Eco-Urban Agriculture.
Design for distributed and networked urban farming in Shanghai

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Abstract

This paper introduces an innovative sustainable design project: "Eco-Urban Agriculture"—Design for distributed and networked urban farming in Shanghai. The goal of this project is to support a paradigm shift in the food model from a rural, disconnected, and monoculture model to an urban, connected and distributed model through creating prototypes of sustainable, urban farming systems.

The key to developing these urban farming systems, is determining the functional characteristics and networked associations that contribute to the success of an urban farm. A systems approach is used, a design toolbox and an iterative development process are applied to evaluate the network and its impact on the model.

It is important to note that during this prototyping stage, the immediate environment and social fabric will underlie the formation and type of urban farm network that can be created. Local resources will be used to integrate the urban farm into the local social and business networks. Stakeholders in the development of these new models are interdependent, local and include those in the fields of government, business, design, architecture and education.

To conclude the paper summarizes the methodology used in this project and explores how the findings can contribute to design development of scalable eco-urban agriculture models.

KEYWORDS: urban agriculture, network, local

1. Overview of urban food in China

The paper introduces a sustainable design project within the framework of innovative methods of urban access to food. It describes the Shanghai system and our design experience of building a Shanghai urban farming community.

The goal of this project is to support a paradigm shift in the food model from a rural, disconnected, and monoculture model to an urban, connected and distributed model by creating prototypes of sustainable, urban farming systems. Specifically, the project develops in the context of a metropolis and its relationship with the surrounding countryside, taking into account the relationship with the wider food environment; moreover, China is a place

where food issues are not only controversial but social and economic factors play an important role.

As concerns rise about our food supply, safety and environment, urban farming is set to be a big part of our future. The world's population is increasing at its fastest rate and is expected to increase by 50% - another 3 billion people over the next 40 years. Furthermore, it is expected that 80% of the world's population will be living in an urban centre by 2050. In China, 2012, urban residents constitute 51% of the population; that number is expected to rise to 70% by 2035.

Currently the focus is on "Eco Cities" yet the next big evolution of cities is likely to be "green cities": as governments start to look for new ways to feed the escalating and urban bound population, and urban residents look for alternative food supplies that provide safe, healthy and local food.

Urban centres are more and more becoming areas of consideration and experimentation with examples all around the world, from grass-roots initiatives to more structured citizenship projects. Recently, Nevin Cohen and Kubi Ackerman by the New York Times reported that "New York City's department of Environmental protection funded three new urban agriculture projects: a rooftop garden at a settlement house, a vegetable garden near the Gowanus Canal and a commercial rooftop farm on a Brooklyn Navy Yard building. These projects are part of an innovative green infrastructure program to turn impervious roofs, vacant lots and streets into spaces that soak up the rain and prevent water pollution." The authors went on to note that "Supporting urban farms and gardens as a means of keeping our waterways clean is an excellent idea, and should be dramatically scaled up. People are exploring with rooftop, vertical and basement farming, with very successful results". Indeed, these methods could represent the future of farming where agricultural land is sparse and populations are dense, especially in China's new urban centres.

A key factor of any urban farming practice is the possibility to extend its positive impact over the food supply chain. Yet in addition the introduction of urban farming can positively impact green cities and buildings which can offer positive benefits all-round including improved local economies. Proven to both save energy and costs, green cities can create and expand markets for fresh, local products and services. From a social perspective, green cities promote healthier and more comfortable outdoor environments and have positive aesthetic benefits. Furthermore, from an environmental perspective, green cities are a win-win model as they help to reduce the impact of global warming, reduce waste, improve air quality, reduce the city heat island effect and promote a healthier living environment.

In China urban farming is trailing behind some of its neighbouring countries, such as Japan, where basement farming with fibre optics now plays an important role in the development of urban food supply.

