

Urban Agriculture in Amman

A Holistic View



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CSBE

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2.0: INTRODUCTION – GENERAL SUMMARY

Urban agriculture was historically widely practiced in urban areas in Jordan and the Levant. The traditional plant palette included fruits such as citrus, figs, pomegranates, grapes, and stone fruits. Growing vegetables such as tomatoes, cucumbers, radishes, as well as herbs such as mint, parsley, and basil was also widely practiced.

Changing attitudes towards gardens (from ones that primarily feature edible plants to ones that primarily feature ornamental plants) as well as increased urbanization and densification has resulted in a diminishing availability of available open space in the domestic and public realms that is available for urban agriculture. For a long period in the history of the city of Amman, with remnants of this still visible today, were old gardens with the traditional selection of fruiting trees, and empty plots farmed by tenant farmers with rain-fed crops such as wheat, barley, chickpeas, and fava beans. Urban agriculture in Jordan, however, has been quickly diminishing, and has unfortunately become an alien phenomenon for those under forty years of age, if not older.

In contrast, urban agriculture has been a growing activity in various parts of the world. Increased awareness of the importance of health issues / organic food / clean living, of bringing greenery into the city, and of the reduction of emissions, as well as the development of new relevant technologies, are making it more feasible and welcome on the individual, institutional, and commercial levels.

Urban agriculture not only serves to provide a source of fresh fruits and vegetables, but is in addition an activity that has a therapeutic value to its practitioners. It also helps create a level of positive social interaction as participants come together to form communities whose members exchange knowledge and experience, as well as the fruits and vegetables they grow.

Urban agriculture also is a form of income generation and community development. In contrast to other income generation projects, such as craft making, which require intricate marketing and sales networks, in the case of urban agriculture, the participants would simply consume what they produce, but also have the options of bartering what they grow or selling it in the market.

With urban agriculture, we are dealing with a historical and important form of food production that unfortunately has disappeared within the context of a country such as Jordan as a result of rapid urbanization and the mismanagement of open space.

This study examines the current shy resurgence of urban agriculture in Amman, and also looks into a few examples outside the capital. It accordingly examines and documents case-studies and pilot projects, and includes the results of interviews conducted with various people who have been involved in this process. It also summarizes the benefits, challenges, successes, and failures of urban agriculture initiatives in Amman and Jordan. The study, in addition, recommends potential avenues for developing the field of urban agriculture in Jordan. It should be pointed out here that urban agriculture may be carried out on either the small-scale household level or the large-scale commercial level. As this study indicates, the two are very different activities, and the contrast between them in terms of scale and economics are substantial. Although this study addresses both levels, the primary emphasis is on the small-scale household level.

It also should be emphasized that we use the term “urban agriculture” in this study to refer to activities taking place in urban areas rather than in peri-urban areas. Even more specifically, we examine areas where land is at a premium and in short supply in relation to demand, and where available empty plots for agricultural activities are very small, in contrast to peri-urban areas, where such plots are plentiful, and conventional farming may be carried out. We consequently are not examining agricultural activities that take place in fields, but those that take place in small spaces, which include available un-built plots of land, private gardens, setbacks around buildings, balconies, and rooftops. This of course defines the type of agricultural activities that may be carried out, and restricts them to small-scale ones that do not allow for wheat fields or spacious orchards for example.

In this context, it also should be added that in a city such as Amman, and because of steeply-increasing land prices over the past fifty years or so, almost all residential buildings being constructed over the past two to three decades, except for those located at the city's peripheries, have been apartment complexes. The only available open spaces in such apartment complexes are parts of the setback areas for building plots (a substantial part of the setback areas are used as driveways for underground parking garages), balconies, and rooftops.

3.1 Reduction of Emissions and Climate Change Mitigation

Food produced locally most often has a lower carbon footprint than that produced in a given location and transported to another distant location. In today's commercially highly-globalized world, it is not uncommon for fruits and vegetables to be produced and consumed in different continents. Moreover, urban agriculture can reduce the heat island effect, provide shade, absorb CO₂, and absorb pollutants. One study, for example, states that a 6-m² planted roof area can remove the particulate matter (particle pollution) produced by an average car over the course of a year (Dubbeling and Massonneau 2012, p. 9).

3.2 Access to Clean Food (Health)

Organic produce is not readily available in Jordan, except in specialty markets and upscale supermarkets. The local certification of organic products is also fairly new and its regulation is still in a state of flux. Urban agriculture helps mitigate such shortcomings. Growers involved in urban agriculture are also the consumers of its products. Even if that is not the case, growers and consumers usually are socially connected. They all will consequently have extensive knowledge of what goes into what is produced in terms of fertilizers and pesticides. Growing one's own fruits and / or vegetables gives people access to foods they feel more comfortable consuming.

3.3 Bringing Communities Together, Creating Stronger Social Bonds, and Helping Increase Wellbeing in Terms of Stress Relief

Many of us have stories from our grandparents' generation of exchanging knowledge and experience about planting and gardening amongst neighbors. In fact, nurseries were generally unavailable for that generation, and those involved in urban agriculture (as were most people at one level or the other before the 1980s) would generally obtain their needs of plants through the exchange of seeds and seedlings with neighbors.

In a number of cities in North America and Europe, for example, residents plant plots in communal vegetable gardens. Such urban plots take on the role of building communities and developing strong bonds between their members.

Moreover, farming and gardening are often employed in therapeutic environments as part of hospitals, youth rehabilitation centers, and psychiatric institutions. Locally, the Nour al-Barakah organization employed urban farming for a few years as an activity for children and adults with intellectual disabilities and developmental disorders. Any of us involved in gardening activities is fully aware of how soothing it can be.

