innovation takes place continuously in rural farming systems, and in some areas it is even intensifying under the influence of increasing market penetration and stronger rural-urban linkages, both driven by globalisation processes. But in the urban context the need as well as the opportunities for innovation appear to be higher, due to the factors mentioned above, leading to a higher intensity of technical innovation, more diversity in farming types as well as new forms of organisation and cooperation.

Demand for non-agricultural services

Various urban needs (other than food) influence urban and periurban agriculture, such as the demand for recreational services, management of urban and periurban green spaces, heat/CO₂ reduction, ecological education, storm water storage, and wind/dust protection, to name but a few. Many urban producers in Western countries, but increasingly also in and around large cities in the South, integrate these new functions in their micro-enterprises.

Opportunities and challenges for innovation in urban farming systems

The specific interactions between urban farming systems and their urban environment create various specific opportunities and challenges for technical, organisational and institutional innovation. Key areas requiring attention include the opportunities for and risks of accessing and recycling accumulated urban nutrients (Dubbeling *et al.* 2005); the need to adapt and intensify production in space-constrained conditions (van Veenhuizen 2003); the risks of exposure to urban contaminants (Cole *et al.* 2004); the opportunities for agro-enterprises and accessing diverse nearby markets (Holmer 2001; Peters *et al.* 2002); and the need to engage with a dense and often intrusive regulatory, policy and planning environment, which impinges on agriculture in multiple ways and makes demands on the types of technologies that can be used (Dubbeling 2001).

a. Technological Innovation

From rural programmes we have learned that successful innovation in more complex agricultural systems (such as the mixed upland systems) requires application of participatory methods and active farmer participation in situation analysis and the technology development process (Biggs and Farrington 1991; Critchley *et al.* 2007). Urban agricultural systems exhibit even higher levels of complexity than rural upland systems and call for a combination of farmers’ knowledge and innovation skills with new technical and market opportunities. However, participatory technology development with farmers is more difficult in the urban context, due to multiple factors such as variable farming strategies, less organisation, commitment to other jobs, dispersal among the non-cultivating population, etc. Moreover, concepts such as “farming system” and “recommendation domain”, which are used in rural agriculture to identify common opportunities for technological intervention (Norman *et al.* 1995), are not as applicable due to the high degree of diversity and rapid changes in the urban production conditions. This makes it difficult to find broadly applicable innovations and interventions.

The more recent “sustainable livelihoods approach” seems to have special relevance in the urban context (Radoki and Lloyd-Jones 2002; Prain 2006), since it analyses households dynamically in terms of the use they make of all their assets (access to natural resources, physical equipment and infrastructure, their knowledge and skills, financial income and credit, social relations) in interaction with their environment (ecological conditions, market opportunities and practices, municipal regulations and policies, institutional services, etc.) to secure their livelihoods (Prain 2006, Bailkey and Smit 2006).

This approach takes into account the multiple livelihood strategies of urban households and the effects an agricultural innovation has on a household’s non-agricultural activities (e.g. reduced availability of

household capital or labour for non-agricultural activities), as well as specific contextual factors, such as municipal regulations restricting agricultural activities in certain locations (Peters *et al.* 2002).

In the rural context, participatory technology development builds on the “indigenous” knowledge of the local farmers. But, as indicated above, in the urban setting the traditional technical knowledge and skills of producers may be restricted or may be of less value. However, the urban producers may have knowledge of other factors that are highly relevant for the innovation process, such as local socio-economic dynamics, opportunities to get access to resources, the market situation or typical urban risks, and the capacity to innovate and learn from experiences. Against this background, it is understandable that good results have been obtained with approaches like the Farmer Field Schools that combine elements of training with experiential learning and experimentation.