Through our Urban Farming initiative, we have been developing rooftop and balcony farming projects with the aim to increase awareness and engage citizens and communities in participative activities that contribute to their own environment. However, as yet much of the latter is retrofit and not part of the initial urban planning, so that green buildings and spaces, while beneficial, are not yet optimized. In China, the potential for change and the ability to pioneer greener, healthier cities, is huge, as China continues its building spree to accommodate its growing and moving urban bound population. Developing urban planning that incorporates urban farming has the potential to make huge changes to the quality of life and availability of fresh food and related economic benefits of such developments.

Through research and surveys developed in 2010, we found that among urban residents there is positive interest to "grow their own vegetables". There are also several architects exploring greener buildings yet the systems are not yet in place to make it easy for people who want to start their own urban farms. Some 60% of surveyed respondents said that they are open to starting an urban balcony or rooftop farm. They believe that the health benefits of having their own urban farm are both direct and indirect: it is fun, enjoyable, provides a healthy activity and it can be exciting to see their own vegetables grow and then eat them! Yet we also know that urban residents need urban farms to be compact and super easy to implement, as space is limited and their lifestyles are fast and furious.

2. Project outline

The project in discussion is based in Shanghai and is one of the main pillars of GoodtoChina's platform, dedicated to sustainable urban living. GoodtoChina offers goods and services to corporations and the urban community of citizens. This is achieved through the key areas of urban farming and sustainable design as well as research and education. For the past 3 years GoodtoChina's work has been focused on community events, model experimentation and understanding of the target through both quantitative and qualitative market research, the market and placing systems planning and design development into operation. A regular revenue stream has been difficult given the levels of experimentation, however to enable further growth and create a real impact there is now a new focus on building business that is economically sustainable. This year sees GoodtoChina realizing the benefits of its developments through various Urban farming based revenue streams. One of these streams and the main revenue source for 2012 is the Corporate Engagement & EMS program. GoodtoChina aims to offer a wide range of resources to help businesses improve their environmental performance. These corporate engagement services and environmental management systems are aimed at companies who are looking to create more sustainable buildings, healthier workspaces and environments for their employees and communities. Team Building workshops and Environmental management system programs are tailored around urban farming experiences to provide creative and inspiring learning for their employees. Teams are given creative building tasks, suitable for urban farming and stimulating thought about sustainable practices such as product life-cycle or packaging and communications; an example of this is setting the team building task to build a scarecrow, a composter or develop packaging for food. In addition employees are removed from their everyday environments, taken to one of our local urban roof top sky farms, a local green and inspiring environment and then they participate in creative manual tasks which are far removed from their everyday "desk" jobs. Here employees are faced with very new challenges and require communications, teamwork, leadership, co-operation, patience and confidence to achieve.

These programs have been developed to appeal to corporations by both enhancing a company's HR and CSR practices: as employees actively improve their corporate skill sets while benefiting the surrounding community and natural environment. These programs have been only made possible due to our creation of "sky farms". These new urban farms provide an oasis in the centre of Shanghai and make it easy for corporations to benefit from outdoor creative urban farming activities. Sky-farms is a rooftop farming initiative in Shanghai – designed to promote and encourage healthier lifestyles and environments that also green our cities. They provide an attractive and convenient outdoor space for people to come together,

learn, and grow their own fresh, local, organic food plus more. GoodtoChina provides supported urban farming by providing workshops to to get started, a seasonal planting calendar, access to on-site farming tools, complimentary seed packets, urban farming resources, and water for irrigation. GoodtoChina, has partnered with the developers of Jiashan Market and Anken Green: both locations have been sustainably developed. Old factories were renovated with reused materials and then further developed to benefit from the principles of sustainable design.

These two locations are both up and running and testing a "member" Sky farms model, where individuals or corporate teams are responsible for farming their own plot of land. Both locations provide incredible locations for "sky farm" activities. GoodtoChina now integrates their corporate team building with the sites, conducts workshops and sustainability building tours for both corporates and schools.