3.4 Raising Awareness Regarding Environmental Concerns

People residing in Jordan are becoming increasingly separated from the natural world. About 85% of Jordanians now live in apartments (the rate of course is higher in Amman, where real estate is the most expensive in the country) (Reich forthcoming, p. 9). At the same time, the number of parks in Amman is very limited. Statistics regarding overall open, green public areas are not fully available, but, according

to the Greater Amman Municipality, the number of parks in Greater Amman is about 140 parks (2014). A good number of them are located at the peripheries of the city, away from densely populated neighborhoods. In addition, almost all these parks suffer from challenges relating to maintenance and upkeep. Considering that Amman's population is about four million inhabitants, this roughly translates to one park per 28,500 inhabitants. In contrast, according to the National Recreation and Parks Association in the United States, the typical park and recreation agency there offers one park for every 2,114 residents served, with 10.1 acres of parkland per 1,000 residents (NRPA Park Metrics). Although a comparison between the two countries is not a fair one considering that one is an upper income country and the other is a middle income country, the difference, a multiple of about 13.5 times, still is striking.

Anecdotal evidence also shows that there is a severe qualitative and quantitative deficiency in the provision of public green areas in Amman. As a result, most of the city's residents are completely disconnected from greenery, and have no meaningful experience with plants, not only in terms of planting and caring for them, but also in terms of interacting with and being in proximity to them.

This disconnection is very unhealthy considering the importance of green public spaces for the health of communities and individuals (Heok and Sia 2016). Among other things, such a disconnection distances people from any understanding of the severe environmental challenges affecting our planet, and therefore any appreciation of the important and urgent need to address them. Such conditions make people less understanding of the need for green areas and natural reserves, and of the need to tackle air, water, and soil pollution, among others. Getting people more actively engaged in activities such as urban agriculture exposes them to various important issues such as the fragility and delicacy of living organisms, the level of care needed to be given to them, the importance of water conservation, and, by extension, the environmental issues affecting our planet.

3.5 Potential Economic Benefits

3.5.1 The Household Level:

Through urban agriculture, participants produce food that has a value in the market. Urban agriculture also offers the added advantage in that the producer and consumer can be one and the same. Moreover, urban agriculture does not exclude the possibility of bartering the product (particularly for other produce items). Producers in addition may grow high-end produce for which there is reasonable demand in the market.

Producers may also save on their grocery bills by growing their own food (especially when buying organic produce, which tends to be more expensive). According to the National Gardening Association in the United States, the yield of a 600-square-foot (about 57 m²) plot can produce fruits and vegetables in the value of 600 USD (about 425 JD), or 12.5% of the annual food bill for an average American household (Taylor 2016). One study indicates that in Durban, South Africa, the amount of vegetables (spinach, tomato, eggplant, spring onion, green pepper, and chili) that may be planted in a 10-m² rooftop area over a period of eight months amounted to about 50 EUR (about 40.5 JD) (Dubbeling and Massonneau 2012, p. 10). The amount of savings obviously will range widely from one location to the other, and detailed studies need to be carried out in any given location to obtain a reasonable estimate for such savings.

Such savings in food costs of course are welcomed, but we should not overvalue the savings that households might achieve from engaging in urban agriculture. When considering their respective incomes, it should be noted that a yearly savings in the amount of 425 JD for an American household, and 40.5 JD for a South African household, although worthwhile, are not large enough to result in any significant transformations in their respective lifestyles. Moreover, the area of 57 m² mentioned above is a sizable one that is not available for the majority of the inhabitants of a city such as Amman, where most live in apartment buildings.

Although the economic benefits of engaging in urban agriculture on the household level should be considered, we also should keep in mind that they are not significant.

During the course of our research on this subject, we have come across an interesting example of a family of four that has managed to grow all of its fruits and vegetables needs in a 400-m² plot in their house property in the United States. They even raise livestock in the plot to provide them with milk and eggs. They produce more than their needs of crops, and sell the surplus to a nearby restaurant. They use the income they generate from these sales to buy food items that they do not or cannot grow. The head of the family even produced a short award-winning home-made film about the family's experience in urban agriculture (Dervaes 2009). The experience, although inspiring, still depends on the availability of a suitable amount of land that is not available to the vast majority of residents in a city such as Amman. Moreover, no mention is made regarding the time that the family members spend on these urban agriculture activities, but it seems to almost be a full-time engagement. This raises the question of how much time does the average household need to put into urban agriculture activities if it is to depend on them for producing most of its food needs. In almost all cases, it would be far more cost effective to engage in employment and buy one's food needs than to devote the needed time to grow them.

3.5.2 The Commercial Level (Supply to Hotels, Markets, etc.):

It is on the commercial rather than the household level that we believe urban agriculture may offer significant economic opportunities. The economic success of farming, after all, highly depends on the economies of scale, which is very difficult to achieve at the household level.

Commercial urban farming ventures will need to depend on new technologies such as hydroponics (growing plants without soil by using mineral nutrient solutions in a water solvent), aeroponics (growing plants in an air or mist environment without the use of soil or an aggregate medium), and aquaponics (a system in which the waste produced by farmed fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, which in turn purify the water).

Such systems are used in vertical farms, for example, which produce food in vertically stacked layers and / or in other structures such as high-rise buildings, abandoned warehouses, or shipping containers that may even be stacked on top of each other (and that have the added benefit of being moveable). One advantage of this use of vertical farms incorporating new technologies is that they also allow for the control of environmental issues including light, water, and temperature. They also can bring about water savings of more than 90%, and do not result in any agricultural runoff. Because of their controlled environments, crops can be grown in them all year round, and they have yields that, in some cases, reach thirty times the yield of more conventionally farmed open fields. The growing process may be fully computerized and controlled by software that ensures that all the plants obtain the right amount of light, water, and nutrients. Proper management and the growing of plants in a controlled closed environment mean that no herbicides or pesticides are required. Also, vertical farms may be located at the periphery of the city where land prices make them cost effective, but where the distance and the transportation time separating areas of agricultural production from those of food consumption (mainly urban centers) are still very low in relation to conventional farming fields. In addition, such vertical farms can tremendously reduce the amount of farmland needed for agricultural production, an issue of extreme importance in terms of protecting preserved natural areas from agricultural incursions and dealing with the limited availability of agricultural land (Frazier 2017; and Vertical Farming).

In this context, it is interesting to note that a study carried out at Columbia University in New York City indicates that if every square foot of rooftop space in New York City was farmed, that would provide enough calories to feed only about 2% of the city's population. In contrast, a complex of 200 buildings, each twenty stories, with each floor measuring about 370 square meters in area and located at the edges of the city can grow enough vegetables and rice to feed everybody in it (Frazier 2017).

