AMERICAN UNIVERSITY OF BEIRUT

THE CONTRIBUTION OF URBAN AGRICULTURE TO FOOD SECURITY IN POST-CONFLICT SYRIA

by
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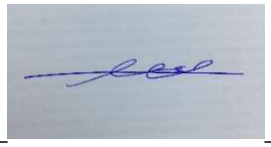

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ABSTRACT
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Background: In Syria, three quartiles (74%) of the total population live in cities by 2050, with scarce water and energy resources as the country is located in an arid and semi-arid region and under the American sanctions. The Syrian conflict that began in 2011 has not been solved yet which left behind it 12.4 million people food insecure, 1.3 million severely food insecure, and 6.7 million Syrians are internally displaced (WFP, 2021). The post-conflict situation requires more resilient solutions and policies to improve Syria's food security (FS). One suggested step is urban agriculture (UA) to feed the urban citizens and create job opportunities sustainably.

Research Question and Objectives: The study research question is: will UA be a useful option to achieve food security (specifically food availability and food accessibility) in post-conflict Syria? To that end, the main objectives of this research are: (1) to assess the potential of Urban Food Ecosystems (UFEs) (Controlled environment agriculture (CEA)) practices, methods, and reinvestments of water and food to improve food security in post-conflict Syria; and (2) to propose preliminary policy recommendations to guide UA in post-conflict Syria.

Methodology: The research first relies on a literature review of previous research on topics related to FS, UA generally, and UA in the MENA region. Based on that, a conceptual framework is therefore constructed. The framework was validated by conducting a semi-structured online interview with nine experts, researchers, and professionals in the fields of UA, water, and food waste reinvestments, and RE. The participants helped the interviewer to achieve the first and second research objectives.

Results and Discussion: A conceptual framework was created based on the literature review. The framework includes the usage of renewable energy (RE) for irrigation, operate wastewater treatment (WWT) plants, and desalination plants that also can be used as a water source besides harvested rainwater. The benefit will return to the Syrian economy by providing job opportunities to women, youth, disabled, and displaced Syrians. Fruits and vegetables would be produced nearby the cities centers which can reduce transportation, decrease the use of energy and water, provide fresh and diverse food to the most marginalized populations in Syria.

Conclusion: If UA is legalized and recognized by governmental leaders and politicians, it would be a contributor to improve the food availability and accessibility of the urban citizens and beyond. The food production would be produced nearby city centers in an environmentally friendly way, positively affecting the environment and Syria's FS.

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ABBREVIATIONS AND ACRONYMS

ADA – Agricultural Department Association

ADWEC - Abu Dhabi Water & Electricity Company

COVID 19 – Corona Virus Disease

ESDU - Environment and Sustainable Development Unit

FAO – Food and Agriculture Organization of the United Nations

FS- Food Security

GCC - Gulf Cooperation Council

MAAN – Moa'ssasat Ma3a

MENA –the Middle East and North Africa

ROUF - Resource Centers Network on Urban Agriculture and Food Security

TWW – Treated Wastewater

UA- Urban Agriculture

UAP - Urban Agriculture Project

UAWC – Urban Agriculture Work Committees

UNDESA – The Department of Economic and Social Affairs Population Dynamics of United Nations

WEF - Water-Energy-Food

WEF – World Food Program of the United Nations

WWT – Wastewater Treatments

LEDs - light-emitting diodes

CHAPTER 1

INTRODUCTION

Urban agriculture (UA) has been described as a new trend in agriculture to achieve food security through short, peri-urban, and/or urban supply chains. It is defined as 'the production of plants and animals in homes or plots in urban or peri-urban areas' (Hoornweg & Munro-Faure, 2008). UA includes wood production, beekeeping, aquaculture production, small-scale animal rearing (bovines and poultry, Guinea pigs), production of specialized crops (*e.g.*, medicinal and ornamentals), and most importantly vegetable and fruit tree cultivation (FAO, 2001b; Ghosh, 2004). UA has gradually passed through multiple stages from traditional agriculture to the integration of food production and new technologies. The benefits of the smart integration of technology and agriculture are that it can create sustainable urban food ecosystems (UFEs) for the rapidly expanding urban population especially in the developing world (Orsini *et al.*, 2013).

Fruit tree and vegetable cultivation will be the only agricultural products studied in this research, as they are socially accepted to be grown in urban areas, unlike breeding animals. Specifically, this research considers fruits and vegetables produced in a controlled environment based on the comprehensive research on UFEs studied by (Davies & Garrett, 2019) and their interconnectedness to the environment reinvestments such as water desalination, food waste, and wastewater treatment.

The rationale for UA is to address the challenge posed by population growth, which is dramatically increasing in urban areas as cities in the Middle East and North

Africa (MENA) region witness the fastest population growth in the world. In 2020, 58% of the total population of the MENA region lives in metropolitan areas, and this number is expected to reach 71% by 2050 (UNDESA, 2019). The increase of urbanization increases the scarcity of arable land and water, as cities are built in many parts of the region on fertile land and the groundwater is depleting, which increases food insecurity hand-in-hand with water scarcity from which the region suffers (Waterbury, 2017). The year 2020 can be seen as a watershed moment as many countries have seen a rapid increase in hunger (WFP, 2020). The Food and Agriculture Organization of the United Nations (FAO) (2020), estimated that 13.2% of the population in the region, or nearly 55 million people, are hungry, and the situation is worsening in Iraq, Libya, Syria, Sudan, Lebanon, and Yemen, where the countries are witnessing conflicts, economic hardship, and violence.

One of the most affected countries by economic hardship and conflict is Syria. The conflict in Syria started its ninth year in March 2020 pushing the Syrians into more poverty and food insecurity. Syria's FS ranks 107th among 113 estimated countries by the Global Food Security Index, 2020Index (2020). Economic resilience is a powerful tool towards developing the state, recovering from socio-economic destruction that happened due to the conflicts, and improving its food security post-conflict (Barthel & Isendahl, 2013). Millions of Syrians who are settling in the neighboring countries are expected to return to Syria after the end of the war. This will require more food availability in Syria in the medium- and long-term to feed the citizens and improve their nutritional status. One option for this objective is urban agriculture.

This research opens with a literature review on urban agriculture in the MENA region and a comparison of the practice of urban agriculture among the region's countries. Urban agriculture in Syria as a means to contribute to food security will be studied as a case study. Methodologically, up to 30 interviews will be conducted with experts in urban agriculture to answer the following research questions: Will urban agriculture be a useful option to achieve food security (specifically food availability and food accessibility) in post-conflict Syria? To that end, the main objectives of this research are:

(1) to assess the potential of Urban Food Ecosystems (UFEs) (Controlled environment agriculture (CEA)) practices, methods, and reinvestments of water and food to improve food security in post-conflict Syria;

and (2) to propose preliminary policy recommendations to guide UA in post-conflict Syria.

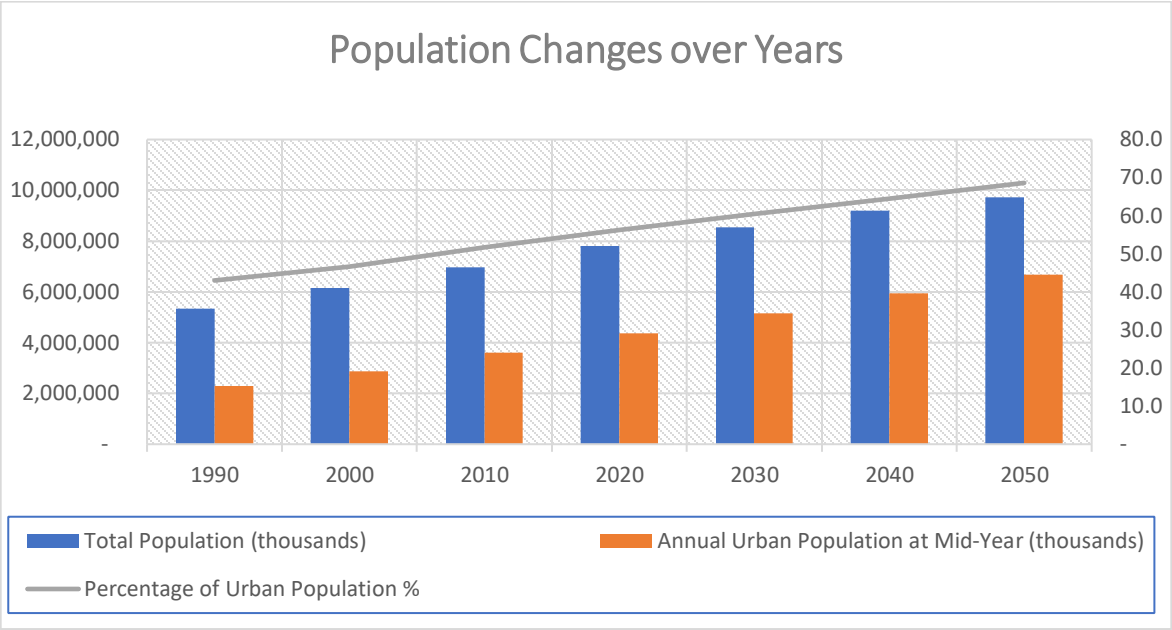
CHAPTER 2

BACKGROUND AND LITERATURE REVIEW:

2.1. Urbanization

Global and Arab population growth is increasing dramatically, and the 21st century will be the era of the city. According to the Department of Economic and Social Affairs Population Dynamics of the United Nations (UNDESA), the global population is 7.8 billion as of 2020 and is expected to be 9.7 billion in 2050 (UNDESA, 2019). Of these, 4.4 billion (56.2% of the total population) currently live in cities. This number is expected to increase to 6.7 billion by 2050, which means 68.6% of the total population will live in cities worldwide (see Figure 1). In terms of physical area, cities are estimated to occupy about 300,000–700,000 km^2 globally (Potere & Schneider, 2007).

Figure 1: Recent and Projected Population changes in the world (1990-2050)



Source: UNDESA (2019)

2.2. Urban Agriculture (UA)

"Urban agriculture (UA) is a complex system encompassing a spectrum of interests, from a traditional core of activities associated with the production, processing, marketing, distribution, and consumption of food, to a multiplicity of other benefits and services that are less widely acknowledged and documented" (Butler & Maronek, 2002). UA, also known as urban farming, is also defined as production in the home or plots in urban or peri-urban areas (Hoornweg & Munro-Faure, 2008). According to FAO (2010a), UA carries many benefits for the urban population: (1) it occurs in limited spaces owing to the massive competition for lands; (2) it is generally conducted near markets, which decreases the cost of transportation and its associated greenhouse gas emissions; (3) it plays a beneficial role in managing natural resources for a sustainable environment due to its

recycling of organic discard and city water; (4) its products are freshly marketed without further processing which improves nutrition security; and (5) most of UA's farmers and producers are characterized by a low level of organization, that what created them a new kind of business to improve their livelihoods In UA, producers can grow a wide variety of products. UA includes wood production, beekeeping, aquaculture production, small-scale animal rearing (bovines and poultry, Guinea pigs), specialized crops (e.g., medicinal and ornamentals), and most importantly vegetable and fruit tree cultivation (FAO, 2001b; Ghosh, 2004).

