# Innovations in Urban Agriculture

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*An alternative design in Kenya (article on page 65).* Photo: Can Ya Love

**This issue highlights innovations in urban agriculture. Innovation and the various forms of innovations are of particular importance because urban agriculture is adapted to specific urban challenges and opportunities. Innovation is taking place continuously, exploring the multiple functions of urban agriculture, including food security, income generation and environmental management.**

The specific interactions between urban farming systems and their diverse urban environments create specific opportunities and challenges for technical, social, organisational and institutional innovation. Key areas include: high land prices; opportunities and risks of applying recycled urban water and nutrients; food safety and risks of exposure to urban contaminants; the need to adapt and intensify production in space-constrained conditions; opportunities for agro-enterprises in accessing nearby markets; combining multiple functions; social inclusiveness; and the need to engage with a dense and often intrusive regulatory, policy and planning environment (Prain and de Zeeuw, 2007).

## Various forms of Innovations

Innovation is generally defined as the process of creating something new, coming up with better solutions for existing (societal or market) needs or meeting new, still unspecified requirements. Innovations can be technical, involving new, improved or adapted products or services, or they can be more social or organisational and institutional, entailing new practices, or improvements in the strategy of entrepreneurs, farmers or organisations. They can also be in combination, often referred to as system innovations, which are fundamentally different ways in which societal needs are fulfilled. Innovations are to be distinguished from inventions, or novelties, which are just new ideas, devices, or methods. Innovations are new ideas that have a certain impact, socially or economically. Innovations are new ideas translated into practice.

The innovation landscape has become much more diverse and much more dynamic. Traditionally, ideas for new products or methods are generated in a research environment, selected and elaborated in a development environment, and commercialised in a marketing environment or disseminated by demonstrations and extension. This *closed innovation* process assures that new ideas stay within the company or knowledge infrastructure. This idea has given way, however,

## Urban Agriculture as Social Innovation

*Urban agriculture, and the development of sustainable urban food systems more generally, increasingly forms part of city agendas for social innovation. The complex and multidimensional issues that cities are facing can no longer be addressed adequately through traditional top-down and sectoral models of governance. There is growing acknowledgment in many cities that new governance and innovation models are needed. In this context, social innovation is intended to be a new model of value creation that tries to mobilise human talents and resources in the city as a means for problem-solving and the identification of solutions. Its characteristics are collaboration and empowerment of all involved stakeholders, and the use of new tools such as IT, online resources and social media. For this, cities need to evolve new services with their citizens by becoming catalysts and innovations brokers. It also requires new forms of leadership, and the implementation of appropriate social environments and networks that support innovation.*

*This social innovation approach has been applied to various thematic areas, including neighbourhood improvement, employment creation, housing development etc. Within the framework of the URBACT programme "Sustainable Food in Urban Communities" it was also applied to issues related to urban agriculture and urban food systems in a network of cities across Europe. The experiences highlighted in this project make clear that providing a stimulating environment for innovations in urban agriculture and food systems requires new roles for local governments, in which co-operation, co-creation and co-responsibility between local administrations, civil society and market parties are key factors.*

*Based on Jégou, F. and Bonneau, M. (2014) Social Innovation: What's behind the city scene? The URBACT Tribune 2014. More info on the URBACT project "Sustainable Food in Urban Communities" www.sustainable-everyday-project.net/urbact-sustainable-food/*

to a much more *open innovation* process, in which ideas that are not selected internally spin off outside the boundaries of the firm or knowledge infrastructure to be picked up by other parties that may develop new applications for totally new markets (Chesbrough 2003), see table 2.
On the other hand, it is also possible for new ideas to develop from actual practice, as is often the case when the users of a certain technology – such as urban farmers – know best their specific needs in their specific context. This is called *lead user innovation* (Von Hippel 2005).

The innovation landscape is diverse and dynamic (for a discussion on this regarding USA see page 35). This holds for any field of innovation, but even more so for urban agriculture, which is practiced by a wide variety of people from all walks of life, who do not always have a background in agriculture. Urban agriculture in the Global South, and also in the developed world impacted by crisis, often has a rather informal do-it-yourself character (see the articles on Southern Europe, starting on page 26). Novel solutions may be developed, shared through the internet or social movements, yet are not always recognised by the formal knowledge system. On the other hand, there is increasing recognition by city authorities that this bottom-up innovation is extremely important for realising sustainable transformations (as discussed in various GROW the City meetings, see on pages 13 and beyond).