The development of vertical farms is still in its early stages, and their effectiveness still has not been fully tested. Naturally, there are those who are skeptical about their success. For example, initial capital costs for creating such farms of course are high, and running costs, primarily relating to providing artificial lighting that mimics sunlight as well as temperature control features, are energy intensive, and consequently expensive and potentially polluting. The rapid growth of renewable energy sources, however, may provide a solution for this issue.

So far, the most commercially viable products grown in vertical farms are leafy greens, which fetch high prices. As the knowledge base and the technology evolve, and as renewable energy costs become more competitive, there is a very high likelihood that urban vertical farms will take on a major role in the production of food worldwide.

Commercial urban agricultural production in Jordan still does not exist, although there is an example of a very promising experiment, that of The Green Hub, which is connected to the Landmark Hotel in Amman. It provides an example of constructive cooperation between two innovative and technically competent entrepreneurs on the one hand, and a supportive hotel management on the other hand. We will be presenting this project in more detail below.



4.1 The Limited Availability of Space

Space, of course, is a very valuable resource in cities, particularly in densely occupied ones. As mentioned in the previous section, the vast majority of Jordanians now live in apartments and have little access to personal and public land for potential farming activities. Resourcefulness, however, is the key here. Every city has its share of unused public and private empty spaces, including leftover spaces connected to streets, sidewalks, and infrastructure installations. There also is a good amount of empty private space found in plot setbacks and on roofs. A part of this project also looks into possibilities for planting in small pots and containers, which may be placed in cramped areas, including small balconies, and even indoors, next to windows with appropriate natural light. Artificial light even may be used for growing plants. In many cases, neon or white LED lights are suitable, but special lights may be needed for some plants, and these are not easily available in the market in Jordan (but would be if appropriate demand for them exists). Of course, new technologies and systems such as those involving aquaponics, hydroponics, as well as container and vertical farming require far less space than that used by conventional agricultural methods, but are more expensive and complicated to use. Still, the amount of edible plants that may be grown on the household level remains small, much smaller than the average household's consumption levels. If significant quantities are to be produced, food plant growing will need to take place on the larger-scale commercial level, or possibly through cooperatives of various individuals and / or community-based organizations, and through using innovative agricultural systems such as vertical farms.

It also should be added that the various empty spaces mentioned above present their own set of challenges. For example, most of them will need to be supplied with soil or a growing medium such as pumice stone that is appropriate for growing plants. In the case of roofs, one also needs to deal with the problems of exposure to the hot sun and drying winds. Both can be very damaging to plant life. Providing the plants with shelter through interventions such as building greenhouses and shade houses can be an expensive undertaking. Constructing a greenhouse in Jordan can cost anywhere from 3 to 55 JD / m².

4.2 The Limited Availability of Water

Jordan is a country that suffers from water scarcity. Farming in the upland areas has historically been rain-fed. Jordan, in general, abounds with historical precedents of water harvesting and water-saving technologies. This inherited know-how, however, has not been passed on to new generations, let alone to the general public.

Although the cost of water is comparatively low, the supply and storage of water is often a limitation in gardening and urban farming. Water is supplied once per week in most urban areas, and most households only have limited water storage, primarily in rooftop tanks. Underground reservoirs are costly and are mostly limited to upper-income households. This, however, will not cause a problem for those involved in urban agriculture at a very small scale (e.g., planting in containers in one's balcony) as the amount of water needed for these is minimal.

Moreover, water saving mechanisms are available and should be used. For example, we at the Center for the Study of the Built Environment (CSBE) are testing a kit produced locally by Meezan Sustainable Development. The kit consists of two containers, with one placed inside the other. The outer container holds water, and the inner container holds the soil and the plant. The kit can reduce watering to once per week or less (depending on its location and the season), since water is located at the bottom

of the kit - thus reducing evaporation - and moves upward to the plant roots through capillary action. In addition, the technologies mentioned above (aquaponics, hydroponics, as well as container and vertical farming) use far less water than conventional agricultural methods.

4.3 Social and Cultural Hindrances

4.3.1 Lack of Community Engagement:

We feel that this is currently a more serious challenge to the spread of urban agriculture than technical issues such as the limited availability of land and water. The practice of urban agriculture has disappeared from the collective memory of city dwellers in Jordan. Moreover, little attention is generally given in Jordan (and countries of the global south in general) to issues relating to upkeep and maintenance. Plant care requires constant upkeep and maintenance, and plants can die even after only a few days of neglect. We have seen more than one example of planting areas in houses, schools, and community centers that were intended to serve as vegetables plots, but that have been neglected and have become weed-infested areas.



Planting kit developed by Meezan Sustainable Development as installed in CSBE's office

Growing food items requires a level of care and patience. One needs to pay attention to various issues. These include providing plants with adequate water. Also important is ensuring that they receive the appropriate amount of sunlight (too much or too little sun can harm or destroy them), and that they are protected from excessive heat or cold. One also needs to protect the plants from disease. Moreover, micro-climatic conditions, which vary even within the same general location according to differing exposures to the sun and wind, greatly determine which food plants grow and how they grow. Mastering all these issues requires a great deal of experimentation and requires engaging in a continuous process of trial and error. Planting fruits and vegetables is far more complicated and requires more care and time than planting ornamental plants such as geraniums, for example, which require very little care and can easily and quickly present visually striking results. Many people accordingly will decide that planting food items is not worth the effort, and that it is much more convenient to purchase them from the marketplace.

It is also our impression that efforts at promoting urban agriculture on the community level should concentrate on individuals rather than groups. Individuals would take care of the plants that they would grow for themselves and their families, and thus are more likely to provide the needed care. In contrast, in the case of groups, we face the phenomenon of the "diffusion of responsibility", where group members rely on other members in the group to do a given task, and nobody therefore ends up doing it.

Of course, urban agriculture as a commercial activity has considerable potential assuming it is carried out at an appropriately large scale and that it uses up-to-date technologies (e.g., aquaponics, hydroponics, and aeroponics combined with vertical and container farming). In the case of The Green Hub, for example, although both the producer and buyer have an interest in ensuring that the project succeeds, it needs to scale up if it is to become economically sustainable in the long run.