Following the previously mentioned developments we undertook the project from the dissemination of urban farming concepts, to make it simple and to encourage people to plant their own vegetables. We are rolling out various programs and working with specific architects, with the aim to develop roof top farming and continuing research and development through our "sustainable design challenges" that in the local Chinese context relates to "healthy homes and safe/eco food in urban China". An envisioned paradigm shift from disconnection of food supply to a connected and distributed model based on urban production requires experiments and prototyping; since 2009 we have installed five different rooftop farms to explore the concept of farming and food supply in Shanghai. Our evaluation will be based on several years of experience, learning and evolution These were retrofit rooftop farms; in other words, farms that weren't necessarily planned when the building was designed but were built because the client commissioned it and the roofs were able to fulfil the necessary structural requirements in terms of access, safety, size and engineering.

Our experience with these farms has enabled us to explore and monitor the challenges and opportunities associated with maintaining rooftop farms, the different revenue streams (actual and potential) that can come from an urban farm as well as the indirect revenue that can be generated based on the social values the farm enhances (e.g. pleasure, participation, healthy lifestyles and increased quality of life). Our intention is to take this learning and apply it to our understanding of what makes a successful 'urban farm' and the multitude of qualities surrounding it.

The project is articulated around research phases and implementation. The research phase has been conceived with specific aims. First, create a networking tissue within the city in which committed individuals and organizations could create a relationship platform. This is important because it contributes to the emerging community of interest, and enables the connection to evolve to a community of practice. Also, the research phase aims to give practical relevance to the urban farming action, through the implementation of tools.

Figure 1. structure of project dissemination process

In the development stage of the research we partnered with urban planners and architects to install our first urban rooftop farm at Jiashan Market. We installed the farm during our first event in Shanghai and invited people to participate in a workshop on how to create an urban farm. All materials were provided and with our expertise and that of architects and farmers we demonstrated how to layout and plant a rooftop farm. This urban rooftop installation was done during the same time period as a cross rural/urban, organic farm installation on the nearby eco-island of Chongming. Following the launch of Jiashan Market, we partnered with the architects at Anken Green and worked with them to develop their rooftop farm. We continued to work with both Jiashan Market and Anken Green, initiating workshops and events at the spaces.

Later on and based on our prior learning, we more accurately structured the process for rooftop farm development. We shifted our attention to the process of community building and the soft values important for motivation, to explore the factual and middle term benefits of participating in urban farms. We were mostly interested in understanding how people envision the use and the food cycle of the production of their urban farm. This is relevant to shift from the participatory aspects of design to the interest of material benefits and to take these material benefits and include them in the design outputs.

This started with a full questionnaire and site assessment to be completed by the potential rooftop owner. The questionnaire focused on the goals of the client, how they were going to use the rooftop farm, and their ability to maintain the farm. This questionnaire enables us to open up the conversation about rooftop requirements to further enable success and specifically helps owners to be more realistic about their goals and planning for their rooftop farm. For example, from our learning, many of our clients envisioned that they would be able to supply their café/restaurant with their own grown vegetables. We observed that they became quickly disillusioned when the production levels were limited and well below their

envisaged output. We found that this was often due to lack of knowledgeable farming and growing experience.

In the case of The Waterhouse Hotel, they commissioned us to install a rooftop vegetable farm to supply their very prestigious No. 1 restaurant. This came at the request of the chef and was endorsed by the manager. Following the installation, we insisted that staff receive orientation and active participatory workshops, a watering schedule, recommendations for maintenance and support to get the farm up and running. Although the farm was somewhat successful in supplying the restaurant kitchen its production was limited due to low levels of internal management and, employees with very little knowledge and minimum motivation. Consequently, the farm was unable to provide the quantity of produce the restaurant needed due to unreliable maintenance of the site.

Figure 2. the community of Jiashan market Urban Farm

We have given some indication of the types of locations of sky farms, such that they share sustainable development principles. Here we can give more details and clarify some differences of the two Sky Farms Urban Farming projects and The Waterhouse Hotel project. The two Sky-farms that are currently active are in Jiashan Market and Anken Green, both represent creative sustainable hubs in the city and both locations offer at least one café that provides a selection of healthy eating.