The debate on closed or open source innovation is ongoing (see table 1, box on Vertical Farming and the article on page 62). Apart from economic, market-driven innovation there is also more socially orientated innovation. Social innovation is inspired by the idea that unequal outcomes of technical, market-driven innovation should be discouraged or prevented, and that innovation should be inclusive (see box on Social Innovation). Social innovation is about new ideas (products, services and models) that simultaneously meet

*Table 1. Types of urban agriculture, based on spatial location and level of control over production process*

| | open | mixed | controlled |
|---|---|---|---|
| building | Microclimates in and around the built environment (mushrooms, vines) | Rooftop gardens (vegetables) | LED light cabinets (vegetables)<br>Urban livestock (rabbits)<br>Aquaponics |
| inner city | Permaculture gardens (vegetables, fruits, nuts, roots)<br>Urban livestock (bee keeping) | Kitchen and community gardens (vegetables)<br>Urban livestock (chickens, sheep) | Urban livestock (worms, insects, etc.) |
| city fringe | Forest gardens (vegetables, fruits, nuts, roots) | Market gardens (vegetables) | Greenhouse nursery (vegetables) |
| periurban | Agroforestry (fruits, nuts)<br>Extensive livestock (beef cattle, sheep)<br>Ecological restauration | Mixed farming (livestock, staples, vegetables)<br>Semi-intensive livestock (dairy) | Greenhouses and precision farming (vegetables, staples)<br>Intensive livestock (pigs, poultry) |

Source: Agriculture Economics Institute, Wageningen based on de Graaf (2011)


*TERRAE participants are trained in the production for local markets (article on page 26).* Photo: TERRAE

social needs and create new social relationships or collaborations in which innovations are co-produced by citizens, governments and market parties.

Social innovations are often pioneered by civic networks, small societal groups, platforms or institutes, at the fringe of mainstream society that try to re-establish ownership over certain societal problems and pro-actively generate practical solutions that are within the locus of control of the particular group (empowerment). In many cases, urban agriculture may be regarded as a form of social innovation. In the Global South, urban agriculture has been an instrument for establishing or re-establishing self-sufficiency and for fighting poverty. In the Global North, alternative food networks – where people buy directly from farmers through farmers' markets, box schemes and web shops – are a way to support family farmers and at the same time make fresh food affordable for customers with a lower income. Social innovation often adopts the vocabulary and methods of open innovation; it does not just assume that knowledge and experience are widely distributed throughout society, it actively promotes this distribution. Social innovation not only acknowledges the fact that, in this Internet age, it is hardly possible to keep others from learning about new ideas; it actually encourages people to use each other's new ideas – not for individual profit making, but for the benefit of society as a whole: (see box on Social Entrepreneurship) and articles on the GROW the City project (pages 13 and further).

*Table 2. Characteristics of closed and open innovation?*

| Closed Innovation | Open Innovation |
|---|---|
| The smart people in our field work for us. | Not *all* smart people work for us. We need to work with smart people inside *and* outside the company. |
| To profit from R&D, we must discover it, develop it and ship it ourselves. | External R&D can create significant value. Internal R&D is needed to claim some portion of that value. |
| The company that gets innovation to market first will win. | Building a better *business model* is more important than getting to market first. |
| If we create the most and the best ideas in the industry, we will win. | If we make the best use of internal *and* external ideas, we will win. |
| We should control our IP, so that our competitors cannot profit from it. | We should profit from other's use of our IP (license out) and we should license in other's IP whenever it advances our business model. |
| We will *own* all results from contract research with universities. | We will partner with universities to create knowledge and encourage use outside our field. |

## Social Entrepreneurship

*The Blue Economy (Pauli, 2010), Social Entrepreneurship (Leadbeater, 1996), and Creating Shared Value (Porter, 2011) are approaches that seek to include social values in the development of innovative businesses. Social enterprises, at the local level and operating in urban-rural regional food systems, strive to incorporate shared values in social and environmental domains. The benefits create a positive synergy between their business goals and the well-being of the community and environment where they operate because:*