4.3.2 Lack of The Cultural Practice of Gardening (Reliance on Paid Labor):

This issue is also widespread in Jordanian society and is a serious one that affects vocational work in general. Agricultural and gardening work is very often taken on by expatriates working in Jordan,

usually from Egypt, as locals usually shy away from it. Obviously, a certain cultural / social shift will need to take place here. Once again, establishing the habit of engagement in urban agriculture in schools, as will be discussed in more detail below, may be a way of addressing it. In the meantime, however, it is worth mentioning that it is not uncommon to find affluent households occupying single-family houses with adequate garden space that devote a part of the garden to growing fruits and vegetables; but, in most cases, it is a hired gardener rather than members of the household who care for the garden.

There of course are numerous examples of initiatives and activities relating to urban agriculture that are taking place in Jordan. We have explored as many as we could, and the people we have interviewed often would connect us to others who are involved in similar activities. Some of those explorations have led us to very promising results, and others have ended by being dead ends in that we found that initial assertions are not supported by any corresponding results. Interestingly enough, we have noticed that a significant number of the urban agriculture initiatives and activities taking place in Jordan are being carried out by Western expatriates living in the country. What follows is a thorough, but not exhaustive, overview.

5.1 Individual Initiatives

The Belgian ambassador in Jordan, Hendrik Van de Velde, has developed a roof garden in his residence in the Amman suburb of Abdoun in which he grows produce. A Belgian architect and activist, Machiel Van Nieuwenhove, who founded the initiative Greening the Camps (www.greeningthecamps.com) developed the garden for him along with his team. The roof garden features around ten modules made of reclaimed palette-wood, and includes built-in seating and lighting. Each module is a raised bed with plastic lining and drainage for excess water that is filled with volcanic gravel (pumice stone) and peatmoss. The bed is watered via a plastic pipe placed at the surface of the soil that leads to the bottom of the bed, where it distributes the water. The water is made available to the plants through a 'wicking' system whereby the roots of the plants absorb their water needs through capillary action from the bottom up. This method promotes root growth and limits evaporation, and is ideal for arid climates. Shade is provided by a pergola and by grape vines planted at the outer edges of the beds. The beds are planted with vegetables, herbs, and a few ornamental plants. An additional small separate area containing a wooden bin is dedicated to composting. The total budget for constructing this setup, excluding labor, was 2,500 JD.

The Ambassador mentioned that developing the garden has been a learning experience for him that included re-learning how to grow vegetables, developing soil compositions suitable for plant growth, fertilizing the soil, as well as protecting the plants from the wind and from disease. The latter included learning how to use fungicides.

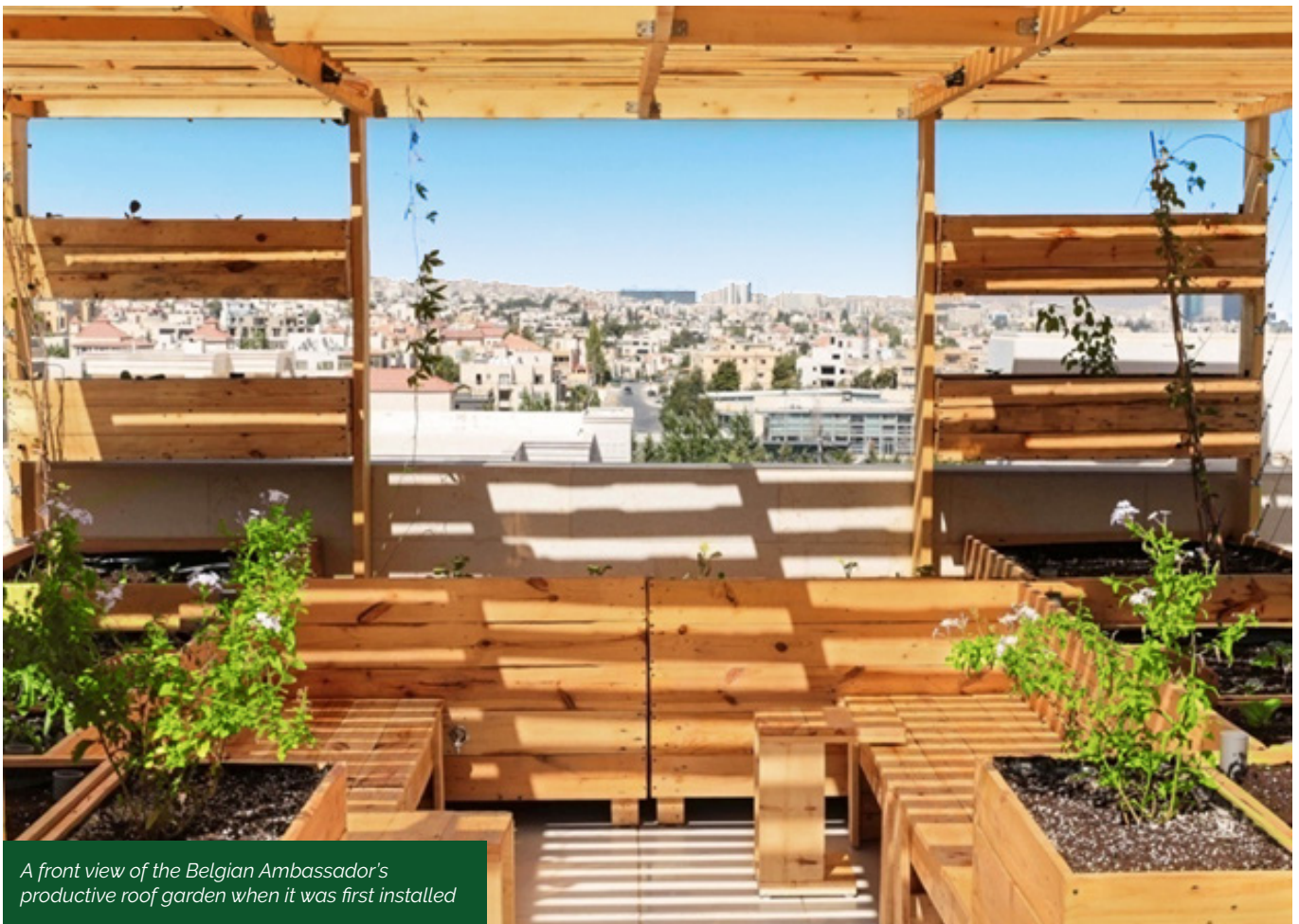
He added that during the growing season (March - October), he would spend about fifteen minutes a day during workdays, and two hours during weekends caring for the garden, but would spend much less time than that outside the growing season. He personally carries out most of the upkeep work with support from a gardener who comes in three times a week.