The differences are that Anken green is a "creative business" hub with one café, situated a little out of the centre of shanghai. While Jiashan market is centrally located, a mix of restaurants, healthy and organic stores and business, plus residential. These differences have created a different demand for the urban farm plots. Due to greater activities, diversity and its central location, Jiashan Market has received many more requests for plots compared to Anken Green: that serves more of a business market. For this reason we have slightly changed our target at Anken Green to invite the "small businesses" that work at Anken Green to take a plot for their business. Thereby spreading the effort required to farm and the enjoyment plus providing activities beyond just the immediate work space.

Jiashan market started with a smaller number of plots (five), all of which were rented very quickly and immediately transferred into waiting list. Following the launch we have now secured another 15 plots on the roof at Jiashan, which have been released in April. People who have rented are a mixture of individuals, partners and young families both foreigners and Chinese, who have very different experience in growing vegetables. All participants are excited to have their own plots to grow organic food in the city. Anken Green by comparison, started with 20 plots and as yet only two plots have been rented.

Jiashan market is a very convenient down town hub, located in the very heart of the "French Concession"; the head quarters of expatriate and middle class Chinese social life. It has many restaurants, services and shops, supported by organised and frequent community activities, with a vivid daily market in the lane and a bimonthly creativity market with DIY products, home chefs and artisans. 50% of the space is occupied by restaurants, 25% is rented for housing and the rest is occupied by creative businesses. The area is successful in offering events and entertainment that appeal to the same audience that is interested in growing their own organic food, and in this sense creates a rich and effective hub. The sky farm both adds to the pull of visitors and benefits from the diversity of the structure and appeal. At Anken Green instead the 90% of the buildings are rented to creative studios and small companies, there is a café that serves the people who work in the area, and several roof top activities are organized including theatre, yoga and physical workouts. Anken Green is less popular or frequented by the expatriates community as it serves the different purpose of less social interactions and more business and working services. In addition, it is positioned in a very Chinese neighbourhood that is slightly out of centre.

The last example is The Waterhouse Hotel, that is a roof top farm that serves only the café at the Waterhouse Hotel. It has not been developed into a Sky-farm and it is not envisioned that it will be used as a public space with public activities; as the farm itself is used as an outdoor restaurant and provides green aesthetic environment for activities.

In positioning Sky-farms in China, important factors for development are the appeal created through design and communications as there is a significant difference in appeal between foreigners and resident Chinese.

Over the past few years we have witnessed a positive support, in China, to the urban farming experience, as clearly mentioned in press releases about the project1 and in the development of national and local government policy. The interest and the public support (also through financial programmes) are positive signs and represent a big change in policy direction and behaviour: as many Chinese are still trying to move away from their farming history and family tradition, as this represents a system of values that oppose modernization and are associated with low quality of life.

Taking these values into consideration, the Sky-farms concept has to represent a contemporary contribution to urban life that reconstructs the identity of living public spaces through design while safeguarding tradition through health and natural balance. Generally speaking we can say that the foreigners community demonstrates a more proactive attitude and immediately are prone to experiment, sometimes with the romantic spirit to recreate more local and small scale living environments, reminiscent of their home town; While the Chinese are in general much less aware of

agricultural practice and are less experienced in proactive citizenship initiatives, they require more teaching/learning strategies and need continuous motivational help. We have observed over several years that when foreigners take the lead and demonstrate that an activity is popular and acceptable to their lifestyle, then the Chinese audience will also develop an interest: they are very rarely the leaders. So, for this reason it is important for us to appeal to both audiences. Given these preliminary differences, we will nevertheless be able to evaluate possible further cultural impacts in the future, after a middle-term engagement period.