As the proportion of urbanization rises significantly over time, the sites of food production have increasingly been located near the main consumption centers. Therefore, urban agriculture (UA) is gaining more relevance around the world (Orsini *et al.*, 2013). As mentioned by A. Thornton (2008), food production in urban areas is increasingly recognized by policymakers as a potential strategy to decrease the demand for rurally produced food and shift it to urban gardens. However, UA will never produce enough food to feed urban citizens, and, at its best, will account for a few percentage points of global food production (Martin-Moreau & Ménascé, 2019). However, these few percentage points could make a small difference in increasing the locally produced food in cities and their immediate environments.

Smit *et al.* (1996) attributed the people's return to growing food in cities to their need or desire for nutrition supply, employment, environment, food security, as well as enhanced ecological sustainability. Furthermore, Mougeot (2000) argues that UA plays a significant role in the socio-economic conditions of its urban citizens by affecting food

security, decreasing poverty, and boosting health and the environment. Despite the research and claims that show the contribution of UA to food security, UA has a low potential to improve the daily intake of food for the urban poor, or it would be infeasible in terms of available arable land (M. G. Badami & N. Ramankutty, 2015). However, and on the contrary to this claim, much of the literature has shown and illustrated the significance of UA towards improving food security, yet others have criticized it saying that it rarely decreases food insecurity and lacks the governmental support, arable lands to grow, as well as the social acceptance, which will be described by details later.

2.3. Urban Agriculture and Food Security:

2.3.1. Concept of Food Security

Many concepts of food security have evolved in the past fifty years to reflect the changes in formal political thinking, such that there have been nearly 200 definitions of food security developed by various international organizations and ministries of agriculture and food around the world (Maxwell & Smith, 1992). Reflecting on the global concerns of 1974, the initial focus was on the stability and volume of food supplies only. In 1974, food security was defined in the World Food Summit (WFS) as: “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices” (World Food Conference, 1974).

In 1983, FAO expanded the concept to comprise securing access by vulnerable people to available supplies, implying the balance between both the supply and demand

sides of the FS equation: It defined food security as, “ensuring that all people at all times have both physical and economic access to the basic food that they need” (FAO, 1984). Then, in 1986, a highly influential report of the World Bank entitled *Poverty and Hunger* focused on the temporal dynamics of FS. It provided the broadly accepted distinction between chronic food insecurity (which is associated with problems of structural and continuing low incomes and poverty) and transitory food insecurity (which involves periods of intensified pressure caused by conflicts, disasters, and economic collapse). This concept was defined as: “access of all people at all times to enough food for an active, healthy life” (World Bank, 1986).

By the mid-1990s, FS had been recognized as a significant topic and concern, scaling from the individual to the global stage. Also, the definition was broadened to associate nutritional balance and food safety for an active and healthy life. It took into consideration food preferences, a social aspect (FAO, 2002). Therefore, in 1996, a more complex definition was adopted by WFS: “Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996). Eventually, the definition was refined in the State of Food Insecurity 2001 to be: “Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2001a). This definition and its dimensions are being used by a wide number of organizations, companies, and governments.

2.3.2. Dimensions of food security:

According to the last aforementioned definition of food security, the four dimensions of this concept are the following (FAO, 2008b):

1- Food availability: this dimension addresses the aspect of food availability determined by the level of production of suitable quality food, whether it is domestic or imported, in addition to the levels of food stocks and the net commercial profit of food exchanges (including food aid).

2- Food accessibility: an adequate supply of foodstuffs at the national or international level does not by itself guarantee food security at the household level, which has led to a greater focus of food policies on income, spending, markets, and prices to achieve food security goals.

3- Food utilization: it is explained as to how the body benefits from various nutrients in food. As the energy and nutrients needed for the individual are the products of good care and nutritional practices, food preparation and diet diversity along with the good biological use of food consumed, determine the nutritional status of individuals.

4- Food stability: the population, family, or individual must have adequate food at all times while ensuring that there is no risk of losing it as a result of crises or periodic

events (such as seasonal food insecurity[1]). Therefore, the concept of stability can refer to both availability, accessibility, and utilization of food.

Therefore, food insecurity exists when people do not have adequate physical, social, or economic access to food as defined above (FAO, 2002). Here, however, food is just any substance that people drink or eat to maintain growth and life. Thus, the nutrition aspect has been added to focus on caring practices like safe and clean water (as an essential part of food commodities), health services, and a healthy environment. That leads to so-called nutrition security which is defined, according to Quisumbing *et al.* (1995), as adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times. In fact, according to Weingartner (2005), food security cannot be achieved without nutrition security, and vice versa.

2.3.3. The Duration of Food Insecurity:

Food security analysts have defined two general types of food insecurity. Table 1 presents both.

Table 1**:** Two general types of food insecurity.

	Chronic Food Insecurity	Transitional Food Insecurity
is...	persistent or long-term.	temporary or short-term.

[1] The concept of seasonal food security falls between chronic and transitory food insecurity. It is like chronic food insecurity as it is usually predictable and follows a sequence of known events. However, as seasonal food insecurity is of limited duration it can also be recurrent, transitory food insecurity. It occurs when there is a cyclical pattern of inadequate availability and access to food. This is associated with seasonal fluctuations in the climate, cropping patterns, work opportunities (labor demand) and disease (FAO, 2002).

occurs when...	people cannot meet their minimum food requirements over a continual period of time.	there is a sudden or an unexpected drop in the ability to produce or access enough food to maintain a good nutritional status.
results from...	lack of assets, an extended period of poverty, and inadequate access to productive or financial sources.	fluctuations and short-term shocks in food availability and food accessibility, including year-to-year variations in a domestic food process, food production, and household incomes.
can be overcome by...	education and access to productive resources, such as credit, as atypical long-term development measures to address poverty. It is significant to provide them with more direct access to a good quantity of food to enable them to enhance their productivity.	transitory food insecurity is relatively unpredictable and occurs suddenly. This makes programming and planning hard and requires different types and capacities of intervention, including safety net programs and early warning capacity.

Source: (FAO, 2002).

An integrated food security and humanitarian phase classification known as the IPC has been developed by FAO/FSAU since February 2004. This international classification distinguishes food security phases and their humanitarian situations and gives each of them their own identification, as presented in Table 2.

Table 2: General Descriptions of IPC Phases

	Phase	**General Description**

A1	Food secure in general	Usually adequate and stable food access with moderate to low risk of sliding into Phase 3, 4, or 5.
2	Borderline food insecure/ moderately food insecure	Borderline adequate food access with recurrent high risk (due to probable hazard events and high vulnerability) of sliding into Phase 3, 4, or 5.
3	Acute livelihood and food crisis	Highly stressed and critical lack of food access with high and above usual malnutrition and accelerated depletion of livelihood assets that, if continued, will slide the population into Phase 4 or 5 and/or likely result in chronic poverty.
4	Humanitarian emergency	Severe lack of food access with excess mortality, very high and increasing malnutrition, and irreversible livelihood asset stripping.
5	Humanitarian catastrophe/ famine	Extreme social upheaval with a complete lack of food access and/or other basic needs where mass starvation, death, and displacement are evident.

Source: (FAO, 2008a).

2.3.4. Urban Agriculture for Food Security:

UA has shown that it can improve FS by improving food availability and food accessibility (Mougeot, 2005). Therefore, these two pathways are briefly outlined.

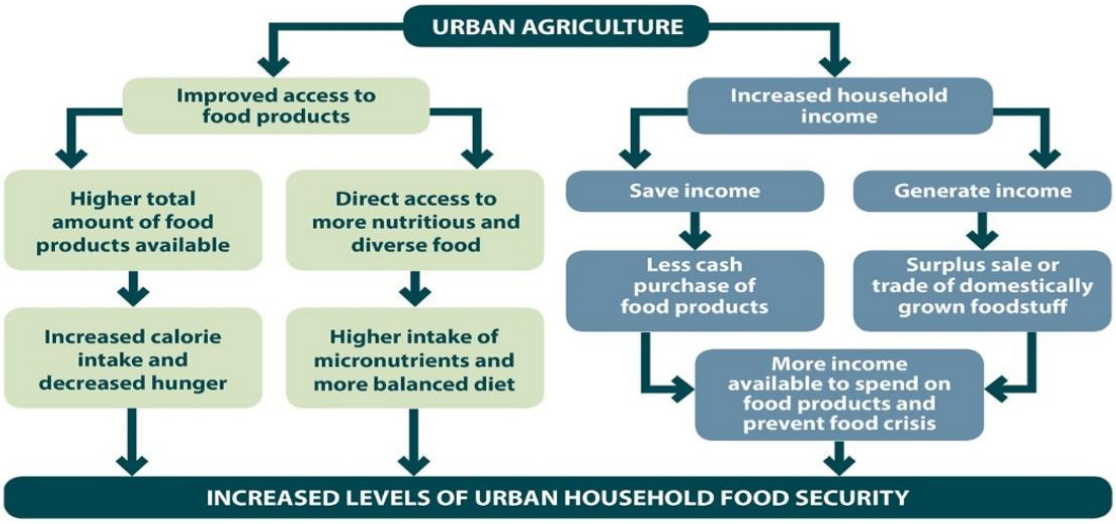
Concerning food availability, Zezza and Tasciotti (2010) argue that locally grown food can increase the total quantity of food available, which prevents hunger and malnutrition. Simultaneously, available fresh food and locally produced food can impact health positively outcomes by advancing the nutritional status of the household's members.

They also state that accessing food directly can diversify the diet of a household that is richer in micronutrients and improves kilocalorie consumption.

Most scholars believe that UA has a high potential in alleviating poverty and addressing food insecurity by increasing the income of urban farmers (Mougeot, 2005), which is the second pathway of improving food security. UA producers can improve their economic status by either saving income that they formerly used to purchase food or by trading their products. Therefore, the relationship between the change in income and the change in calorie intake is positively correlated: the higher the income, the higher the food consumption (Dawson & Sanjuán, 2011). For example, from a survey conducted in Ouagadougou, Burkina Faso, Gerstl (2001) measured the impact of UA on income and found that, on average, every household practicing UA was earning money equivalent in value to the monthly GDP per capita, which was the lowest in the world at that time about ($20). It is pretty similar to the Syrian GDP per capita nowadays during the conflicts and the economic collapse, as Syria's GDP per capita is $65 per month (IMF, 2020).

Korth *et al.* (2014) developed a framework that explains the linkages between UA and FS (Figure 1).

Figure 2: Urban Agriculture's Framework: two pathways to increased food security.



Source: Korth *et al.* (2014)

UA has proved that it improves food availability for vulnerable communities at the household level. Gallaher (2012a) studied the impact of sack gardening[2] in the slums of Nairobi, Kenya. The researcher concluded that 88% of the farmers perceived in a follow-up survey that their gardens provided them with extra food production.

The most positive added value of UA to FS is the increased amount of fresh food, more caloric availability, and greater dietary diversity (Korth *et al.*, 2014; Zezza & Tasciotti, 2008). For example, according to Armar-Klemesu (2001), UA can provide direct access to a larger number of nutritionally rich foods (vegetables, fruit, meat) and a more varied diet. Nugent (2000) argues that UA plots have the potential for high yields and can be even more productive than rural production. Regarding household-level yield potential, a plot measuring an area of 10 m by 10m can provide the needed vegetables for a

[2] Sack gardening, a relatively novel form of urban agriculture in the Kibera slums, involves planting various crops into the top and sides of large plastic sacks filled with soil, which allows people to plant a larger number of plants into relatively small spaces by making use of the vertical space occupied by the sacks.