He has found that herbs, lettuce, and other greens have been the easiest to grow and require the least effort. He also has had a good experience growing carrots, zucchinis, and eggplants, but has faced difficulties growing tomatoes and cucumbers. He estimates that the garden provides around 20% of his family's produce needs (family of six members).

He composts the organic waste generated from his household to use as fertilizer for the garden. He mentioned that the composting bin is not covered and works well, although it would work better if covered. It also only needs adding water once every while. He mentioned that the composting process does not produce smells, nor does it attract flies. He expects that this may be due to the location of the bin on the roof, where it is exposed to windy conditions. He generally found it easy to maintain.



A side view of the Belgian Ambassador's productive roof garden when it was first installed in October 2017



A front view of the Belgian Ambassador's productive roof garden when it was first installed



Images of the composting bin in the Belgian Ambassador's productive roof garden



5.2 Commercial Initiatives

5.2.1 The Green Hub:

The Green Hub mentioned earlier is a very good example of this. We have met with the two entrepreneurs in charge of the project, Kevin Schiltz from the United States, and Grant Forbes from South Africa. This enterprise is a partnership between Mr. Schiltz and Mary Nazzal, whose family owns the Landmark Hotel. It is located at the Landmark Hotel, which has given them the opportunity to install an "urban farm" on one of the roofs of the hotel. The hotel also buys their products of vegetables and fish and uses them in preparing the food in their kitchen. This of course is a convenient arrangement for both parties, and is very positively received by the patrons of the hotel restaurants. It also provides a good deal of public goodwill for the hotel, which, for example, makes it possible for school groups to visit the facility. The project is not economically viable at this stage, mainly because it still functions at a relatively small scale, but it is an experimental project that provides a prototype for what may be accomplished in the near future in terms of urban agriculture within the context of Amman.

The project in fact is almost an experimental research laboratory for urban agriculture. It includes a 78-m² geodesic greenhouse dome that houses 45 m² of growing surfaces of hydroponic, aeroponic, and aquaponic plant growing systems. The team running it also has developed very simple small-scale hydroponic kits, and they have installed a composting bin on the roof.

They primarily produce about 75 kg of green leafy vegetables per month in terms of plants. As for fish, they harvest 150 kg of fish every year. Their aquaponic system uses the fish waste to provide organic fertilizer for the plants. The approximate cost of constructing the dome and equipping it was 7,000 JD.



The Green Hub geodesic greenhouse on the roof of the Landmark Hotel



The composting bin at The Green Hub



A view of part of the interior of The Green Hub greenhouse showing an aquaponic vertical growing system (on the right) and an aquaponic system (on the left)



A view of the other side of The Green Hub's aeroponic vertical growing system

5.2.2 Jadal for Knowledge and Culture:

This center, which is located along one of the public stairs connecting the Downtown area to Jabal al-Luweibdeh, has a rooftop garden planted with produce that is connected to its café. It was designed and built by the Greening the Camps team for a budget of 2,500 JD. It includes two green houses, one for soil-based cultivation, and the other for hydroponic methods, in addition to a composting bin. This project was implemented during the summer of 2017, and employs the same wicking bed system used at the Belgian Ambassador's residence. Care for the rooftop garden is now gradually being transferred from Greening the Camps to the center's staff.



A view from above of the roof garden of the Jadal for Knowledge and Culture center just after the completion of its installation. (Photo credit: Greening the Camps)



Planting beds in the roof garden of the Jadal for Knowledge and Culture center just after the completion of its installation



Herb beds at the roof garden of the Jadal for Knowledge and Culture center just after the completion of its installation



A view of planting beds at the roof garden of the Jadal for Knowledge and Culture center about a year after its installation



Hydroponic beds made of reused bathtubs in the productive roof garden of the Jadal for Knowledge and Culture center just after the completion of its installation



A view of planting beds at the roof garden of the Jadal for Knowledge and Culture center about a year after its installation

5.3 Kits for Home Use

We believe there is considerable promise here since the simpler the process of growing plants is, the easier it will be for people to take on this activity. These kits for home use are relatively inexpensive and simple to use, and are suitable for growing items such as cucumbers, tomatoes, peppers, and lettuce (in other words, all the ingredients needed for a healthy salad!). We already are testing the kit developed by Meezan Sustainable Development, as mentioned above. We have planted cucumbers in it, and a number of cucumbers already have begun to appear. We planted the cucumber seedlings relatively late in the year (in September), so we still are not in a position to make any definitive conclusions regarding this particular experience. We also have developed our own simple hydroponic kit that is made out of a filing box with openings in which cups with holes that are filled with peatmoss and pumice are placed. We have planted lettuce seeds in them. The seeds have sprouted seedlings, but they did not grow robustly, and some of them died. This may be because of a lack of nutrients in the water, or a lack of exposure to the sun. We are now replanting them. Again, it is difficult to make any definitive conclusions before we try such a kit over more than one growing cycle. We are using these kits in order to get a better hands-on knowledge of their effectiveness, and so as to ensure that our study is not a purely theoretical one.



In addition, The Green Hub team has developed two very simple hydroponic containers for growing items such as herbs and leafy greens in them, and they are using them. The success of urban agriculture activities depends on providing the proper soil or growing medium, nutrients, lighting, watering, and also protection from disease, but even then, a level of experimentation that extends over more than one growing cycle is required. There is also a need to ensure that the process of urban agriculture, whether directly in plots or in beds or containers, is very simple to carry out. Otherwise, one runs the risk of alienating people from trying it, since growing food items demands time, energy, and patience.