1. *they are inclusive;*
2. *they create employment, meet social needs of their workforce and the neighbouring urban and rural communities, and increase human well-being;*
3. *they source their inputs locally;*
4. *they are energy-saving, recycle waste streams, and optimise the energy-water-food-nutrient nexus.*

*(Based on ETC-RUAF programme development)*

Traditionally, government and market parties have played a large role in financing agricultural innovation. The increasing popularity of more distributed models of agricultural innovation coincides with the emergence of new actors who are able and willing to take part in financing these innovations. New ideas only gain impact, and thus become innovations, if they are properly resourced. Backing can come from public funds and agro-industries, but increasingly also from other sources such as venture capital, philanthropic capital, crowd-funding, and/or institutional investors. Each source of funding has its own preferences and profile, and different sources may be applicable, and applied, depending on the life cycle stage of the innovation (Green deal 2013).

## Innovations in Urban Agriculture

Because urban agriculture is a very diverse activity, innovations have very different expressions. Several typologies have been proposed previously (RUAF, 2006; Bhatt and Kongshaug,

*Cultivation in jute bags (article on page 72).* Photo: Gorakhpur Environmental Action Group

2005; Cohen, Reynolds and Sanghvi, 2012) which are flexible and are based on such different characteristics as: *organisational form* (for example, backyard garden, allotment garden, community garden, institutional garden, commercial farm) and spatial form (micro-garden, low-space/no-space, scattered in neighbourhood, food boulevard, integrated in public green infrastructure). An alternative typology, which is illustrated in Table 1, can be created on the basis of *spatial considerations* (in or around buildings, inner city, suburbs, city fringe, periurban) and agronomic considerations; the level of control over the production process (from almost full control, as in closed green houses and livestock permanently confined in stables, to some control, as in open field crops and livestock ranging in meadows, to hunting and gathering in wild or redeveloped nature).

This variety within urban agriculture implies a wide range of possible manifestations, and hence innovations, each having its own unique fit with the physical and socio-economic environment (functions other than food production that urban agriculture can provide). The range of practices encompasses inner city initiatives where the food grown is naturally adapted to the microclimates in and around buildings (such as mushrooms; see also the article on page 52), and different varieties of community and market gardens to periurban greenhouses and precision farming, to highly controlled production circumstances, such as the LED cabinets used in vertical farming (see page 62).
Sometimes it is claimed that only high-tech (controlled environment) initiatives are sufficiently adapted to the city and can solve the issue of urban food provisioning. We suggest however that low tech solutions (using or rebuilding nature's productive capacity) may be equally important. The character of innovation may be quite different in each case; for example, to increase the productive capacity of nature requires insights and skills that cannot be so easily patented. In addition, many people are critical of exclusive ownership of what nature provides. In the context of innovation, it is therefore also relevant to look at forms of high tech innovation that can also be combined with an open source strategy (see also box 3 below). It is also interesting to see that on investment fora such as the GFIA a wide range of urban agriculture types are showcased and a wide range of investors show interest in this wide range of innovations (see side bar on GFIA).

## Continuous innovation

By definition, urban agriculture in itself is an innovation of more conventional models of agriculture, which are situated in rural rather than urban areas, which tend to be based on linear rather than circular models of nutrients and water use between city and countryside, and which are directed to global markets rather than to the demands of nearby consumers. In the urban context, the needs as well as the opportunities for innovation are high, leading to a higher intensity of technical innovation, more diversity in farming types, and new forms of organisation and cooperation. Urban and periurban "farms" may 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.

The innovative nature of urban agriculture concerns a number of different yet interrelated dimensions:
- Confined land space
- Urban metabolism
- Organisation of production
- Participation in urban design and planning

## Vertical Farming: Hype or Promise for the Future?

*Vertical farming, basically, is cultivating plants on vertically inclined surfaces, or in different layers within a high-rise building. This refers both to basic structures (multistory structures, sometimes referred to as "low-space, no space"; see UAM 19, and Ranasinghe, 2009) and to more sophisticated structures and buildings. An early example of such structures are the hanging gardens of Babylon. As well, reports on the use of hydroponics have appeared in many publications, although this often refers to one-layer use on rooftops (see also UAM 10 on microtechnologies) or in greenhouses. More recent use of the term vertical farming refers to the use of techniques similar to glass houses, where natural sunlight can be augmented with artificial lighting. Stacking of layers is easier now than it used to be: as LED light produces less heat than conventional greenhouse lights, the height distance between lamps and plants can be reduced.*