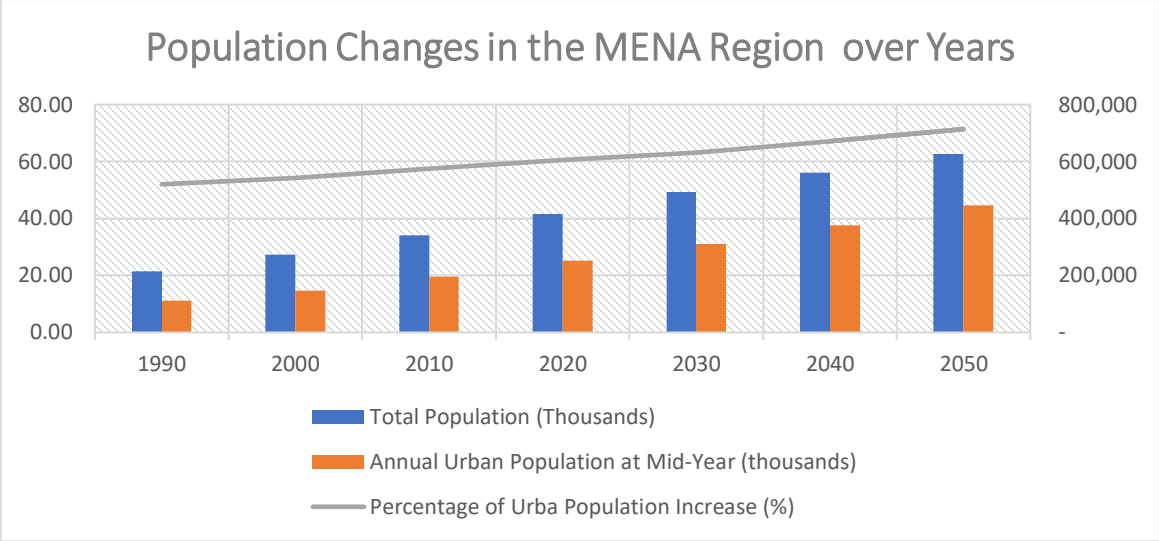
household and cover a big share of its vitamin A, B, and C and iron needs (Brown & Jameton, 2000). In urban farming, an area measuring only 1 m^2 can provide either 36 heads of lettuce every 60 days, 200 tomatoes (30 kg) per year, 100 onions every 120 days, or 10 cabbages every 90 days; thus, UA can provide 20 kg of food per 1 m^2 a year (FAO, 2010c).

In the developing world, the literature shows that urban poor employed UA to supplement their household's income, as well as the first source of income (Armar-Klemesu & Maxwell, 1999). In a study conducted by FAO (2010b) to estimate the profit of the poor's micro-gardens, urban producers can generate USD 15-30 a month per 10 m^2. Elsewhere, Danso *et al.* (2002) analyzed the costs and returns of urban grown vegetables in Kumasi, Ghana. The researchers revealed that the annual income from urban vegetable farming was USD 400-800, which was two- or three-fold the average income of the rural farmers at that time. In contrast, Armar-Klemesu and Maxwell (1999) conducted a study in Accra, Ghana, and claimed that UA does not generate more than USD 20-30 per household per year. Hampwaye *et al.* (2007) also examined the status of UA in Lusaka, Zambia. From a survey of 100 households, they concluded that 65% of the studied sample claimed that urban farming contributed less than 25% of their income; 22% of producers reported that it provided them with a range between 25%-50%; 10% said that the contribution was between 50%-70%, and only 3% of those surveyed reported the highest income contributed by UA at over 75% of the household income. Therefore, contradictions exist among the literature of UA. Some researchers proved that UA is a source of significant income and others denied that.

2.4. Food Security in the Middle East and North Africa (MENA) Region:

The MENA region is characterized by extreme land and water scarcity and low efficiency in resource use (Waterbury, 2017). According to Keulertz (2017), the MENA region's water and food insecurity leads to a greater rural exodus, due to threatened rural livelihoods, and thus to higher-level urbanization. The region's cities grow much faster than any other region in the world, as reflected in Figure 2.

Figure 2: Recent and Projected Population changes in the MENA Region (1990-2050).



Source: (UNDESA, 2019)

Figure 2 shows the demographic population changes over the years in the MENA region and its urban areas, as well as the percentage of urban population increase. According to (UNDESA, 2019), the population has been increasing dramatically in the region. For example, the number jumped from 214.5 million in 1990 to 416 million in 2020, and it is expected to be 626.5 million in 2050. This rapid increase is mainly concentrated in urban areas as mentioned above. In 2020, 58% of the total population lives

in the cities and is predicted to reach 71% in 2050. Thus, the future of the region will be in the cities (Keulertz, 2017).

FAO (2020) estimated that 13.2% of the population in the region, nearly 55 million people, are hungry, and the situation is particularly worsening in Iraq, Libya, Syria, Sudan, and Yemen, where the countries are witnessing conflicts and violence. The reasons for the alarming food security situation in the MENA region are multiple. Rural-urban migration has increased poverty in the cities, especially in suburban areas, which raises the prevalence of FI and malnutrition (Ruel et al., 2017). The high poverty level among urban citizens is particularly concentrated in countries facing social upheaval, political turmoil, and unparalleled mass immigration, internally and externally, due to conflicts such as Syria and Yemen (Sun et al., 2017) and low GDP per capita (Omidvar et al., 2019). Food insecurity in the region is also attributed to social inequities, economic instabilities, low agricultural production, and the high dependence on food imports (Jomaa et al., 2019).

2.4.1. Urban Agriculture in the MENA Region:

UA has been implemented in many countries in the MENA region despite several obstacles, such as shortages of recognition from policymakers, researchers, planners, practitioners, and agriculturalists. This section reviews the literature documenting UA in the MENA region. The reviews are divided into three sub-sections: 1) historical implementation of UA, 2) implementation of low-tech UA in poor countries to improve the

livelihoods and food security at the household level, and 3) implementation of high-tech UA in rich countries to improve food security at the national level.

2.4.1.1. The History of UA in the MENA Region:

UA is not new in the MENA region, rather it is a historical activity. For example, according to Cartwright (2018), the Hanging Gardens of Babylon, in Iraq were built by its greatest leader, Nebuchadnezzar II, and ranked as one of the Seven Wonders of the Ancient World. Many scholars agree that the purpose of the gardens was purely for pleasure rather than cultivating food. According to Cartwright, from that inspiration, the notion of the hanging gardens spread throughout the Mediterranean for the rich to grow their gardens and cultivate their food from them. Babylon is located in the desert of Iraq, about 80 km (50 miles) south of modern Baghdad. According to Dalley (1993), irrigation water was transported to Babylon through a pumping system made of reeds and stone and stored in a huge tank, and the *Shadow*, a manually operated water-raising device, transported the water to the plants.

2.4.1.2. Implementation of Low-Tech UA in Poor Countries to Improve the Livelihoods and FS at the Household Level

In modern times, the art of urban agriculture has been revitalized in the MENA region in many different ways. Even though UA is an ancient activity in the MENA region, it was mainstreamed in Amman, Lebanon, and Yemen by the Environment and Sustainable Development Unit (ESDU), American University of Beirut (AUB), Lebanon in a project that led by Resource Centers Network on Urban Agriculture and Food Security (RUAF) in

2004 (Tohmé Tawk, 2004). To sustain the development of UA, a multi-stakeholder forum was established in the city of Great Amman, Jordan. The forum consisted of the municipality, the Ministries of Agriculture and Environment, the University of Jordan, and several civil society organizations. Also, the initiative created an UA bureau with dedicated human and financial resources. The purpose of the bureau is to give a solid initialization prospects for the city's strategic agenda. In parallel, rooftop pilot projects were implemented in the poor areas, value chain development of selected products, and vacant land assessment to link farmers to landowners. The process of multi-stakeholder proved success in mainstream and promote UA in the MENA region involving governmental institutions and communities (Tohmé Tawk *et al.*, 2014).

To study the impact of the projects on food security, Tohmé Tawk *et al.* (2014) conducted a study to describe UA activities and to investigate food security in Lebanon and Jordan. In Jordan, UA was executed in the city of the Great Amman based on a multi-stakeholder policy formulation and action planning approach. The main agricultural products were rain-fed olive and figs, which were irrigated from a spring in the summer, intercropped with onions and aromatic herbs such as thyme. In Lebanon, the municipality of Bebnine-Akkar – a large and poor peri-urban community located on the edge of Tripoli – has witnessed another UA experience. The studied area mainly contained rain-fed olives, rain-fed crops, and vegetables grown in greenhouses and outdoors. Farmers had to buy water in summer by cisterns due to the polluted water with gas station wastewater and untreated sewage water. Animal products were limited because of the high price of feed. This literature shows the location of both planted areas, source of irrigation, and kinds of agricultural products. However, it did not cover what sorts of animals raise, rather only

plant production. To study the impact of UA on FS, Tohmé Tawk *et al.* (2014), conducted a survey using a stratified random sample of 400 households to reflect the proportion of producers versus non-producers: 200 agricultural households and 200 non-agricultural households in Wadi el Seer, and 300 agriculture households and 100 non-agricultural households in Bebnine. Food security was assessed by use of questionnaires, focus group discussions, and critical informants like municipality officers, producers, organizations working in the areas, and agricultural input suppliers. The results showed that in Bebnine, producers had lower levels of household food consumption from their production compared to those in Wadi el Seer. Food was more available in Wadi al Seer (90%) compared to Bebnine (75%). By using the Household Food Insecurity Access Scale as a measurement tool, the overall food insecurity score revealed that 37% of households in Wadi el Seer and 51.6% of households in Bebnine were food insecure. In a comparison of food insecurity between producers in both sites, 32% of producers in Wadi el Seer were food insecure compared to 55% of producers in Bebnine; the authors argue that this is because agriculture in the latter lacks an institutional framework, unlike the former. In both cases, non-producers had a higher level of food security than the producers.

Another Urban Agriculture Project (UAP) in Lebanon sought to improve the FS and self-sufficiency of Syrian refugees and the most vulnerable Lebanese communities (ESDU, 2015). This project built on the work of Gallaher (2012b), who concluded that UA can be a significant solution for low-income and limited access to refugees to supplement them with fresh food and creating job opportunities. According to (NEF, 2016, JAN 28; Süß, 2018), the UAP was implemented in three sites (Bourj Hammoud, Nabaa, and Dawra) in Beirut. The project aimed at enabling households to produce a part of their food

themselves on their rooftops and balconies to improve their food availability and accessibility by selling their products. The number of beneficiaries reached was 73 participants, who received training workshops, all required materials, and equipment (seedlings, soil, planting kit), as well as containers for composting. The most cultivated plants were lettuce, hot peppers, and mint. Other plants were grown like tomatoes, cherry tomatoes, eggplants, strawberries, parsley, and thyme. The main source of water irrigation was tank water (80%); only 22% (additionally or exclusively) relied on piped water. Süß (2018) studied the contribution of the UAP to the beneficiaries' FS and found that the availability of fruit and vegetables increased through UA for at least 68% of all studied households (the study sample was 41 households). Since participants joined the project, 24% of them indicated that they spent less money on food purchases due to substituting the formerly purchased food with the garden products. However, the remaining percentage (76%) stated that their spending on vegetables and fruits stayed the same, and 61% of these households indicated that they increased their intake of fresh fruits and vegetables. Süß (2018) concluded that, in producing agricultural products, the higher self-sufficiency of refugees could improve their food security and reduce the pressure on vulnerable host communities and aid agencies.