5.4 Community-based Markets

Such markets are very important in that they provide an outlet for small food producers, particularly at this critical preliminary stage when the practice of urban agriculture in Jordan is not yet fully established. The best known of these is the Nour Al Barakah Saturday market, which is run by the non-profit Nour Al Barakah organization (www.facebook.com/NourAlBarakah/) mentioned above. The organization serves children and adults with special needs, and accordingly fully understands the therapeutic value of planting. It was established in 2009, and has shown tremendous ability at growth, inclusiveness, and sustainability. Their market is held every Saturday in the Princess Iman Garden, a public park in Amman's Rabiya district that the organization uses for its activities (they managed to get approval from the Greater Amman Municipality to use the park for their activities, but not without difficulty). Growers can rent stalls to sell their crops at their Saturday market, and so can providers of cooked foods. The Nour Al Barakah project included a planting activity in the park for about four years and until two years ago. Although some planting still takes place in the park, its emphasis has expanded beyond planting. In addition to the market activity, the organization also has constructed facilities at the park that hold various recreational and educational activities for persons with special needs, which the beneficiaries found more engaging than planting. This experience shows that efforts still need to be made before gardening and urban agriculture become widespread activities in Jordan.

An important related activity that Nour Al Barakah carries out in the park is composting. They encourage people to bring their organic waste so that they would compost it. They receive about ten (50 x 30cm) containers every week. They have five composting heaps, with each heap producing six 24-kg bag when it is ready. The heaps are at different processing stages, so compost is ready in one heap at any given time. Although the setup is small and simple, as far as we are aware, it is the largest organic composting arrangement in Jordan.

In addition, the Jordanian bank Investbank supports al-Shams Farmers' Market (<http://www.souqalshams.com/>), which is organized weekly at the bank's branch in Amman's Abdoun district. The market features organic produce grown by farmers in the Ajloun governorate in northern Jordan. Through Investbank's support, the farmers received some training from the Royal Society for the Conservation of Nature to grow organic produce in cooperation with the Jordanian Organic Farming Association.



5.5 Supporters of Urban Agriculture Initiatives for Community Benefit

The presence of large private-sector companies that are willing to support and enable the various activities connected to urban agriculture through their Corporate Social Responsibility (CSR) efforts are important. As mentioned above, Investbank has directed a good part of its CSR funds to agricultural activities and their marketing, but this so far has not included direct support for urban agriculture activities. The support that Landmark Hotel has provided to The Green Hub is also a good example of how large commercial establishments may support urban agriculture activities, in this case for the benefit for all involved, including the hotel itself.

5.6 Schools

We believe that if people are to become engaged in urban agriculture activities, schools are the best place to start. Students generally are already in a learning mode, and accordingly a good number of them will devote the needed time and energy to learning how to plant food items and care for growing them. We have come across schools where plants are being grown successfully, and where students have shown interest and enthusiasm in the process (although we also have come across schools where food growing efforts have not been successful). The initiatives established at the following two schools provide very serious endeavors aimed at achieving this goal.

5.6.1 Amman National School

This private school, which is located in Amman's Dabouq district, decided to construct a rooftop greenhouse occupying an area of about 78 m² as an educational tool that informs students about planting food crops. The greenhouse was designed and installed by Meezan Sustainable Development, and includes three sizable growing beds. The beds use an aquaponic growing system. They are filled with pumice stone, and water circulates through them through power provided by a mechanical pump. The greenhouse has been operational for about a year and a half. Produce including tomatoes, cucumbers, sweet peppers, lettuce, and herbs have been grown in it. Students from different age groups have been engaged in the growing process, from planting to harvesting, under the supervision of Qays al-Hinti, who teaches biology at the school. The project so far has proved to be very successful, with a number of the students showing considerable enthusiasm for growing food crops. Mr. al-Hinti is also looking into expanding the area used for planting to include outdoor growing beds that would be placed in an unused terrace area in the school grounds. The project shows what may be accomplished

in a school environment when there is a supportive administration and dedicated teaching staff members. We believe that what is taking place at the Amman National School provides a very good model that should be replicated for engaging and training students at a young age in growing food crops, and provides an effective building block for spreading the activity of growing food crops in society.



Interior view of the Amman National School rooftop greenhouse at the beginning of the growing season



Interior view of the Amman National School rooftop greenhouse towards the end of the growing season



View of a growing bed in the Amman National School rooftop greenhouse at the beginning of the growing season

5.6.2 King's Academy

This private school, which is located outside the city of Madaba, has purchased a container farm (an enclosed year-round plant-growing space that takes the shape of a 40-foot shipping container occupying a 30-m² area) produced by the American supplier Freight Farms (<https://www.freightfarms.com>). Such a growing environment, which features a computerized closed-loop hydroponic irrigation system, LED lighting, and temperature control systems are of course costly, and a 12 m by 2.5 m container can easily cost 85,000 USD. This is one of the first examples of computerized container farming to be used in Jordan, and provides an example of introducing new and innovative farming techniques to the country.¹ According to the company's website, the container, which has up to 4,500 'growing sites' distributed along 256 'crop columns', may produce two to four tons of leafy green produce per year using less than nineteen liters of water per day. The school will be using the container farm to produce items for its cafeteria kitchen, but also, and no less importantly, for educational purposes. The container farm is being installed at the writing of this report, and it has the potential to be a very promising initiative. The high cost of the container farm will hopefully ensure that it will be used as extensively and efficiently as possible for both teaching and production. The school currently spends 1,000 - 1,200 JD per month on leafy greens. It is hoping to cut this cost by at least 50% through the use of this container farm