*In this issue, various contributions deal with controlled environments (the articles on modular design, page 47, The Farmery on page 50, and two articles on Vertical Farming on page 61 and 62). As described in these articles, these controlled environments offer a number of potential advantages, such as reduced susceptibility to pests and diseases and a reduced footprint, and opportunities to reduce water use, control quality, produce closer to consumers, etc. Interest abounds, especially among researchers, planners, designers and enterprises delivering the infrastructure, because it is highly innovative and visible, fits with the concept of the green circular economy, and creates options for eco-green buildings. Because of this high level of interest, the structures, designs and technologies develop rapidly, and efficiency is quickly improved. Other examples of these controlled environments are PlantLab and Plantagon (see on page 63), which claims to offer a comprehensive technology.*

*Despite this interest, to date only very few of the proposed concepts have been realised, and a number of challenges still stand in the way. A major obstacle is the relatively high cost of investment as compared to growing food horizontally (sunshine is free and land designated for agriculture or horticulture is cheap relative to land designated for commercial real estate or housing). Higher investment costs drive up produce prices which raises the critical question of the potential for profitability and social accessibility.*

*In addition, very little research has been done on the environmental impact of the constructions and the energy needed. It is argued that, to really achieve the environmental benefits, alternative energy sources like solar power need to be utilised. These, however, will require further substantial investments. Furthermore, important issues are yet to be resolved with respect to the role of growing in or on top of buildings, with regard to real estate ownership and spatial planning. New forms of organisation and new approaches to both facility management and zoning need to be developed before vertical farming can take off as an industry well integrated in the urban fabric.*



*Other points of concern are the social acceptance and social inclusion of vertical farming. The technology can be used to increase the supply of healthy food for urban residents, thus – in theory – improving its availability and reducing its price. In practice, however, high-end market approaches may dominate as investments have to be earned back. Vertical farming, in this respect, may benefit from experiences in other industries, where business models are based not so much on the ownership of the technology, but rather on its use (e.g., photocopy machines that charge per page copied rather than per machine). For the practice of vertical farming to truly take off, there is still an urgent need to further develop viable business and organisational models. These might range from business-driven and mainly market-oriented initiatives to social enterprise initiatives that aim to integrate vertical farming techniques more into community-based approaches. Whether these models should, and will, be developed in an open innovation context is a matter of growing debate. Groups like MIT-City Farm and the Association for Vertical Farming (page 62) are striving to make these models public, whereas larger businesses are attempting to make growing food indoors proprietary. For further clarification of potential business and organisational models, it is especially worthwhile to better analyse the experiences of "real world" vertical farming initiatives that are currently emerging around the world, especially in Asia, Russia and the USA.*

*In light of the great interest in Vertical Farming, some claim that these technologies are the key to the future of urban agriculture in resilient cities. This claim, however, does not take into account the present, considerable, diversity of urban and peri-urban farmers, and the multiple functions of food production in and around the cities. This diversity is illustrated in this magazine, such as flood water and waste management, greening, recreation and leisure, education, community building, and so on. In addition, in many cities around the world the main problem – more than the total production volume of specific food products – is rather the distribution of, and lack of proper access to, healthy food.*

*More detailed and empirical impact assessment is required, in terms of environmental benefits, economic performance and social inclusion. We hope that these first contributions on vertical farming will mark the start of a more extensive debate on the potential (as well as limitations and conditions) for vertical farming techniques within the wider framework of urban agriculture and resilient city-region food systems.*

A big challenge for urban agriculture is high **pressure on the land** and **insecurity of land tenure** in urban areas. Land and space for agriculture is limited, and when available it can be contaminated; urban producers may also have to compete with a multitude of other users. Because urban agriculture, especially in the inner city, is limited by the availability of space and often is practised on small pieces of land, several articles here focus on growing crops in very small spaces and in areas where land is not fertile.