Yemen has also implemented UA in the city of Sana'a to decrease its food insecurity, which has been affected by land degradation, groundwater depletion, and climate change. Under this UA effort, more than 37,500 tons of qat, vegetables (onions, tomatoes, radish, leak, and coriander), fruits (apricots, peaches, nuts, berries, and grapes), and other seasonal grain crops were produced over 7,700 hectares. Farmers also produced and raised animals, such as cows, sheep, goats, camels, donkeys, bees, and poultry. The

main source of irrigation was groundwater, which was used mainly for qat and horticulture production, while grain and forage production were rain-fed. A Yemeni agricultural team researched the impact of UA on FS and found that UA reduced the poverty rate, promoted food security, eased the demands for waste disposal, and beautified the city of Sana'a. The team also argued that UA was integrated into an ecological system and an urban economy (Al-Ariqi, 2009). While this literature shows the implementation of UA before the Yemenis crisis that started in 2012, it lacks the quantitative measure of the impact or association between UA, food insecurity, and poverty. Also, as it was published in 2009, this study does not show if UA has been carried out during the war in the country or even during the Corona Virus Disease 19 (COVID-19) pandemic that emerged in December 2019. However, Yemen's food security situation remains precarious, ranked 111 among 113 countries in the world (Global Food Security Index, 2020).

In the Gaza Strip in occupied Palestine, many of the local societies have become interested in the practices and approaches of UA. Many NGOs have promoted agri-tourism, aquaponics, rooftop gardening, and home gardens such as the Urban Agricultural Work Committees (UAWC), the Agricultural Development Association (ADA), and Moa'ssasat Ma3a (MAAN) Center (GUPAP, 2019a). Also, many projects have been implemented, aiming at improving the lives of the 2 million citizens who live in a small area of 141 square miles. For example, according to GUPAP (2019b), a project called "Facilitate & Strengthen Institutional Capacities & Innovation in Urban & Peri-urban Agriculture in Gaza Strip" was funded by MADRE (an international organization fighting for feminist futures). The project aimed at improving the women's income and boosting human rights, as well as at strengthening and facilitating institutional capacities and innovation in UA for

youth women farmers to improve their marketing practice and innovation production (GUPAP, 2019b). The overall target of the project is to strengthen women's livelihoods and resilience. This literature does not present the number of beneficiaries, age limits, marital status, as well as it did not quantify the impact of the project on their food security.

Another example of an UA project in the Gaza Strip comes from the FAO (2011c), which carried out two emergency food production support projects funded by the Kingdom of Belgium. In the first project, in July 2010, 119 poor female-headed households were provided with aquaponics systems, rooftop gardens connected to fish tanks (Picture 1). Additionally, 24 community and educational establishments were provided with the same systems. The overall targets of the project were: (1) give the beneficiaries fish-based protein and increase the availability of high-quality fresh vegetables for the urban poor, and (2) reuse nutrient-rich water from the tanks to irrigate the plants to encourage the sustainable use of scarce resources. The results of the project show that all women beneficiaries were able to enhance their household food consumption; simultaneously, they could keep taking care of their children because the activities and the work were light and at home. After the success of the first project, FAO executed the second project in August 2011. Additionally, to the rooftop and fish tanks, the water was recycled to conserve scarce water through a more advanced aquaponics system. The project targeted 100 women-headed households who were food insecure and impoverished. The objectives of the project are: (1) generate income to allow the beneficiaries to buy their basic needs, (2) improve their skills in the field, (3), and most importantly, provide them with fresh vegetables and fish. Picture 1 shows the first implementation of the aquaponics system by a mature woman

who is the head of her household. Fish are in the blue tank of the water and connected by black irrigation pipes to the vertical farming system (VFS). The FVS consists of multiple pink pipes. Furthermore, the plants grown were leafy green vegetables that are rich in minerals. Most importantly, the woman is engaged with her children in work, which empowers the women and the youth involved, as well as provides them with experience and environmental beautification.

Picture 1: The first project of aquaponics over rooftops in the Gaza Strip.

Source: (FAO, 2011c)

Another example of UA activities in MENA countries comes from the Gaza Strip. The project entitled "Humanitarian Response to Food and Water Needs in Gaza Strip with

Innovation in Humanitarian Action" was carried out by MA'AN Development Center in cooperating with the Danish / Norwegian Joint Assistance Program. The project aimed at spreading and promoting the culture of UA and food sovereignty to create income-generating projects and strengthen the economic side for its beneficiaries. It targeted 7,781 individuals in 1,000 families who are food insecure and impoverished. The main activities included in the project are (1) electronic vouchers for buying fresh vegetables, fruits, poultry, and groceries, (2) coupons for potable water, (3) emergency preparedness activities, and the most important, (4) urban farming within the homes of the targeted families in different areas in the Gaza Strip to improve safe home production of food. Approximately 2,249 individuals received education about the culture of UA and training sessions to gain practical experience. The beneficiaries had received the awareness sessions during the establishment of three home income-generating units. Based on the literature, the project succeeded in alleviating suffering from poverty, improving resilience, strengthening preparedness mechanisms for vulnerable households, and disseminate and promote knowledge about the culture of the importance and benefits of the UA (Albinsson, 2019). The project's primary focus is on the knowledge and the culture of UA. It did not provide all participants with the required equipment to grow their food. Knowledge is indeed a great power to change behaviors and improve the economic status of people. However, the Palestinians do not have the money and the authority to import UA equipment due to their living in besieged areas with pauperized life impacted by Israel.

When the Palestinians grow their food, they can be food secure. According to Abdelnour *et al.* (2012), eating locally produced food can be an effective tool in providing

the citizens with the essential micronutrients and calories in a case where 75% of Gazans are malnourished, and 88% receive food aid. Further, according to Beach (2017), the rooftop UA in Gaza is not only a matter of survival and helping to meet the need for food, but it also enables and empowers the people engaged in the field. It also helps to create a healthier population and allows them to discover effective ways to confront environmental problems. However, implementing UA projects is subject to many constraints, limiting the development of more resilient and sustainable methods for a better life. According to GUPAP (2019c), UA in Gaza lacks improved production techniques, urban policies and strategies related to agricultural land use, and research on participatory urban agrarian development. Also, UA has been ignored as an urban development strategy and land use category by the current urban development policies and land use classifications. Institutional and policy reform initiatives would be significant to enhance the potential of UA for sustainable urbanization, poverty alleviations, and food security improvements.

2.4.1.3. Implementation of High-Tech UA in Rich Countries to Improve Food Security at the National Level:

UA has also been shown to be an effective tool to improve food security in the Gulf Cooperation Council (GCC) countries. Water scarcity, lack of arable land, and high temperatures have led the Arab Gulf region to plan for sustainable farming solutions, such as adopting urban farms in massive warehouses, which can place climate control, rented at low cost, protecting crops from the harsh climate. For example, in Abu Dhabi, the government established Abu Dhabi Farmers' Services Center to help the producers to improve their productivity through technical and operational support, as well as offering

consumers the chance to purchase fresh fruit by adding the brand name local harvest to its products. Therefore, the plans are succeeding due to governmental support to cover the population's needs and combat the lack of natural resources needed to produce food (Kumar, 2015). Also, GCC countries are adopting new technologies for water desalination based on solar power, which is economically satisfactory. Desalinated water is being used to cover the needs of urban agriculture production to overcome water shortages (Al-Jabri & Ahmed, 2018).

While GCC countries are located in one of the most water-scarce regions on earth (Waleed Al-Zubari, 2003), they are among the leaders in water desalination as 57% of water desalination exists in this region (Global Water Intelligence, 2014). Water desalination plants provide water to local produce, as well as potable water to millions of citizens in the GCC region (Sale *et al.*, 2011). According to Global Water Intelligence (2014), 62% of the energy used for water desalination was thermal-based. Another source of water for agriculture is treated wastewater. For example, Bahrain, Kuwait, and Saudi Arabia (KSA) reuse 30% of their treated wastewater, and the remaining quantity, 70%, is filtered and pumped to the Arab Gulf (AFED, 2011). It is worth mentioning and providing an example of how water and electricity sectors are set up in Abu Dhabi; the government of Abu Dhabi subsidizes water through Abu Dhabi Water & Electricity Company (ADWEC). ADWEC financially compensates the distribution companies that sell the water and electricity to consumers (RSP, 2014). The governmental financial support of energy and water is highly significant for agricultural producers. The agricultural sector in the GCC region has suffered from poor irrigation methods which have led to 50% water loss (World Bank, 2005). For that, Saif *et al.* (2014) studied the Water-Energy-Food (WEF) nexus to

analyze the water scarcity dynamics in the GCC region towards achieving food security through local production, While relying on food imports is subject to international fluctuations and crises, it is also cheaper. The team concluded that water efficiency usage in irrigation for local food production coupled with the best crop selection is a priority. Comparing to the rest of the MENA region, food security in the Gulf countries is the highest.

Across the GCC countries, the importance of Controlled Environment Agriculture (CEA) is growing by the interest of the regional and overseas players. One of the CEA's leading countries is the UAE, with the facilitation of the Ministry of Climate Change and Environment. The CEA projects are vertically built by Shalimar Biotech and Crop One Holding Inc companies (iGrow Reporter, 2017). With the inspiration of Silicon Valley, the minister of the Future of Food Security, Mariam Al Mehiri, plans to create a "Technology Hub" or "Food Valley" to develop food and farming automation. The idea aims to attract and enable a new generation of farmers to help build a better future (iGrow Reporter, 2017) (Picture 2).

Picture 2: Controlled Environment Agriculture in the UAE

Source: iGrow (2018)

CEA is considered as an alternative agriculture production system that ranges from greenhouses, roof-top, container gardens, to vertical farms in buildings, skyscrapers, using artificial lighting, LED lighting (FAO, 2011b). The LED provides 24/7 production with the required optimal amount of light quantity and quality for a specific crop production needs (Kozai *et al.*, 2016). Such precision agriculture can produce 200-300 times of the open-field production in the same area of land (Blomqvist, 2018). However, producers cannot grow strategic crops, such as wheat, nuts, and fruits.

Even though precision agriculture in a controlled environment can reduce the usage of energy by 50% relative to other practices of conventional agriculture (Davies & Garrett, 2019), the target of improving local production in the GCC region requires more energy to be deliverable. Fossil fuels remain the major form of energy supply in the region (Yilbas *et al.*, 2015). Solar and wind based-energy generators are considered as renewable and sustainable resources supply that ensure the increase of electricity flow for industry, municipalities, and agriculture (ESCWA, 2015a). However, the adaptation of this technology requires indigenous innovation, manufacturing, and maintenance, which demands local policies and governmental support in the MENA as a whole. Besides, according to ESCWA (2016), access to renewable energy would decrease the usage of water while operations are used during the extraction of fossil fuels, water desalination, and irrigation. This raises what Mohtar and Daher (2010) defined as the water-energy trade-off, envisaged under the water-energy nexus.

Reducing the usage of agricultural water in arid regions while improving economic productivity is a major challenge, and CEA offers advantages including indirect resource use, productivity, and efficiency per available water (Pate *et al.*, 2005). In a comparison between hydroponics (one of the CEA's practices) and conventional agriculture conducted by Barbosa *et al.* (2015) in the state of Arizona in the United States, the authors found that the used amount of water in the hydroponics system was 13 ± 2.7 times less water demand compared to the open field production. However, the adaptation and implementation of the CEA technologies are restricted by the economic and political regulations and policies across the MENA region, and the main leader of it is the GCC

region hand in hand with water desalination as long as it is one the most scarce water in the world.