3. Models of urban farming and project discussion

The current phase of the research project includes the development of a whole package for an urban farming experience, through a clarified interaction, development tools, fruition cycle, in a way that repositions food in the psyche of urban residents. This on-going phase includes the development of different urban farming styles and user profiles, as described. Nevertheless, all the models share basic minimum facility requirements, like rainwater collection (for crops, toilets etc.), grey-water recycling, reduced waste through composting, and the use of organic farming practices where possible.

Member Model - This model is based on an experienced farmer supporting development and ensuring that the farm is successful. The main characters in this model are the individuals who buy into a small and we believe manageable plot.

The launch of Sky-farms at both Jiashan Market and Anken Green is an example of the member model. This involves an individual annual membership fee for a small plot of land on which to grow organic vegetables. These plots are designed to be efficient and manageable and are approximately 6 sq. meter (which could provide 50% of annual vegetable needs for a family of three). Sky-farms provides members with a community of support, someone to answer urban farming questions, and set-up is made easy with on-site tools, a composter and water for irrigation.

This is 'ready-to-go' urban farming experience with a community of support that we envision will keep up the momentum and excitement of farming in the city. In addition to the roof-top community, both environments support social interaction and sustainability through activities like yoga, theatre, places to relax, spaces for corporate engagement programs, galleries, outdoor films and talks. Both Anken and Jiashan seek to become city sustainable hubs and Sky-farms works with the vision, concept of the building/space to support them as low-impact, creative hubs with sustainable design as a key component, and environment for live/work/play community.

Using the terminology, 'Sky-farms', we aim to redefine the farm as a new, modern and desirable place. It is no longer just about farming; the name, place, imagery and design all play out in terms making this an attractive space for local habitants.

Figure 3. example from the current Sky-farm

Villa Model – this is a purpose-built concept, a villa where inhabitants pay a premium for high-quality safe food, in their complex, that they can both, see growing and interact with. The design and integration of greenhouses into this environment has to optimize the look and the feel of 'new food', in fact, it should be a functional artistic piece where the greenhouse itself can be viewed as the food packaging. Due to space restrictions, these villas will optimize the most leading edge growing solutions including hydroponics and aeroponics. These spaces will look nothing like your traditional farm. Villa residents will feel like 'leaders' in innovation and healthy lifestyles. The villa model is designed to communicate contemporary, high quality, luxury food. Prices for villa inhabitants to buy into this model are also on the high side. During 2012 we aim to create the network of professionals and organizations to explore this model in Shanghai.