Innovations also encompass simple landless farming techniques, such as gardening in sacks (also of use in urban slum areas and in refugee camps, see UAM 21), hydroponics (UAM 10) and modular design (see pages 47 and 50) and the more recent phenomenon, vertical farming. Agricultural land in the city is scarce but many houses have flat concrete roofs, which provides space for growing crops (see also the articles on rooftop gardening and its role in adaptation to climate change in Nepal, in UAM 27), Making the best of scarce city land by using space on flat concrete roofs can also be linked to other sectors, such as health (see the article on Toronto on page 58), and linked to design (see the article on Berlin on page 55). Land scarcity and insecurity also can result in social and institutional innovation such as "land banks" for redistribution of temporary use of land (see the article about TERRAE on page 26).

Urban agriculture is also innovative in comparison to the conventional agricultural model in the way it is **spatially organised**. Traditionally, patterns of urbanisation and industrialisation led to a spatial segregation of agriculture and the city. By contrast, urban agriculture seeks to spatially integrate these two functions. There are various ways to achieve this, generally referred to as a debate between "spare" the land or "share" the land. The former refers, on the one hand, to the argument that urban development and urban agriculture should be as dense as possible, in order to leave as much space as possible elsewhere ("spare the land") for biodiversity and green space, and points in the direction of specialised agriculture being included in the urban fabric, though as a functionally separated and optimised productive activity. Land-sparing innovations typically concern intensifying production, processing, distribution and / or recycling technology (vertical farming, rooftop farming). On the other hand, it is argued that urban development and urban agriculture should be as rich as possible, where different activities are not only spatially but also functionally integrated ("share the land"). In this orientation, agriculture is envisioned as being included in the urban fabric, in such a way that it simultaneously contributes to other functions. See also: http://wle.cgiar.org/blogs/2013/05/15/sharing-or-sparing-land-for-nature. Land-sharing innovations typically are about intensifying the restoration of natural ecosystem functions and their exploitation as productive urban landscape, and about exploiting possible synergies and trade-offs between different activities and functions, such as adaptation to climate change (see the article on Gorakphur, on page 72), biodiversity, recreation, etc. This is also further elaborated in eco-city planning, green corridors and integrated planning concepts such as Continuous Productive Urban Landscapes, and in the promotion of City Region Food Systems. The debate at the GROW the City meeting in Almere (see page 19) also focussed on the opportunities for "sharing", or optimisation of multiple functions of urban

*Biogas reactor in the Netherlands.* Photo: René van Veenhuizen

*Mobile toilet designed by Practical Action, Bangladesh (article on page 77).* Photo: René van Veenhuizen

agriculture, while UAM 27 illustrated the role of urban agriculture in climate-smart and resilient city development.

A lack of clean water may also limit urban agriculture, and this is a key determining factor in the development and use of technologies; at the same time large amounts of organic wastes are available in cities. The closing of nutrient and water cycles by means of urban agriculture sometimes provides alternative solutions to expensive infrastructures. Innovations in urban agriculture may therefore also seek to further the development of closed loop farming (see articles on pages 68 and 71 here, and in earlier issues: UAM 20, 23 and 26). At one time, environmentalists regarded the city as a parasite since, rather than producing its own food, it encroached on the wider region in which it is located, polluting water, air and other resources (Odum 1989). Innovations in urban agriculture, however, increasingly propose a more nuanced approach in which cities feed on agriculture but at the same time agriculture is feeding on cities, by using or reusing its nutrient-rich waste water, its waste energy and its urban green waste to re-build the soil. There is increased interest from practitioners as well as city governments in integrating agriculture in the **urban metabolism**, the flows of energy and matter that encompass the urban system's input, throughput and output. The debate in the GROW the City meeting in Rotterdam looked into this issue (see page 24). and called for a more proactive, more systematic analysis of urban flows and what they can contribute to the city (see also on page 47). A more systematic analysis and development of innovations is needed.

Another dimension in which urban agriculture is innovative is the way in which it **organises the production, processing and distribution chain** (both social and market innovation). Whereas, in traditional food supply chains, many parties stand between producer and consumer, urban and periurban agriculture is generally characterizeds by short supply or value chains. In the shortest chain, urban dwellers grow their own food (self-provisioning through allotments or community gardens), a practice that may be considered as "backward" from the standpoint of mainstream economics as it supposedly lacks the benefits of division of labour and specialisation on the one hand and must incur the high costs of urban land on the other. Increasingly, however, we also see urban agriculture as a sophisticated strategy for employment creation (or even a survival mechanism), not only in the Global South but increasingly also in Global North countries facing economic crisis, such as in Southern Europe (see articles on pages 26-34). The debate in the GROW the City meeting in Utrecht explored this issue (see page 22).