The use of non-traditional sources of water, such as water treatment and desalination, is increasing across the GCC region, raising the share of water budgets (ESCWA, 2015b). This new desalination technology can enable the desert areas with new water resources to make them modern agricultural CEA production areas for chosen greens and vegetables, as 97% of the earth's water is saline and not suitable for agri-production (Davies & Garrett, 2019). Gulf countries mostly rely on seawater desalination to cover the need of the water demand, and desalination technology is being supported and promoted (UNEP, 2015).

Renewable energy can also play a crucial role in the implementation of Treated Wastewater (TWW) for water reuse (ESCWA, 2016). The term 'water reuse' refers to the wastewater that can be treated for beneficial purposes, such as potable and irrigation water. The amount of water reuse is low compared to ground and surface water (United States Environmental Protection Agency, 2018). However, with the advancement of wastewater treatment WWT techniques, potable and non-potable reuse is predicted to increase (United States Environmental Protection Agency, 2018). Also, TWW is a viable substitute for freshwater irrigation in an arid and semiarid region, and the irrigated soil of TWW produces more yield and higher revenues of crops for the farmers as compared to groundwater irrigation in dryland conditions which boosts their profitability (Alikhasi *et al.*, 2012; Tahtouh *et al.*, 2019), and thus food accessibility. However, the applicability of earlier studies to the production of food under UA is unclear. For example, Tahtouh *et al.* (2019) conducted their study in the United States on the crop of cotton, in an open field,

and with the same weather conditions. Growing fruits and vegetables in a controlled environment require further studies to quantify the impact of TWW irrigation on CEA production. Furthermore, TWW irrigation shows higher yield production of grape (Mendoza-Espinosa *et al.*, 2008), and the reason for increasing the agricultural production is that TWW contains nutrients that replace soil conditioners and fertilizers (Jiménez-Cisneros, 1995; M Qadir *et al.*, 2007). Some other researchers, conversely, rejected replacing the use of groundwater with TWW claiming that the latter increases salinity of the soil, which degrades its physical properties (A Battikhi, 2014; Klay *et al.*, 2010; Qian & Mecham, 2005).

WWT plants have been implemented in most of the MENA region and particularly in the GCC countries. Annually, the volume of wastewater generated by industrial and domestic sectors is 13.2 billion cubic meters (BCM), of which 5.7 BCM (43.2%) is treated (US Environmental Protection Agency, 20004). The volume of discharged untreated wastewater in the MENA region is 7.5BCM, 57% of the total wastewater produced in the region, and 83% of TWW is used for agriculture, adding to that, untreated wastewater is used by urban farmers (Manzoor Qadir *et al.*, 2009). More than one-third of TWW is used to irrigate fodder and non-edible crops (Tolba *et al.*, 2010), and the farmers in Jordan, Syria, and Tunisia are irrigating with TWW for growing all food crops (Alkhamisi & Ahmed, 2014). However, TWW is not treated or even stored correctly, which poses serious health and environmental threats (Özerol & Günther, 2005). Also, the comprehensive process of wastewater treatment lacks central transmission infrastructure (pumping stations, pipes, channels, and storage tanks), and the majority of the treatment plants are located far away from agricultural areas, which is economically costly

(Alkhamisi & Ahmed, 2014). For example, in the GCC region, the capital investment of wastewater treatment is USD 2.3 billion, and it requires an additional 10% for maintenance and other operational installations (Laamrani, 2017). For WWT plants as well as water production, the energy use will be tripled by 2030 (W Al-Zubari *et al.*, 2019), and this energy demand varies based on the treatment and technology used (i.e., the energy requirement range of primary treatment is 01-03 kWh per m^3, and 0.27-0.59 kWh per m^3 for secondary treatment), according to (ESCWA, 2015a).

All the aforementioned techniques are for producing more food in an environmentally friendly way and improving the food security for the MENA region by decreasing the usage of energy and water for sustainability and the future for new generations. The Water-Energy-Food (WEF) nexus approach has been studied by many scientists across the globe to create integrated governance across sectors and integrated natural resources management to be provided to the policymakers (Allan *et al.*, 2015; Hoff *et al.*, 2017; Mohtar & Daher, 2010). However, very limited progress has been made in operationalizing the nexus approach (Leck *et al.*, 2015), and that implementation faces many challenges in the MENA region, such as limited vision, lack of knowledge and experience, insufficient incentives, and the absence of applied technological practices (Weitz *et al.*, 2017). One solution for that is the smart integration of technology that can create sustainable urban food ecosystems (UFEs) (Orsini *et al.*, 2013) for the rapidly expanding urban population in the MENA region.

In a comprehensive study on new urban agriculture technologies, entitled *Connecting Farm, City and Technology Transforming Urban Food Ecosystems in the Developing World*, Davies and Garrett (2019) have identified 12 platforms of innovative

technologies to better advance the food ecosystem in the developing world. These platforms are: “1) connectivity: information delivery and digital technology platforms; 2) uberized services from producers to consumers; 3) precision agriculture (GPS, IoT, AI, sensing technology); 4) controlled environment agriculture (CEA), including vertical farms; 5) blockchain for greater transparency, food safety, identification; 6) solar and wind power connected to microgrids and storage; 7) high-quality, enhanced seeds for greater yield, nutrition, climate, and pest resistance; 8) advanced genetics, including gene editing, synthetic biology, and cloud biology; 9) biotechnology: including microbiome editing, soil biologicals, cultured meat, alternative proteins to meat and dairy; 10) nanotechnology and advanced materials; 11) 3D printing/additive manufacturing; 12) integration of new technology to scale-up underutilized, existing technologies, such as efficient drip-irrigation with new precision soil sensors and solar-electric pumps to allow both “on” and “off-grid” usage” (Davies & Garrett, 2019).

According to Davies and Garrett (2019), technology-enabled UFEs hand-in-hand with the smart policy of land usage would allow more efficient, sustainable intensification of productive agricultural areas, vertical production, and intensive production with CEA. Considering UFEs as a new advancement method of urban farming, it not only increases the productivity of agriculture, but also creates new sustainable environmental plans, and the overall purpose is to improve the region's food production (Addo, 2010). In addition, UFEs can help decrease greenhouse gas emissions from livestock and traditional agriculture (Davies & Garrett, 2019).

UFEs will improve the economic status of urban dwellers. According to Davies and Garrett (2019), with the support of governments to new business models work on new

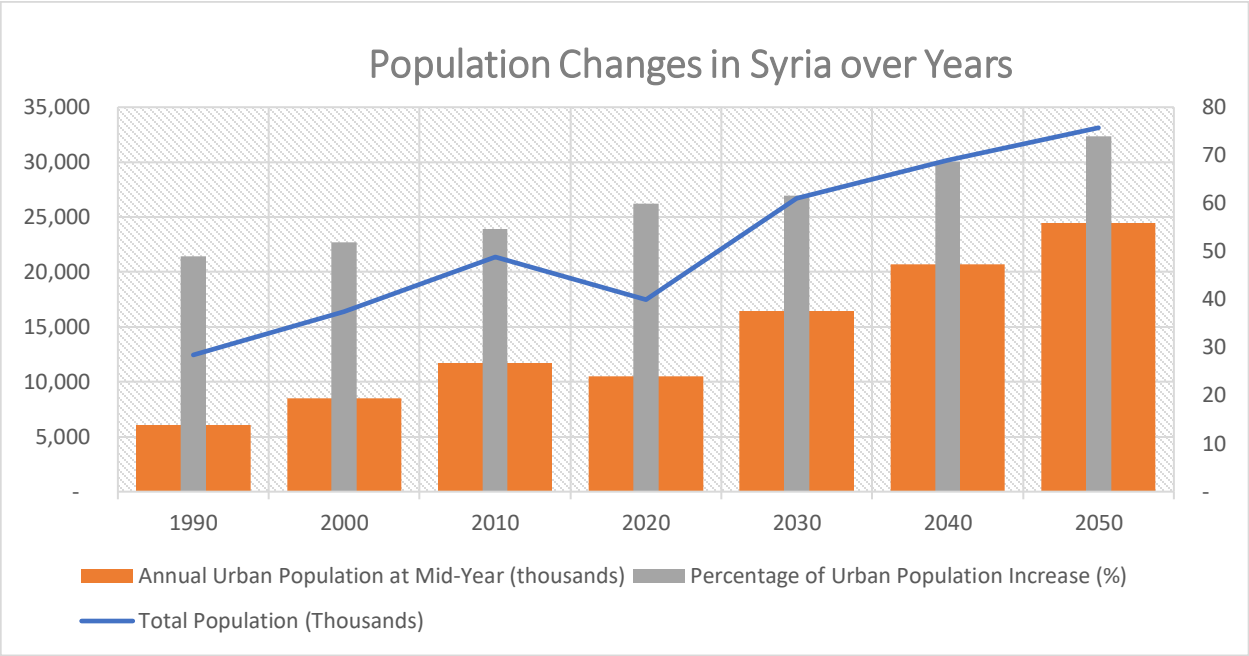
technologies can create a revolutionized, resilient, and productive UFEs which will generate tons of modern opportunities for entrepreneurs and job seekers. According to (Kite-Powell, 2018), these UFEs can create unprecedented opportunities throughout the overall supply chain.

2.5. Food Security and Urban Agriculture in Syria:

Syria is located on the east coast of the Mediterranean Sea in southwestern Asia with an arid and semi-arid climate (Smith, 2019) over a land area of 183,630 km^2 (70,900 sq. miles) (worldometer, 2020). The conflict in Syria erupted in Murch 2011 during the Arab Spring. The conflict deployed throughout the country. It has been reduced in some parts but not yet completely resolved yet.

According to (UNDESA, 2019), the total population of the country is 17.5 million in 2020; the population was 21.4 million in 2010 before the conflict that began in 2011. This sharp decline of the total population has been attributed to many factors, such as the refugees who fled to neighboring countries and beyond. Approximately 11.8 million Syrians have sought asylum outside of the country (UNHCR, 2020). See Figure 3 for more elaborations.

Figure 3: Recent and Projected Population changes in Syria (1990-2050).



Source: (UNDESA, 2019).

As Figure 3 shows, the total population increased from 12.5 million in 1990 to 21.4 million in 2010. The reason for this rapid increase was for the improvement of well-being conditions and social-political-economic stability (Kherallah *et al.*, 2012). Regarding the urban population, the percentage of urban dwellers slowly increased between 2010 and 2020, from 55% to 60%, respectively. It is also expected to continue its slow increase to be 62% (16.5 million) by 2030, and based on UNDESA (2019) predictions, it should reach 69% (20.7 million) and 74% (24.5 million) by 2040 and 2050, respectively.

The conflict has pushed Syrians into more poverty and hunger despite the recent security improvements in most parts of the state (FSIN, 2019). Due to the conflict, 6.5 million people are in severe food insecurity and in need of livelihood improvements to reinforce their resilience, and 2.5 million are at risk of food insecurity (HNO, 2019). The

crisis has significantly affected the availability of food and the devastation of its food system (Zurayk, 2013). According to FAO (2019), agricultural production has been constrained due to a lack of inputs, high field contamination, and damaged or destroyed infrastructure, particularly irrigation systems. FS in Syria is one of the worse in the world. Syria's FS ranks 107th among 113 states around the globe (Global Food Security Index, 2020).

The literature on UA in Syria rarely exists and the practice in UA has not prevailed among Syrians. The literature found tends to describe the process of implementing urban farming due to the need for that during the war. This literature is briefly reviewed here.