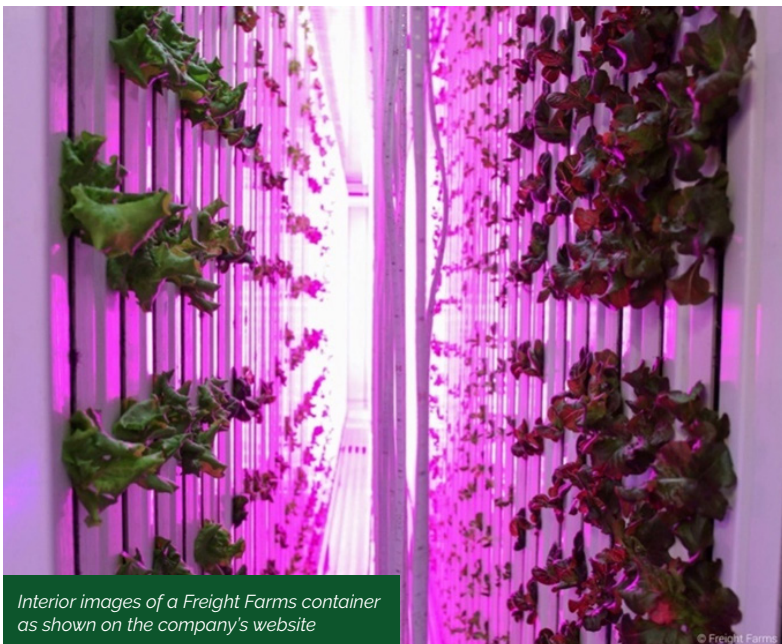
1 There is another example of container farming in Jordan we have come across that has been developed by Khalil Ibrahim Hamarneh and Sons Co. This company manufactures 3 m x 10 m containers to accommodate agricultural activities, and have produced a dozen farm containers so far, each of which is sold for 30,000 to 35,000 JD. The containers are provided with computerized watering, heating / cooling, and lighting systems that have been developed locally. They currently are placed in rural areas, and so far have only been used to grow barley for sheep grazing. Each container is producing a ton of barley daily. Plans, however, are being made to use them to grow other items. They have not yet been placed in urban areas.



Container farm developed by Khalil Ibrahim Hamarneh and Sons Co. in which barley is currently being planted (see footnote 1)



The Freight Farms container farm after being installed at King's Academy in October 2018



Interior images of a Freight Farms container as shown on the company's website



5.7 The Public Sector and Non-Governmental Organizations/Foreign donors:

The Greater Amman Municipality (GAM) had developed a few initiatives relating to urban agriculture, but none of them have survived, partly because of a lack of institutional continuity and because of differing levels of support that such projects have received from successive GAM administrations. The most significant of these projects is one carried out in Amman's Jabal al-Qal'ah district (2010). The project was initiated during the mayoralty of Omar Maani (2006 – 2011). The project initially was intended to simply clean up rooftops in the area from accumulated discarded items and to decorate them with layers of pumice stone since the area is located in an important touristic and cultural heritage district of the city, near the Amman Citadel. The project, however, grew and expanded to also develop rooftop gardens for these houses. Accordingly, a team from GAM headed by Hisham al-'Umari, who eventually headed a department within GAM devoted to urban agriculture, provided basic training to members of the local community, and provided them with plants and also containers and beds for growing the plants. Mr.

al-'Umari informed us that about thirty rooftop gardens were installed. GAM enthusiastically embraced the project at that time, and there even were plans to extend it to cover 10,000 rooftops in different parts of the city. This, however, was not realized. In fact, the original project was gradually abandoned after Mr. Maani's tenure ended. As far as we can tell, none of the original planted rooftops survive today except for a couple that already had existed before the project was initiated.



View of a roof garden in Jabal al-Qal'ah. (Photo credit: Khaberni 2010)

The Greening the Camps initiative, which was founded by Machiel Van Nieuwenhove, who installed the roof garden at the Belgian Ambassador's residence mentioned above, developed a productive roof garden for a vocational training center in the Gaza Refugee Camp near the city of Jerash, which is run by the One Love organization (<https://www.facebook.com/GazaCamp/>). The project was initiated in November 2017 and installed in March 2018. It consists of hydroponic beds and a wicking bed. The Greening the Camps team followed up on the maintenance of the garden for six weeks after installation, but it was not adequately maintained after that. It has now unfortunately deteriorated due to a lack of follow-up by the stakeholders. The infrastructure is still functional, and the Greening the Camps team is in the process of addressing the maintenance plans with One Love. The cost of installing this project, excluding labor, was 2,000 JD.



Images of the roof garden at the vocational training center in the Gaza Refugee Camp in Jerash. (Photo credit: Greening the Camps)

In addition, the German governmental international development agency GIZ, through its Facilitating Social Participation of Palestinian Refugees (FASPAR) project, and funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), had carried out a rooftop garden project in the Husun Refugee Camp near the city of Irbid. The project was conceived and implemented by the locally-based al-Karmel Club.

The camp consists of 100-m2 dwellings that used to be surrounded by small outdoor areas planted with a variety of productive plants and herbs. As time passed, the residents added extensions to their houses at the expense of the setback gardens. In 2016 and throughout 2017, GIZ funded a project to reintroduce vegetation into the camp via rooftop farming. The aim of the project was not income

generation, but rather the greening of the camp. Twenty-four houses were equipped with greenhouses, raised planting beds and water recycling systems in order to both save water and to protect the houses from water leakage (since the water proofing of the roof is not watertight). Ten additional green houses were also installed on the roofs of a community-based organization, amounting to 34 roof gardens in total. The material cost of each greenhouse was approximately 600 - 800 JD. Only a handful of houses, if that, sustained their roof gardens following the implementation phase (Binz, Brennauer, and von Lueder, p. 177).

In general, there seems to be an interest among aid agencies in exploring the use of roof gardens in refugee communities to create greenery as a source for providing food or as a source of income generation. Such projects, however, have not proven to be sustainable.



An example of the greenhouses and raised vegetable beds implemented in a house in the Husun Refugee Camp (Photo credit: GIZ)

It seems from our observations that such projects carried out by NGOs / foreign donors and public sector organizations have not been sustainable primarily because they are essentially free handouts to the beneficiaries. It is our experience that what is given for free is accepted, but not necessarily appreciated. For such projects to succeed, not only should there be a clear demand for them by the beneficiaries, but also a willingness by the beneficiaries to engage in a level of cost-sharing in realizing these projects, whether financial or in-kind.

Moreover, as mentioned above, growing plants on rooftops is challenging from a technical point of view. Rooftops tend to be exposed to the sun and drying winds, which create difficult growing conditions. An investment in infrastructure in terms of sheltering plants from these conditions is needed via shade houses, greenhouses, and windbreaks. Moreover, roofs in Jordan, and particularly in lower-income areas, are not very easily accessible. Many small single family houses have ladders rather than staircases leading to the rooftops. Roofs are also usually designed to house services such as water tanks, as well as for storing items such as furniture and installing solar panels. They are not equipped for daily use and are therefore not safe. They have low parapet walls and no safety barriers. The lack of adequate waterproofing is also an issue. Many roofs suffer from leakage and moisture seepage. Protection, accessibility, safety, and waterproofing are key issues to consider when setting up a productive roof garden. This increases the cost of the initial investment.