Urban agriculture emerges as a way to **reconnect** farmers with urban dwellers, and to bridge the gap between industrial agriculture and increasingly demanding urban consumers in the Global North. Urban agriculture is innovating in new ways to create transparency (not based on formal certification schemes but on direct contact and supervision) and new ways to meet consumer demand (just-in-time, demand driven), and also in new ways for citizens to engage

*Drone used for aerial photos of urban agriculture in Ouagadougou.* Photo: René van Veenhuizen

as participants, co-producers and co-creators (consumers co-creating urban agriculture practices in terms of finance, labour, market insights, etc.), and in urban planning. Urban farmers experiment with new products and services, benefitting from urban microclimates in and around the built environment, and answering to segments in urban consumption that are not addressed by the conventional system (ethnic food, edible landscapes, etc.). The debate in the GROW the City meeting in Groningen looked into this issue (see page 10). One of the conclusions here was that the role of the municipality needs to change into that of a facilitator, allowing its citizens to explore new ways of community and production.

## Facilitating innovation

Urban agriculture is increasingly recognised as a vehicle for the development of, and the transition to, productive and sustainable cities. Since urban farming systems vary widely – from purely subsistence to fully commercial and from micro-units to large enterprises – there is a need for a multi-actor and transitional approach that caters to the development needs and opportunities of the variety in urban food provisioning requirements. This variety implies a wide range of possible manifestations, and innovations, each having its own unique fit with the physical and socio-economic environment.

A focus on business models, enterprise and micro-enterprise development and enhancement of entrepreneurial skills will greatly enhance the innovation process (in production

*Pigeon farming on roofs in Dhaka is a lucrative business.*
Photo: René van Veenhuizen

Global forum for innovations in agriculture
2015 | ADNEC | Abu Dhabi
9-10 March: Exhibition
9-11 March: Conference

Hosted by the City of Abu Dhabi, capital of the United Arab Emirates, and in partnership with the Abu Dhabi Food Control Authority and a wide variety of sponsors and contributors, the Global Forum for Innovations in Agriculture (GFIA) was held for the first time on 3–4 February, 2014.

The GFIA brought together participants from across the agricultural spectrum: over 3000 participants from 60 countries, more than 120 exhibitors, and NGOs and ministerial delegations from the countries UAE, Netherlands, Ghana, Zambia, Kenya and Tanzania. A number of innovations also included in this issue of the UA Magazine were presented in fifteen-minute long TED-like talks, during which speakers sought to convince the audience why their innovation would change prevailing thought about agriculture. GFIA was presented the "Best Conference" award at the Middle East Events Award Ceremony. As one of the GFIA partners, RUAF supported the attention for urban agriculture and food systems by putting the issues of participative innovation and social inclusion on the agenda (see below a short report on the round-table session organised by RUAF).

The 2015 GFIA is planned for 9–10 March. The 2015 edition will include partnership initiatives on post-harvest waste reduction, ICT, a workshop on hydroponics and algae production, and a forum on innovations in water technology, including recovery and reuse by IWMI. In addition, it will also focus on **Edible Cities, building resilience with urban agriculture,** including discussions on vertical farming, planning and design, climate smart urban food systems, and stakeholder collaboration.

## GFIA 2014 Roundtable Session: Promoting Social Inclusive Innovations in Urban Agriculture

The objective of this roundtable was to discuss experiences with scaling up innovations in urban agriculture, and how to strike a balance between social impact on the one hand and economic viability on the other. It was facilitated by René van Veenhuizen of RUAF with Jan Willem van der Schans of Wageningen University and Research, The Netherlands.
A discussion was held with panellists from IWMI, University of Arizona, Farm City Rotterdam, MITCityFARM, MASDAR Institute, Tamagama University, Puranatura and the Aga Khan Foundation.
The focus of this discussion was on food systems in and around urban areas, adapted to specific urban conditions such as confined space, proximity to consumers, and food safety. System innovation refers to improvements in the relations between various actors, e.g., multiple land use, short food supply chain development, and closing urban waste cycles, which are often a combination of technical, organisational and market developments.