According to Andreoni (2016), people who lived in besieged areas of Syria were the most food insecure. A significant solution to improve their food security was urban agriculture. For example, a project called the 15th Garden was implemented by the Syrian women in all Zabadani city in the rural area of Damascus (the rural area of Damascus is classified as it is a separated governorate of the Damascus). The project was a brainstormed idea during an inspiring conference, called Dome Event in Athens, that showcases projects that deal with the refugee crisis innovatively. The experience succeeded in getting food to people in besieged cities and raising awareness about the importance of food sovereignty and organics. Therefore, gardens had been implemented in 17 different besieged cities throughout the country (Andreoni, 2016). According to (Montgomery, 2014), Yarmouk was one such area that implemented the 15th Garden project. However, citizens found there many problems, such as lack of land. Therefore, they grow their plants over fertile land,

previously was a garbage dump. Also, they did not have experience in agriculture. Thus, they received training from farmers in Germany with the coordination with the project directors. Moreover, and most importantly, they suffered from water scarcity, which had led them to extract water and pump it using fuel. It was highly costly. A German-Iraqi woman who was working for the project, Ansar Hevi, stated that the UA in the Yarmouk area harvests had a direct impact on the local economy, fed the most vulnerable people, and decreased the food prices due to the increase of food availability. The literature in both localities, in Zabadani and Yarmouk, lacks quantitative analysis to show how much the project had improved food security for its beneficiaries. However, it was a vital tool to fight poverty and hunger during that short period of time.

According to Lucente and Al Shimale (2016), urban agriculture was a solution for Syrians in East Aleppo to survive and improve their food self-sufficiency and food sovereignty. An independent volunteer organization known as the Red Team took over the work and grew 37 hectares with crops including potatoes, zucchini, cucumbers, eggplants, parsley, and spinach, among others. The local city council provided the seeds to the farmers, but the problem was not getting enough farmhands and fuel. However, the project successfully achieved its target to supply Syrians in east Aleppo with food, as well as forage to their animals.

2.6. Constraints in Implementing UA:

In its *Urban Agriculture Magazine*, (RUAF, 2013), stated that UA requires financial and political legitimacy to boost its contribution to feeding cities. Most urban

agricultural producers suffer from shortages of investment schemes and credits to develop their activities with inadequate resources. Based on the aforementioned statement, UA lacks the local government support in the MENA region to be implemented. Also, investors and businesses do not have the willingness and desire to invest in UA. Smit *et al.* (2001b) argued that urban dwellers consider UA as a means of survival only, and seek to deny the 'myth' that UA provides entrepreneurial opportunities for small and large businesses. The question here, which policies and procedures are required to motivate businesses and entrepreneurs to take over UA?

In the MENA region, according to Nasr and Padilla (2004), numerous constraints are limiting the development of sustainable and safe urban agriculture. They include prohibitive urban regulations and policies, where cities in the developing world are built without taking into consideration UA or even green areas. UA in MENA is suffering from a lack of recognition, planning, policymakers, research extensions, and suitable policies and strategies. However, not all countries in the region are the same or rely on the same policies and laws. As previously explained in the literature, the GCC countries have prioritized FS and UA in their regulations and policies.

As Dubbeling and Santini (2018), concluded in their research on City Region Food System Assessment and Planning, to support sustainable resilience, each city has to assess first what their food dependencies are and how the people are fed. Researchers should identify weaknesses and potential pressure points, and when it is possible, policymakers can develop targeted policies to improve the local food system.

2.7. Research Questions and Objectives:

Based on the literature reviewed thus far, the main research question has been identified: Will urban agriculture be a useful option to achieve food security (focusing on food availability and food accessibility) in post-conflict Syria? The corresponding sub-questions are: What is necessary to introduce urban agriculture in post-conflict Syria? What policies are needed to be introduced to allow Syria to increase food security via urban agriculture?

To address these research questions, the following research objectives have been set: 1) assess the potential of UFEs (with a focus on CEA) and their practices, methods, and reinvestments in terms of water and food waste to improve food security in post-conflict Syria; and 2) propose preliminary policy recommendations to guide UA in post-conflict Syria.

CHAPTER 3

METHODOLOGY

3.1. The Source of Data and Research Design:

The research first relies on a literature review of previous research on topics related to FS, UA generally, and UA in the MENA region. The research included academic literature from scientific journals and applied literature from development organizations such as FAO. The literature review considered research conducted in countries where UA was characterized with low technology implementation such as Jordan, Lebanon, Syria, West Bank and Gaza, and Yemen. It was also conducted literature from countries characterized by the high-tech implementation of UA such as Kuwait, Oman. Qatar, Saudi Arabia United Arab Emirates. The purpose of the review of the literature published on UA in the MENA region is to benefit from existing thinking and the experiences of similar contexts. A theoretical framework was constructed benefiting from the high-tech implementation of UA (CEA) and its reinvestment of treated wastewater, desalinated water, and controlled environment agriculture.

The research also relies on primary data using key informant interviews with nine (9) experts in the field via online, one-to-one human interaction. The chosen respondents are experts, researchers, policymakers, professors on the field, and UA practitioners or farmers. The participants were expected to help the researcher answer the first and second sub-questions of the research. The interviews were semi-structured, and the questions were tailored to the key informant's position, area of specialty, and experience. The interviews

were conducted using online applications (Zoom or Microsoft Teams, according to the preference of the expert). The required time for each interview was 50 minutes on average.

The theoretical framework was presented to the interviewees during the interviews, and they commented on it, suggested changes, and assessed its potentiality in post-conflict Syria, and made recommendations to the policymakers to implement such sustainable systems.

3.2. Ethical Consideration

This research study involves human subjects research and so was subject to the approval of the Institutional Review Board (IRB) at AUB. (IRB) approval was submitted on December 17, 2020, after defending the proposal on September 22, 2020. The ethical approval was secured on January 28, 2021, in advance of primary data collection.

3.3. Data Collection

For the primary data collection via expert interviews, an official invitation was prepared within the IRB application and sent to the targeted number of participants which was 27 experts in the field of UA. Every interview was recorded and then transcribed immediately after the end of the interview into a Word document. Data saturation was reached upon conducting nine interviews with nine respondents. Interviews were conducted between February 19 and March 25, 2021.

All participants are professors, experts, researchers, lecturers, and teachers in the field of UA and water and food reinvestment. Participants belong to multiple countries around the world not only for the MENA region and Syria. Regarding their level of education, the majority of the participants are Doctorate of Philosophy (Ph.D.) holders (8 participants) and one participant has a master's degree. The average age is 47.4 years old, with a high level of experience[3].

3.4. Data Analysis

The structured data analysis began on March 26, 2021 The data are analyzed qualitatively. The software used for that purpose was Quirkos. It is a user-friendly application that facilitates the coding work and provides the analyst with Preliminary results. The application breaks the data into meaningful parts, makes sense of the data, manages the data, and describes it in an understandable way to read the results later on a Word file.

[3] Detailed demographic information including professional affiliation and job titles cannot be presented, in order to ensure confidentiality in line with IRB protocols and regulations.

CHAPTER 4

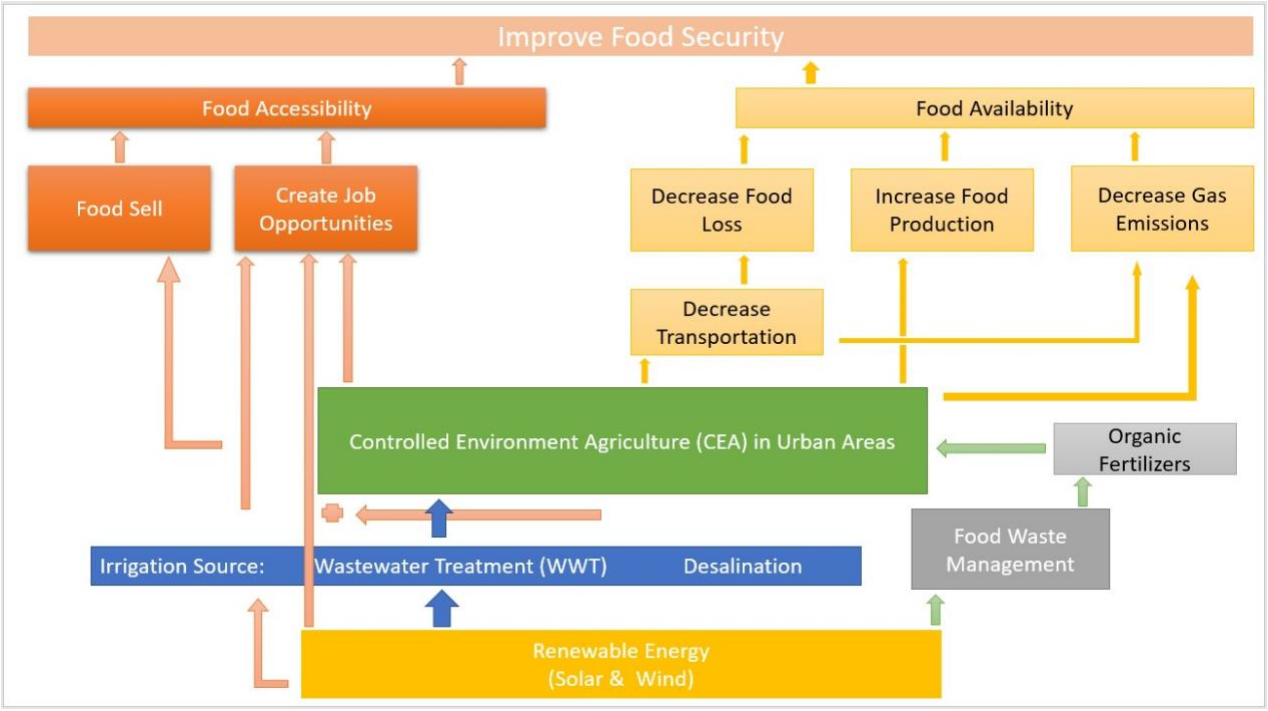
FINDINGS AND RESULTS:

4.1. A Framework for Urban Agriculture and Food Security in the MENA Region:

This chapter opens with a presentation of the framework developed by the researcher. Then, subsequent sections explore each part of the framework including their pros and cons and policy implications, building on relevant input from the participants. These sections are organized to mirror the flow of the framework.

The future of Syria requires more creative and localized solutions for human use of natural resources like water and soil and the production of critical resources like water, energy, and food. As CEA is the focus of UA practice in this research, a framework has been created based on the literature on UA and reinvestment in the GCC region. It could be suggested to policymakers to implement successful, modern UA regulations and policies to boost the local agricultural production in cities. See Framework (2). Food waste has been added to the framework to be converted to organic fertilizers to decrease the usage of chemicals and improve food security.

Figure 4: The contribution of controlled environment agriculture and other renewable and reused resources to improve food security.



According to the framework, renewable energy is important to operate WWT plants, desalination plants, and to pump water in irrigation. The reinvestment part of the framework is represented by treated wastewater and food waste. Food waste can be converted into biogas to provide gas for domestic use and fertilizers for agricultural production. Besides TWW, desalinated water was added to the framework following the GCC countries' experience as a source of drinking and irrigation. Renewable energy and reinvestment are directed to produce food in CEA in cities. The kind of food production

suggested is fruits and vegetables in an advanced way. Light is artificial, water and fertilizers are reinvested and recycled.