Main challenges for technical innovation in urban horticulture

Innovation through intensification of urban and periurban horticultural systems, which can be described as maximising output from minimal space, is encouraged by the urban setting and occurs in different ways, each of which is associated with specific health and environmental risks:

- **Cultivation of high-value crops during the off-season.** This requires irrigation and/or covering, the use of adapted varieties and/or increased pest control measures to control or avoid higher pest pressure. Risk factors are high cash investment, prolonged pesticide contamination and increased losses of urban biodiversity.
- **Adoption of high-yielding varieties and/or increased use of agro-chemicals.** This method leads to a higher output per unit of land. Risk factors are pesticide contamination, nitrate leaching and loss of urban biodiversity.
- **Application of bio-intensive gardening and permaculture practices.** Both methods entail intensification and diversification of production through the application of ecological principles and low-cost improvements to agricultural management (IIRR 1991, Getachew 2002 and 2003). They have low health or environmental risks. The BIG approach is very suitable for use in the urban context due to its emphasis on intensive use of available space, as well as the nutritional quality and safety of the food produced. The same applies to permaculture that seeks to make optimal use of locally available resources by combining the cultivation of fruits, vegetables, herbs and the raising of livestock with rainwater collection, reuse of household wastewater, composting of household organic wastes, dry composting toilets, green building etc (Watkins1993).

Two intensification methods used in the urban context are less common or non-existent in rural agriculture:

- **Maximised use of available natural resources** where these had not previously been used for agriculture. This includes the use of wastewater, as a source of water but also as a source of nutrients (Buechler *et al.* 2006), the use of composted urban organic solid wastes (Cofie and Bradford 2006) and the use of abandoned or marginal lands, such as old factory or workshop areas, riverbanks or wetlands. Risk factors in this strategy are exposure to pathogens, parasites and heavy metals.
- **Intensified use of limited and vertical spaces.** This strategy includes the use of patios, roof tops, cellars and balconies; the use of various types of container systems and hanging baskets, growing walls and cascades or pyramids ; the use of soil-less systems like hydroponics (Marulanda and Izquierdo 2003) and “organoponics” (Premat 2005) and other “low space, no space” technologies.

Sustainable intensification in urban horticulture clearly needs to go hand in hand with:

- **Reduction of health and environmental risks** by facilitating the conversion to practices based on Integrated Pest Management (IPM) or organic farming practices and enhancing farmers’ capacity to apply safe management practices when using urban wastewater and organic wastes;
- **Improvement of the fertility of the soils** - due to compaction, overuse, presence of trash and farming on marginal land, fertility in urban farming systems is often a problem (Evans *et al.* 2000) asking for incorporation of organic materials, e.g. composted urban organic wastes, or transfer to popular hydroponics and organoponics;
- **Enhanced access to low-cost seed and planting material**, which is of major importance for the poor urban producers (Scheidegger and Prain 2000). This can be addressed through the promotion of

local seed networks (Arce *et al.* 2004) and the use of indigenous species that produce easily harvestable and storable seeds (Poubom 1999).

Main opportunities and challenges for innovation in urban livestock systems

The key challenges for technical innovation in urban livestock systems are the following:

- **Diversification and adaptation to space constraints.** In the urban setting more attention is needed for technology development regarding small and micro livestock (including guinea pigs, grass cutters, earthworms, snails, fish in small ponds and containers, and rearing young stock) as well as zero grazing dairy units and the inter-relations between urban crop and livestock production.
- **Enhanced access to feed.** In the urban context access to forage and other feed sources, and their efficient use in livestock nutrition, are important issues for technical innovation. Since forage is often scarce in urban and periurban areas, three responses are common: a. Forage is brought (e.g. Napier grass, fodder legumes, Para grass) from periurban areas into the city for use by livestock keepers in the sub- and intra-urban areas (e.g. in Hyderabad). In this case, frequent problems occur in relation to transport issues and the lack of space for forage markets (Njenga *et al.* forthcoming). b. More intensive use is made of concentrates to feed the animals (at high cost). c. Large amounts of food residues are collected from restaurants, markets, agro-industries and urban households for the preparation of animal feed. The third option in particular should be given more attention.
- **Reduction of zoonosis risks.** The increased risk of transferring diseases from animals to humans in urban areas needs to be reduced by working with producers on the adequate management of animal diseases and wastes, preventing scavenging, and maintaining adequate slaughtering procedures, among other issues (Lock and De Zeeuw 2001).

b) Organisational innovation

For the reasons mentioned above, urban producers are often poorly organised. More research is needed to identify existing informal networks and groupings of different types of urban producers; to analyse their problems and needs; and to identify effective ways to support urban farmer organisations and their involvement in urban planning and development processes.