Given the challenges discussed in the previous sections and the assessment of various local case studies, the successful implementation of an urban agriculture project in Amman or Jordan is challenging. If urban agriculture is to become widespread in the country, efforts at reaching that goal will need to be carried out patiently and over the long term.

Below are potential approaches for spreading urban agriculture on the household level that we feel are more likely to succeed and be sustainable:

6.1 Schools

As mentioned above, starting educational urban agriculture programs in schools provides for realizable, implementable, and promising projects. Most schools already have the necessary space for such a project, and, as mentioned above, schools are places where learning and instilling interests and habits take place. The costs for such a project should be manageable, and can simply consist of planting in available land plots, in containers, or in constructed beds. A cooperative school administration of course is required, as well as one or more school faculty or administrative staff members who have basic knowledge in the subject and are willing to take on a long-term leadership role in the project.

6.2 Community-based/Cooperative Projects

It is also worth exploring the initiation of both individual and group urban agriculture projects through existing community centers. Group projects are trickier to realize and sustain, since there is a need to ensure that those participating in them are willing to continue their engagement in them for the long term, rather than getting bored and leaving the project after the first growing season. The community center may start a communal vegetable garden and invite those who are interested and willing to dedicate the necessary time and effort into it to take part in it.

The center also may make the individual small kits mentioned above available to their community members and provide training on growing plants in them, but eventually sell them to those who wish to try them, and not give them away free of charge. This also can provide the center with an income-generating activity, and the fact that those who wish to use the growing kits will have to pay for them will increase the chance that they will make the best use of them.

We feel that the most effective of such community-based initiatives probably would be to provide training to interested members of the community in urban agriculture. Such training needs to extend over a complete growing season at least. Those participating in the training would pay a small registration fee and should cover, or at least contribute to covering, the costs of materials and plants involved. The participants in the training would then engage in food growing activities in their own houses, but should also be encouraged to form social contacts with each other to exchange knowledge and even plants.

6.3 Commercial Enterprises

On the commercial level, one would need to deal with a totally different model. Here we are referring to high-density urban farming projects that use newer agricultural techniques as mentioned above. Such projects of course will require considerable investments in money and time. The success of

such projects, however, will also depend on policy and regulatory issues relating to the cost of water and energy, and also on the regulations that already exist and that will come into being regarding the production and marketing of foods through such projects.

6.4 Composting

A few comments need to be made about composting. If we are to (and we should) view urban agriculture activities within the context of integrated production, consumption, and waste generation cycles, we should keep in mind that the organic waste we produce may be converted through straightforward composting procedures into fertilizer for plants. The average Jordanian produces about 0.9 kg of waste a day (Yamin 2018). According to World Bank numbers, over half of the waste produced in upper middle income countries such as Jordan consists of organic waste, i.e. waste that may be composted (Hoornweg and Bhada-Tata 2012, p. 19). Composting of course may be carried out at the household level, but it takes a considerable amount of time before the contents of a composting bin are transformed into fertilizer (about three months). Composting also requires continuous follow up (layering of waste, watering it, mixing and turning it ...). Most people find this too much of an effort, or may not have appropriate space in their home plots for it. Considering that it is a challenge getting households to engage in urban farming activities, it will be no less a challenge getting them involved in composting. As a result, the process is barely practiced in Jordan. What is unfortunate is that composting also does not take place on the municipal level, even though municipalities collect large quantities of organic waste from households and establishments.

As mentioned above, as far as we know, Nour Al Barakah has the largest composting facility in Jordan, but it remains miniscule in comparison to the amount of organic waste produced, even within the context of the neighborhood in which its park is located. Efforts clearly should be made to integrate composting in any training provided regarding urban agriculture activities, whether in schools or in community organizations. Moreover, it is absolutely necessary that municipalities initiate the process of separating the garbage they collect and composting the organic components of it. Unfortunately, neither separating waste nor composting takes place anywhere on the municipal level in Jordan in any meaningful way. This clearly needs to change, and achieving such change is a very realizable goal.

7.0: GENERAL CONCLUSIONS

The practice of urban agriculture in Jordan on the household level still has a very long way to go. As things stand, the knowledge, interest, and dedication regarding it amongst households remain weak. It will take years of concerted efforts to spread the practice amongst households. Although training and pilot projects offered by community centers can be of help if administered properly, the best hope for spreading this practice is through schools, where instruction in planting foods may be part of the curricula or an extracurricular activity. Of course, personnel who are dedicated in the long term to these activities are essential for any of them to succeed.

The financial rewards of engaging in urban agriculture on the household scale are very low. Any initiatives aimed at promoting urban agriculture will need to take into consideration that although financial savings may be a byproduct of urban agriculture activities, such savings will not be substantial. In order for such activities to be financially viable, they would not only require enough space for planting and adequate supplies of water, but would also require the dedication of considerable time and effort. All these are not available in the case of most households.

The value of urban agriculture accordingly lies elsewhere: in greening the city and bringing nature into it; in moderating the climate; in establishing social bonds between those who engage in it; in its therapeutic value as a relaxing activity that involves caring for living entities; and in establishing a higher level of appreciation of the environmental challenges facing our planet. These of course are more difficult to quantify than are amounts of produce, their cost, and their market value, but are no less important.

In contrast, we believe that the potentials for engaging in urban agriculture on a large commercial scale are promising. Here, not only is there a need to further try out technical developments, but there is also a need to develop the necessary regulatory environment that would encourage large-scale urban agriculture activities. Such regulations would relate to issues such as the price of water and energy, zoning, taxation on agricultural activities, as well as the marketing and distribution of fresh food products.

Accordingly, although governmental intervention is essential to promoting large scale commercial urban farming activities, it is not necessary for promoting urban agriculture on the household level. Government intervention on the municipal level, however, is definitely required in terms of putting in place composting practices for all organic waste produced.

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