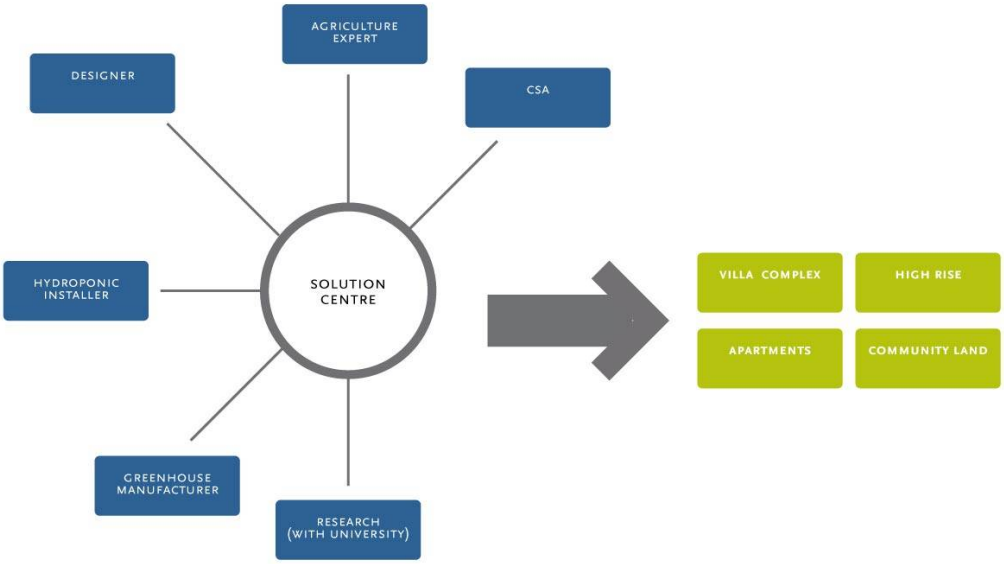

Figure 4. diagram of urban farming concept

Figure 5. render of Villa Model envisioning

Rooftop Model – These are high-rise rooftop farms that are developed specifically to feed the residents of the building, optimise food production, supply the cafés/restaurants or to provide value-added goods. These farms will be run by a professional farmer and could range from a full greenhouse/full production/full-efficiency farm providing food for café/CSA/value added (e.g. honey) through to a mix of greenhouse and soil-based farm that can be a multi-use area through to a green roof that is completely soil based. These rooftop farms will be customised and individually budgeted depending on the objectives and needs of the community.

At this stage of the project we can discuss several lessons learned and future directions for investment and commitment.

First, there is the maintenance issue. For the first urban farms that we installed, we did not discuss with the users specific maintenance strategies, that became to be of primary importance during the development of growing vegetables. We understood that the success of an urban farm cannot completely rely on self-organized and grasshoppers initiatives, but requires instead strong leadership; in this case our key learning was that a qualified farmer must be involved in maintaining the farm in order for it to be successful. Without an experienced farmer, we found that the majority of participants initially involved in the rooftop farm, even if highly enthusiastic and dedicated to begin, lost interest and passion and therefore discontinued their efforts. Also, we have found that while there are many opportunities whereby owners/building managers request rooftop farms; we have also identified that there is relatively little understanding of how these farms will be maintained, their level of production, which is often over-estimated, or indeed the type of produce to be grown. Overall we can conclude that there is very little planning with regards to the rooftop farm vision.

The main reason of this is a matter of awareness, and progressive detachment from the reality of food production knowledge. Users often, even the more committed, lack realistic knowledge about the reality of having a growing and living space and the necessity to maintain such a project. We have learnt that it is part of our role to make clear that an urban rooftop farm is not simply a landscaping installation, it is a living, growing, and changing environment that needs daily maintenance.

A final remark is required about the perception and the meaning of the practice of farming among our users: we have found that there is also a difference in attitude and perceptions between foreigners living in Shanghai and local Shanghainese. In the case of foreigners, there is a perception that setting up and maintaining an urban farm can be easy. Foreign urban farm participants have indicated that at the beginning of the project they have an idealistic and romantic view of urban farming, that it will enable them to get back to nature. Perhaps they have memories of their parents gardening and the abundance of produce that came from the family garden. However, following involvement in an urban farm project, we found that this perception changes. Often, participants understand that it is more involved than they had initially thought and that there are not only some 'trade secrets' and benefits to having farming experience but that it is also hard work.

Chinese residents, on the other hand, hesitate to get involved in farming projects because of their 'farming heritage'. There is a common belief that it is for the economically challenged and a lifestyle that most Chinese want to move away from. Farming in its rural and traditional sense, is not something that is going to engage a young, contemporary Chinese resident. For this reason, urban farming in our understanding, will be most successful if it represents a new contemporary way of living, that is disassociated with traditional Chinese rural life.

Although we were aware of some of these perceptions prior to starting this project, these realities of oversimplification by foreigners and the need to present a new "face of food" to local urban Chinese became clearer as our urban farming projects evolved.

4. design vision

At the current stage, we will continue to implement active urban farms and launch new rooftops in the next spring season. The project plan is for 2 years and will be pursued through practice. Among the results we can collect from research and practice, there are several wider design scenarios that are arising, in which the contribution from active citizenship can help to contribute and facilitate more efficient urban planning. In this perspective, we are seeking to explore urban farm hubs to support sustainable urban planning, with the aim to reduce food transport miles: as well as connect people with their food and support safe food. We will aim to support Innovative scenarios in urban planning that consider the system effect of the city, this will also require us to think about the individual elements and their capacity for sustainable purpose in their fundamental construction and application. The urban farming practice can envision cities in which connected and mainly local solutions emerge. We will outline these as innovative solutions represented by an integration of function within the designed and planned residential and working environment.