It is important to bear in mind that producer organisations in urban areas may take more diverse and unusual forms than those in rural settings. In the *Urban Agriculture Magazine* 16 on “Strengthening Farmer Organisations” Santandreu and Castro (2006) distinguish between *economically oriented organisations* (more like the rural agricultural cooperatives, with a main emphasis on improving production, cheaper inputs, savings and credit supply, and marketing), *socially oriented organisations* (community groups / gardens organised with the support of churches, community centres and NGOs to help vulnerable households enhance their food security/nutrition and self-help capacities) and *politically oriented urban producer organisations* (focusing on advocacy and lobbying activities to improve their legal status, enhance access to land, and increase their participation in urban planning). Each of these types has its own dynamics and forms of innovation and will require different intervention strategies to strengthen that innovation.

To deal with the low social capital in urban areas described earlier, a lot of attention will have to be given to capacity building in areas such as building group cohesion, conflict resolution, leadership development, participatory planning, etc. Preferably, such organisational capacity building will be closely linked with processes of technical innovation and enhancing technical analysis and problem solving capacities (Arce *et al.* 2007, Prain 2006).

In urban farming, more than in rural farming, innovation takes place in the form of *micro-enterprise development*. Due to their closer proximity to consumers, urban producers tend to engage more in direct marketing of their produce, in the form of fresh products (farm sales, local outlets and mobile shops, farmers’ markets, direct sales to shops, restaurants and supermarkets), processed foods (preparation and vending of foods in local food stands and small restaurants, packaging, etc.) or as inputs (e.g. compost, earthworms). Innovation in urban agriculture can be greatly enhanced when research and support organisations link up with the micro and small enterprises engaged in agricultural processing and

marketing activities to support their local initiatives and strengthen their entrepreneurial skills and business development capacity (Holmer 2001). A good example of a successfully implemented micro-enterprise approach to innovation in urban agriculture is the PROVE programme in Brazil (Homen de Carvalho 2001), which combined capacity building and organisational strengthening, adaptation to municipal sanitary requirements, creation of a trademark serving as a quality seal, creation of “producers’ kiosks” in supermarkets, and enhancing access to capital for investment in small agro-industrial processing facilities.

A “cluster development” approach might also be highly relevant in the urban context. In this approach groups of similar agricultural micro enterprises (e.g. small-scale mushroom producers) and closely associated (actual or potential) support services analyse how they might cooperate in order to overcome scale disadvantages, make more efficient use of scarce resources and facilitate innovation in their enterprises. This can be done through a small intervention leveraged across the cluster (Holmer 2001).

c) Policy and institutional innovation

In the urban setting, innovations in agriculture are strongly influenced by local institutions, policies and regulations, which are more pervasive and invasive in urban areas than in the rural areas. Innovation in many cities is constrained by the informal legal status of urban agriculture, lack of land use security, and lack of support from technical and financial institutions. Innovation processes in urban agriculture have a better chance of success if they are part of an integrated approach to urban development and are embedded in an enabling institutional and policy environment.

Cuba serves as a useful example of how an enabling policy environment can impact the development of urban agriculture. Through effective policies and institutional support, urban agriculture developed between 1989 and 2000 from a marginal activity to a major component in the urban food system in Havana and other cities, a major employer of urban labour and an important source of micro-nutrients for the urban population. At the same time, it greatly reduced the accumulation of organic wastes (Novo 2003).

No policy or institutional change related to urban agriculture can be achieved before the value and potential benefits of urban agriculture are recognised, the associated risks are made clear and the actual constraints to and opportunities for its development are known. Therefore it is necessary to raise awareness among politicians and institutional managers and to provide them with adequate information that will allow them to involve other local stakeholders.