The benefit of the system is to produce food in an environmentally friendly way. Food production would be nearby city centers so that food loss and transportation would be less compared to rural food production. The benefit of that is to increase food production and decrease gas emissions, thus increasing food availability in urban areas.

The systems in all elements and stages can offer job opportunities for unemployed persons, especially in the post-conflict where lots of Syrian returnees will come back to Syria looking for jobs. Also, the food producers can sell food surplus what can generate more income. So that, food accessibility can be increase for households that are engaged in the field of UA and its supportive elements such as renewable energy and reinvestment centers. It is worthy to emphasize that this framework was constructed based on the literature on UA in the GCC countries and it is reinvestment in WWT, desalination plants, and the use of renewable energy to light the controlled environment indoor farming and for water pumping. The framework was shown to the participants during the interviews. Participants commented on the framework and suggested preliminary recommendations to policymakers to implement the system in post-conflict Syria.

As one of the participants mentioned, Syria's future government and policymakers should have the overall framework to implement it with all of the elements with their cons and pros. *"You cannot tell them that it is just agriculture in the city, to enable them to think beyond just producing food in cities. They might say that food yeah, we have food, but if you explain that it is important in terms of the variety of food and food accessibility and*

other important aspects. In this case, it might be more convincing especially if you are talking to urban policymakers. They think that ooh! food, it is not our aspect to deal with," Participant (8). It is a multidisciplinary approach. It is not the business of one person only as long as it is relative to more than one institution.

4.2. Renewable Energy

RE is the fundamental base of UFEs, as it is the key element for agricultural operations, particularly for the irrigation source (WWT, desalination, and water pumping). Most of the participants highlighted the importance of implementing RE in post-conflict Syria to not only grow food but rather to supply cities with energy resources especially with the devastation of the infrastructure. RE also can create job opportunities for unemployed Syrians and can be a chance for businesses and entrepreneurs to exploit that sector. According to Participant (1), *"There is an opportunity to build its infrastructure again and consider renewable energy plants into the governmental agenda. It is not only for UA but rather for the whole country."*

Other participants reported on the drawbacks of RE systems such as solar panels and wind plants. *"I am not with implementing solar panels as it requires lots of lands which can be used for agriculture and other purposes so that I would recommend having vertical panels, but that also is highly costly,"* Participant (5). *"For wind plants, I need to ensure that I am not threatening migrating birds."* Participant (4). For others, the main issue of RE is the high cost, such that RE might not be profitable for agriculture purposes.

"I do not think that UA's production will cover the cost of RE, however, "RE can be important for having an environmentally-friendly energy resources" Participant (1).

However, there would be many obstacles to carry out RE in post-conflict. One of the challenges is know-how. *"Beneficiaries of RE should be trained and practiced the implementation of RE implementation and maintenance,"* Participant (4). The lack of investment and financial support is another obstacle towards executing RE. *"The lack of investment. The lack of money. The cost is high in RE,"* Participant (6).

Multiple participants recommended to policymakers to include RE in their post-conflict agenda and cities development. *"It should be included in the governmental plans and should be considered in its governmental policies,"* Participant (7).

The first step to include RE in the post-conflict agenda is that RE requires the assessment and analysis of the benefit, cost, profit, stakeholders, and environmental considerations before taking any step prior to the execution. *"I have not done any assessment for Syria yet, but the future government should assess the potential implementation of centralized RE plants and their impacts on the economy, livelihoods, land, and environment. It should also know whether the changes and equipment would be brought from abroad or locally made, which is better to make locally to create job opportunities and decrease the cost,"* Participant (5). Another participant suggested decentralizing RE to be close to food production centers in the same area combined with biodigesters to provide gas for domestic use and energy for water pumping to greenhouses. "RE resources can be combined with the digestors in the same site in the same area, and then the solar panels can be decentralized which can be used for the pumping of water for

irrigation, as well as for domestic usages. So, every greenhouse should have its panel," Participant (6). It is also recommended to integrate RE with the Traditional electricity grid, food waste biodigesters, to WWT plants to provide the cities with the required energy and water to produce the food in cities.

4.3. Irrigation Source

4.3.1. Desalination plants

Desalination plants are not recommended by most of the participants for many reasons. One reason is the high cost of implementation and water pumping. *"I will not recommend desalination plants to be created in Syria because it is expensive, also the big cities are far away from the coastal area which requires more cost to pump the water, which also requires energy for that purpose. It is not the best solution so that I recommend investing in wastewater facilities including connection to urban agriculture and biodigesters,"* Participant (6). Another reason is the excessive use of water if desalination plants would be implemented. *"Keep in mind that the implementation of desalination of water gives the impression that we have more water than what we have. So, once you desalinate water, you give the people the impression that there is an abundance amount of water. It is not true. We call it the paradox of supply. Then the people might think that there is a lot of water so that they start to grow the crops that are very thirsty and waste more water. So that, to supply more water, we need to be more efficient in the water consumption,"* Participant (6). Moreover, Syrians do not currently know how to carry out such projects. There is a lack of knowledge and experience in building and operating

desalination plants. *"It would be highly costly to import experts and materials from abroad to implement desalination plants in a poor country such as Syria,"* Participant (8). There is also a fear of having saline water if the desalination plants are not operated professionally. *"You might get highly saline water,"* Participant (9).

If desalination plants would be implemented in post-conflict Syria, there are multiple considerations and recommendations to do so. It should be simple and manufactured locally to be cheap and suitable for the Syrian economy. *"It needs to be a simplified system. the cheap system. It should be simple and localized,"* Participant (8). As desalination plants require lots of energy, most of the participants recommended it to be operated on RE rather than the fuel. *"There are systems that use solar panels to desalinate the water. I will not recommend using the fuel-based plants,"* Participant (9).

4.3.2. Wastewater Treatment

All participants were asked about the importance of WWT. Some of them expressed their interest in WWT for environmental purposes and supported the idea behind implementing it in a devastated country such as Syria, which is arid and semi-arid. *"I think that Syria is devastated, and there is a great chance to rethink of urban planning with leaving spaces to wastewater treatment plants, to have localized systems and connect it to urban agriculture,"* Participant (2). WWT is needed in Syria due to its water scarcity. *"I think that it can be very useful in a country like Syria which is water-scarce and lots of people are residing in urban areas,"* Participant (6).

The implementation of WWT would face multiple obstacles and barriers in the post-conflict. The first obstacle is the high cost. So, economically, it might not be feasible in the short term. "I do not think for the short term that this can be a good and feasible solution," Participant (8). *"It is so costly to provide urban farmers with treated wastewater. However, it is still important for the environment and to create job opportunities,"* Participant (1). The safety issue is another challenge. *"For wastewater, there are lots of issues related to safety because it is not properly treated,"* Participant (6). The safety issue is also a social barrier. *"But there is a social barrier due to food safety issue,"* Participant (2). According to participants, Syrian citizens would not accept eating wastewater-irrigated based food due to a religious perspective.

The participants offered basic recommendations that can be useful to take over the implementation of WWT. As long as Syria has WWT plants, and some of them have been devastated due to the war. Participant (6) recommended repairing the devastated plants with the related infrastructure. *"We need to collect the wastewater. The issue of Syria is that many infrastructures have been damaged. So that, we need to repair the infrastructure that was damaged including the wastewater infrastructure that collects the wastewater from houses, and then expand it in some places. And then we need to upgrade the wastewater treatment plants,"* Participant (6). The plants should be locally made to be cheaper and to create job opportunities. *"Make it also locally, for the whole materials. For each one of the elements, there are people are working and benefitting,"* Participant (8). The safety issue comes as a priority. Before thinking of using the treated wastewater for agriculture, it has to be well recycled with no risk. *"Usually, trees are not highly affected because they are higher than vegetables, and they do not touch the soil. I would also recommend that using*

it for other purposes such as institutional uses and irrigate food in cities with clean and safe water," Participant (4). *"The wastewater treatment plants, the centralized ones, of course as far as it happens, we need to consider the social and religious aspects. People might be more conservative to use it to grow the edible products,"* Participant (7). Another participant advises operating WWT plants with biogas, and the gas can be used domestically. *"Wastewater treatment plants should have biodigesters to provide the cities with gas, energy. This energy can be used to run the wastewater treatment plants, and it can be also a source of domestic cooking,"* Participant (6). It is also recommended to irrigate with rain harvested water instead of desalination and treated wastewater.

4.3.3. Rain Harvesting

While asking the participants about the best source of irrigation to not deplete groundwater and municipality water, some of them added a new value to the framework to be a source of irrigation. Rain harvesting was advised by Participant (3) as it is an alternative water source instead of treated wastewater and desalinated water. *"I think because controlled environment agriculture can use a lot less water, I assumed that it would be possible to collect your own rainwater put that into the system,"* Participant (3). Also, Participant (8) supported the idea of rain harvest saying that *"Water catchment, yes, it can be a good solution. Let's say that you have a refugee settlement, and you can catch the water, that can be a good solution that can help to serve other things."* Participant (7) has another thought, *"Rain harvesting is one option, of course, however, if we talk about an arid and semi-arid region, such as Syria, that will not be sufficient alone. It might be more*

feasible in the coastal area than the rest cities," Participant (7). And for that, Participant (7) suggested having a multidisciplinary plan for rain harvesting: *"It requires disciplinary sectors to participate, such as engineers, meteorologists, municipalities, and private sector to make it more efficient."*

4.4. Food Waste Composting

While discussing fertilization and food waste in the framework itself, all participants highlighted the significance of composting food waste into organic fertilizers. Most participants were highly supportive of benefitting from the Syrian crisis to transform devastation into an opportunity for urban development. *"There is a great chance to develop food waste composting plants and Composting toilets,"* Participant (2), *"it also can become a business idea,"* Participant (4). Participant (3) also identified food composting as an important source of fertilizer that can be made available for farmers to enrich the soil with organic matter. *"Policies on waste management, so enabling food waste and organic matter to be composted and made available to urban farmers to enrich soils – yeah, so developing this waste infrastructure with the circular economy in mind as well probably,"* Participant (3).

For the implementation of food composting plants, one participant recommended digesting food waste into biogas to provide homes with gas, also to operate WWT plants with the source of energy if RE is not implemented. For instance, according to Participant (6), *"I will recommend connecting the WWT plants with food waste biodigesters to provide*

homes with domestic gas as long as Syria is suffering from the lack of energy, or to use the gas to operate the WWT plants."

4.5. Controlled Environment Urban Agriculture (CEUA)

This section explains the importance of CEUA, its potential role to play in improving Syria's FS, and the most needed policies to implement the UFEs in the post-conflict context.

The most recommended type of CEUA is the simplified hydroponics system. Most participants consider that it is cheaper and more suitable in the context of Syria. *"It can be adapted in a simple way for the local environment. Part of it is to minimize the cost of human resources for the people to run it. In the case of emergency for the refugees and crisis, labors are much cheaper, so there is no reason to use the expensive and advanced when the workers are available,"* Participant (8). There is a risk of failure also when implementing expensive systems. *"There is a risk of implementing this kind of high tech in the post-conflict, so the simple system might be wiser and more viable in the short term,"* Participant (9).

4.5.1. Significance of CEUA:

All participants were asked about the importance of CEUA being implemented in Syria. Some of them claimed that Syria has a wide arable land, so UA is not needed. "*I do not recommend growing food in cities in Syria which has large arable lands and green areas*," Participant (1). However, the majority informed the significance of CEUA in the

post-conflict era to improve its food security through providing fresh food to the market and improving the Syrian economy. "*Yes, I think CEUA is needed in the cities to supply food around the year during the harsh weather conditions*," Participant (4). CEUA can thereby "*reduce the cost of families for accessing the food and selling the surplus to buy another kind of food,*" Participant (6).