Retrofit Farms

This will be 70% of the buildings in the city – we will continue to explore the issues and challenges around setting up urban rooftop farms. We now understand how to set up rooftop farms, the maintenance requirements, and understand the time and knowledge deficiencies that exist. This learning will continue through our new and current projects. We are also talking to other urban farming organizations around the world to get their input and experience. We will now launch Sky-farms – another way of engaging people with growing food but in a supportive environment where a knowledgeable farmer is available to give advice and answer questions.

Purpose-Built Environments

With learning from the existing farms, we aim to create new environments with urban farming at the core. We are looking at both distributed and centralised farming models (e.g. distributed – growing in buildings, on balconies, in apartments, living furniture, kitchen lettuce, living wall dividers; centralised – entire floors dedicated to food growth)

These purpose-built environments will bring together a network of experts from different disciplines e.g. agronomists, designers, hydroponic specialists, greenhouse manufacturers, CSA farmers, researchers etc. We will tailor how we apply these experts depending on the function, target and location of these environments.

For Shanghai, we've identified three different solutions or economic models

- Villa complex – high end economic bracket (see description above)
- High rise – middle to upper income families (see description above)
- Apartments – maximising the relationship with food through growth inside the apartment

There will be a spectrum of economic input from private to government subsidised design solutions.

5. Conclusions and remarks

In this paper, we presented and discussed an on-going project of an urban farming system and we evaluated the first years of experiences.

Based on our current experiments and learning we believe that there are a variety of solutions that can help to support micro-economic urban farm environments and lead to success. We have found that the following elements help support success.

» Farmer managed or supported environment: farming made convenient and easier
» Create a desirable environment, one in which people want to spend time, one where they want to come, see, learn and participate
» Provide a pleasurable environment with activities beyond planting and growing vegetables – these environments are preferred compared with most city locations – it is a park with a function
» Create a brand extension through the food
» There are multiple benefits to be had by the different stakeholders
» For people who live in these environments: Fresh, safe, healthy food with good nutrients; and self-sustaining, people know where food comes from, they can influence the crop, can create more community, can set up a full ecosystem with composter, water collection, grey-water use and reduced waste
» For the owners it can lead to increased property value – both developers and inhabitants are happy – other people want what they have – therefore drives demand for local economies
» The environment helps to create the brand and brand imagery of the company (e.g. Jiashan Market, Anken Green)
» For developers, it creates a beehive for investors and inhabitants. It represents a lifestyle that is healthier and one that new home buyers are looking for. It's an added incentive to make a property choice when a buyer asks "why should I buy this property over another one?" then the response is because it offers access to safe, fresh food.

Still, the work is to be done, and many hard questions arise and some will be explored during the next steps of the active urban farming program and hopefully through the contribution of others. Some of these questions include the development of local policies to make it easier and safer to install rooftop farms. Systems to include a wider involvement with community and businesses to communicate the new face of food and its re alignment of values, the tools and insights on how to grow food, the benefits and methodologies to introduce urban farms: potentially these might include pop-up installations around the city where we aim to communicate the best of food, change opinions, change values, support farmers and provide interest in buildings that have access to food. Another realization could be attaching urban farms to hotels so that hotel guests can harvest their own food.

There is also community land that is ineffectively zoned or unused cemented areas that could be reclaimed for educational and participatory urban farming. For example, in Shanghai, there are areas within the EXPO site that could be used as urban farming educational stations where families, corporations, friends can learn and experience: linked with new technologies and modern farming methods that are key to urban farming.

We conclude the paper with envisioning healthier and more humanistic Chinese cities by supporting and enabling urban farming practices with clear and easy to implement systems habits and tools.

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