Various communication and lobbying strategies are used to better inform decision makers (Dubbeling 2005). The most effective strategy is to stimulate institutional engagement in urban agriculture, that is, to engage all relevant institutional “stakeholders”, including policymakers, right *from the beginning* in the situation analysis and design of research and action projects, in the monitoring and evaluation of results and in determining consequences for actual policies and programmes of the local government, national organisations and other stakeholders.

The RUAF “Cities Farming for the Future (CFF) programme” brings together local authorities, NGOs, universities, farmer groups and other “stakeholders” in a joint learning and planning process on urban agriculture by assisting in the establishment of a Multi-Stakeholder Forum on Urban Agriculture, the formulation of a City Strategic Action Plan, and the revision of existing policies and regulations on urban agriculture (see the city pages on www.ruaf.org).

The CGIAR Urban Harvest programme similarly emphasises engagement with policymakers and relevant local institutions to facilitate the development of safe and sustainable agriculture. This programme has implemented Stakeholder and Policy Analysis and Dialogue (SPAD) in Lima (Warnaars and Pradel 2007) and Hanoi (Tinh 2004), among other areas.

Learning points for supporting innovation processes in urban agriculture

The experiences gained to date with promoting innovation in urban agriculture in the RUAF-CFF and CIP-Urban Harvest programmes have resulted in a number of “lessons learned” regarding the best ways to support urban producers in innovation processes.

a. Focus on livelihoods: For urban agriculture to be viable and sustainable, innovation needs to take into account that in the urban context agriculture usually complements other income-earning activities undertaken by the household and contributes to and draws on the diverse set of household assets. In order to come to a correct understanding of the actual role of farming in the livelihoods of the urban poor and the opportunities/constraints for its development, a situation analysis should be based on the livelihoods concept.

b. Focus on enhancing innovative capacity and experiential learning

Given the dynamic and challenging urban conditions, innovation support to urban producers should focus strongly on building their problem-solving capacities (problem analysis, identification and testing of alternative solutions) as well as their capacity to identify and utilise new opportunities (e.g. analysis of specific requirements of various market segments, adaptation of crop choice and production practices, certification and trademarks, strategic alliances, etc.). The most effective approaches seem to be those that help urban producers identify gaps in their actual knowledge and skills and provide practical learning and experimentation opportunities to fill these gaps (like in the urban farmer field schools; Prain 2001).

c. Combine technical innovation with building and strengthening urban farmer organisations

Considering the high socio-cultural diversity among urban producers their lack of producer organisations and the multiple livelihood strategies of the urban poor, continuous efforts are needed to enhance group cohesion, build up trust and cooperation, enhance motivation and self confidence, strengthen organisational skills, etc., when engaging in processes of agricultural innovation with urban producers of the poorer sections of the population. An emphasis on group building would facilitate the technical innovation process at hand as well as the organisation of urban producers and their claim-making capacity.

d. Link technical-organisational innovation with institutional innovation

The need for institutional innovation (both public and private) is even stronger in the urban context than in the rural areas due to the tradition of institutional neglect of the urban agricultural sector.

e. Focus on enterprise development

In the urban setting a focus on micro-enterprise development and enhancement of entrepreneurial skills, such as the capacity to analyse markets and react to new opportunities, will greatly enhance the innovation process (in production as well as in processing and marketing). The importance of enhancing the food security and nutrition of the urban poor should not be forgotten, but the need for cash income is high in the urban context; and in order to arrive at sustainable urban production systems, intensification (in a safe and ecological way) and a greater market orientation will be needed.

f. Recognise the diversity in urban farming systems

Urban farming systems vary widely from purely subsistence to fully commercial and from micro-units to large enterprises. The development needs and opportunities of the various urban farming systems thus also differ widely. The most promising approaches therefore appear to be those that recognise this diversity and tune support and interventions to the needs and opportunities of each specific type of producer (for example: jasmine growers, community gardeners, intra-urban zero grazing dairy units, periurban intensive horticulture).

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