A major challenge is to strike a balance between social impact on the one hand and economic viability on the other hand. To further professionalise and scale up urban agriculture innovations, external investment may be needed. But if urban farming projects focus on economic viability only, they do not really differ from conventional agriculture, which is likely to be more efficiently organizeds. If urban farming projects focus on social inclusiveness alone, it is unclear whether this can be scaled up and whether it can make a real impact on urban challenges. Clearly then, both economic viability and social inclusivism are required, in varying intensity at the different stages of development. This is often a matter of social innovation more than technical innovation. Two cases were introduced and discussed. One introduced by IWMI related to urban waste recovery and reuse, and how to bring in business approaches to make the initiatives more robust. The other case, by University of Arizona, building on "anytime, anywhere" agriculture and referring to agriculture operating in fully controlled environments, applied to locations with arid land, or places with a shortage of land, like cities. The participants referred to cases from their own experience.

It was also mentioned that, in the innovation of urban agriculture, we should look not only at costs, but also at the willingness to pay for increased access to fresh and nutritious food. Costs will be reduced when innovative forms of city farming mature, but it is also a matter of credibility and legitimacy. Urban agriculture should use more decentral, direct marketing channels in addition to the conventional, more centralised distribution channels. In order to gain competitive advantage over the current food system, urban agriculture would need to distinguish itself: with new forms of growing (closed nutrient loop, low energy), new varieties (perishables) and new ways of relating to customers (co-creation). In addition, agriculture adapts itself to the city, but the city will also adapt itself to agriculture and food. Cities have been optimised to a number of other things than food, but with current initiatives and insights, cities need to include and adapt to include agriculture. More sharing of data on economic performance as well as social and ecological performance is required.

Economic viability and social impact are not always at odds. Cases illustrate that economic performance is increasingly important, even for publicly financed socially orientated initiatives. It is also clear that there is no silver bullet to provide a solution to world food insecurity; it is very likely that a portfolio of solutions is needed, sometimes high tech (led light growing facilities) and sometimes low tech (pasture land for roaming livestock).

Development of UPA and short-chain food delivery involves the creation – or re-creation – and strengthening, at the city-region level, of networks and linkages, many of which were broken in earlier processes of globalisation and specialisation. UPA is driven by initiatives of market parties (including producers), government agencies and civil society. Generally, initiatives that build on a balanced and complementary mix of governance mechanisms (e.g., through public-private partnerships, multi-stakeholder platforms and an increased role for SMEs) appear to be relatively successful and more resilient.


*A design of a vertical farm in Berlin (article on page 55).* Photo: VFA

as well as in processing and marketing). There are a variety of business types, and showcasing this variety is important. Cutting across these types are various business aims: cost saving, cost recovery, revenue generation, profit maximisation, portfolio diversification, social enterprise, etc. Business models must always be attuned to the specific contextual setting and historical conditions which determine the success or failure of a case. The participatory nature of multi-stakeholder processes can play an especially important role in success and impact. Successful innovation requires facilitation of bottom-up initiatives, using mixes of financing, active networking and farmer/entrepreneur participation in neighbourhood and city platforms (undertaking joint situation and innovation analysis and policy reformulation).

In the urban setting, innovations in agriculture are heavily influenced by local institutions, policies and regulations, at various levels which not always are mutual supportive. Innovation in many cities may be constrained by existing legislation, the informal legal status of urban agriculture, lack of land-use security, and lack of support from technical and financial institutions. Given the challenging urban conditions, support to (innovation in) urban agriculture needs to focus firmly on giving space to, and building problem-solving capacities of, the main actors: including citizens and the urban producers and entrepreneurs (in problem analysis, analysis of specific requirements of various market segments, identification and testing of alternative solutions, building strategic alliances).


*Rotterzwam Growkit.* Photo: Rotterzwam

Many cities have created and are actively supporting platforms, councils (including those whose focus is food), and specific agencies for urban agriculture; many cities are also implementing related policies and programmes. RUAF facilitates this with its Multi-Stakeholder Action Planning and Policy Formulation (MPAP, Dubbeling et al, 2010), and is supporting City Region Food Systems. 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.

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