4.5.1.1. Food Availability:

CEA can increase food availability in two ways. It can produce food locally for the farmers themselves and allow them to access more diverse and fresh food. Therefore, a higher amount of food products will be available. "*The producers could produce for themselves*," Participant (3), which "*can increase their calorie intake and prevent hunger if they could implement it*, Participant (4). The producers also can access more diverse and nutritious food that improves their nutrition security. "*CEUA might be costly in the post-conflict, but if it happened, it would give bigger access to a more diverse food to the whole household*," Participant (7). "*It would provide the source of the best quality of nutritious food*," Participant (1).

Growing food in cities can also improve food availability indirectly. By producing the food in cities, transportation will be less. This reduction in distance and transportation time can similarly reduce food loss and the use of fuel, which mitigates the greenhouse gas emissions that affect food availability over the longer term. "*Food production nearby cities' centers can decrease transportation which decreases the use of car fuel and gas emissions which negatively affect climate and food availability*," Participant (6). Food

produced in CEUA uses less water compared to conventional agricultural systems. According to (Barbosa *et al.*, 2015) lettuce grown in a CEA used 13 ± 2.7 times less water demand compared to conventional production. Other participants consider CEUA as a solution for water in an arid and semi-arid region. "*I would say it is useful to implement CEUA because it is feasible and proved to be highly efficient in water use. So, if you want to save water you need to keep the windows closed which requires an efficient climate-controlled system and what requires energy too. And for that, the solar panel system can be a solution*," Participant (9). Based on the participants' information, CEUA may prove to be an environmentally friendly manifestation of WEF nexus.

4.5.1.2. Food Accessibility:

The potential contribution of CEUA to Syrian farmers' FS is not only to make food more available in a country with huge agricultural land. Rather, but it could also improve their economic status by selling the food that is produced (and not consumed within the household), becoming a source of income for youth, women, and agricultural engineers engaged in CEUA. All participants agree on the point that UA is a source of income in many countries around the world, and it could be in Syria for the marginalized communities if it were legalized. According to the law contained in the water legislation of 2005 issued by the Ministry of Water in Syria, a fine is imposed on every person who uses city water for purposes other than drinking such as watering crops (M.O.W.R., 2005). For example, Participant (3) explains, "*It can be the source of income where they sell their products in the market and gain money*." Per Participant (8), "*The producers can save money to purchase food that meets their dietary needs and food preferences*."

4.5.1.3. Food Security Impact at Household Level:

Urban agriculture could create job opportunities for the Syrian youth. During the conflict, most of the Syrian men were involved in military and fighting. UA could offer a post-conflict activity for former combatants. Participant (1), who worked in post-conflict Sierra Leone, proposed, *"It could provide job opportunities to the youth instead of carrying arms and working in smuggling drugs to avoid that. So, for people to stop doing that, they have to have some other activities."*

Another potentially positive impact of UA on youths is through the educational system. School children also have their chance to benefit from their own grown food to eat them in the schools *"Children would be able to grow their food and then eat them in the schools*," Participant (9).

Women also could have the opportunity to work on UA, earn additional income from this activity, and improve their diet and their household food security. It also gives them the chance to work hand-in-hand with their men which help to improve gender equality. *"In most of our cases, women were more interested than men because they see these activities are good to improve their diet and food security and livelihoods,"* Participant (9). Which is a benefit for both men and women *"That also might improve the gender equality,"* Participant (7).

Improving the livelihoods of women and youth may result in enhancing the FS of the whole household and even the wider community. As Participant (4) informed: *"That what would give bigger access to a more diverse food by the whole household."* Once individuals, the foundation stones of community, improve their FS, the whole economy will be improved and developed. The development of a community starts with human capital.

"The variety of the food would return to the economy back by providing human resources with better health status who can work," Participant (7).

4.5.1.4. Food Security Impact at the Macro Level:

In this section, we will highlight the importance of CEUA on the Syrian economy at the macro-level, its FS, economic barriers, and the most needed policies to implement CEUA and overcome the barriers.

Some participants do not agree with the idea that UA will improve the Syrian economy at the macro level, but rather at the household level only. Participant (3) justified that the Syrian infrastructure might not be recovered and rebuilt yet. The destructive infrastructure would interrupt the food supply chain in the post-conflict. So that, the producing families would be able to produce their food and not being reliant on outside resources of food. *"I think that if people are able to practice at the household level and provide families with the security to have a nutritious diet so that they are not reliant on outside food sources which in the post-conflict situation may for the food supply chains have been interrupted. Infrastructure may not yet be built. So it puts the power into the people's hands, should be able to produce their food,"* Participant (3). Participant (1) extends the argument but also considers UA could improve the whole economy if it is institutionalized. Also, Participant (2) supports the same idea: *"I think the micro-economy would be more benefitted at least in the short term, but for sure, in the long term, the macro will be benefited as well, if it's institutionalized."*

CEUA could improve the Syrian economy in different ways as the participants explained. One view is that it might increase food export and national gross domestic product (GDP). *"UA could increase the Syrian food production if it's institutionalized and a food surplus might happen due to the increase of the grown area in cities with vegetables and rural area with strategic crops such as wheat,"* Participant (4). Participant (7) commented that *"The GDP might not be considered, and that depends on the plants and crops would be produced, the number of urban farmers, and projects. But we should not undermine the role of CEUA hand in hand with its related industries to improve the whole economy."* The production of food production is not the only activity that might support the economy, but rather the input materials and equipment from plastic materials, seeds, and fertilizer if they were locally made could also stimulate economic activity and job creation.

At the macro level, the businesses and entrepreneurs would be engaged in the field of UA if the sector got governmental support. Otherwise, UA will be considered an illegal activity and the businesses will fail to achieve their targets, and the entrepreneurs will not create new models to sustain this activity. *"It can improve the macroeconomy. For example, one business can spatialize and grow the food and benefit from it, others can create networks and supermarkets to sell and distribute the food, and others can manufacture the required equipment to implement the system,"* Participant (1). Entrepreneurs have a great potential to benefit from UFEs if they are recognized by governmental agencies. Entrepreneurs have the chance to develop, create, invent, and financially benefit from the CEUA. *"The whole idea is urban agriculture is still an innovative way of production in food production. So, it's an alternative way, and it has lots of potentials to be improved, changed, adjusted, and adapted. For that, attracting*

entrepreneurs could bring new ways of practicing UA which creates a sustainable system. Thus, more businesses would engage in the field and the overall result is to improve the whole economy," Participant (7). Therefore, employment would be the first and foremost priority in the post-conflict era where lots of Syrian have lost their job, and their economy of living has been dropped down. *"In the post-conflict, employment would be the priority,"* Participant (6).

4.5.1.4.1. Economic Barriers of Implementing Controlled Environment Urban Agriculture:

In this section, we will be presenting the economic barriers and their related policies that are recommended by the participants.

The foremost economic obstacle that could impede urban growers to have such sustainable CEUA is the cost and the lack of investment. All participants agree on this issue as it is the hardest step to start up an UA business. For example, *"I think any startup costs so obtaining inputs seeds tools and materials to be able to begin,"* Participant (3). And *"it might lack investment and money, and the cost is high in CEA,"* Participant (6).

4.5.1.4.2. Policies to Support Businesses and Entrepreneurs and Overcome Economic Barriers:

1- CEUA should be politically recognized to gain economic support. As Participant (2) informed: *"If you get the political support, you get the economic support. UA should be formalized. The formal economics is for business and farmers."*

2- For the Syrian investors in UA, it is highly important to have the money to start their projects. Participant (6) mentioned that, while lower tax rates are important for businesses located outside of Syria, for the businesses and entrepreneurs inside Syria the government should provide investment funds. *"Yes, the reduction of taxes is for the private sector from outside the country. However, for the private sector from inside Syria, you need the money for that, seeds, plants, the technical part. It might be as loans,"* Participant (6). It is also recommended to provide subsidies for only the equipment to start. However, the direct subsidies are not recommended by Participant (7) as it harms natural sustainability. *"I would say direct subsidies there are, they could cause issues regarding sustainability of natural resources,"* Participant (7).

1- Comprehensive and strategic UA plan that considers and supports all practitioners from producers, distributors, exporters, and importers. *"The government should consider companies that promote agriculture, import, and export in its strategic agendas,"* Participant (4).

2- The government should invite all practitioners and beneficiaries to a roundtable dialogue to see the different points of view and each entity's requirements. For example, the academic perspective might be different than the business view of point which also can differ from the governmental approach. And participant (2) elaborates that, *"You need to understand the different voices and approaches from the governmental, business, academic, farmers, and entrepreneurs,"* Participant (2).

3- The most important step of policy is providing the businesses and entrepreneurs with the land, water, energy to produce the food. *"The future government needs to*

show the investors the water to grow the food, land, and the tenure of the land is secured," Participant (6).

4.5.1.5. CEUA and Society:

This section presents the impact of CEUA on society, social obstacles, and the most needed social policies to be addressed.

4.5.1.5.1. Social Impact:

UA could support social reconstruction in a post-conflict context. It can offer both a source of activity and livelihoods. In addition, it can serve as a mechanism for improved social cohesion. For example, while the Syrian conflict has left behind lots of psychologically, mentally, and physically disabled persons, CEUA would be a critical source for them to continue their lives healthily. *"In the post-conflict era where lots of Syrians lack physical and mental activities, it can [be] a source of the livelihoods to improve and continue their life,"* Participant (8). The practice of UA also can improve social cohesion. Once individuals grow their food together, they incorporate, have friendly competitions, and the overall result is enhancing their social cohesion. *"I think when the community grows together, there is this cooperation. People learn from each other. There's a bit of a competition, but it is friendly. It also helps the community to grow together and sometimes it is more successful than individual growing,"* Participant (3). Besides, many farmers can help and feed each other. *"Many of the farmers are providing food for their fellows,"* Participant (2). In addition, UA has proved that urban farmers can have social inclusion through sharing information and working together, as well as

excluding social discrimination either in the same group of religion or outside it (Martin *et al.*, 2008).

4.5.1.5.2. Social Barriers:

However, the adoption of UA faces several social barriers including negative, class-based attitudes about farming. Farming is also seen as difficult and unattractive compared to other activities. Farming is a reminder of rural status. Most participants highlighted this social challenge. Urban residents think of themselves as more advanced and with a higher class than being redirected to farm again, especially the urban dwellers who left the rural areas looking for a much better and sophisticated life. *"Farming is a reminder of a rural status. Some people identify themselves as urban and a higher class not farmers or rural,"* Participant (7).

Many social perceptions exist when it comes to farming in cities and how people think about UA. Most urban residents think that food is produced in the rural areas only. *"I think there is just this cultural perception that food production happens outside cities,"* Participant (3). Also, some others might think that farming is a short-term solution until they find another activity or sustainable job opportunity. Participant (2) says: *"Farming in cities is considered as an instant solution."*

On top of the social obstacles comes the lack of know-how and experience. Most of the participants have highlighted this obstacle conserving as it is the most challenging part of their work. For example, *"Agriculture itself is so complicated and requires lots of things such as the materials and the know-how to do it to keep growing and maintain their equipment. Which requires more time and the skills to do,"* Participant (7). However, these

obstacles are different in non-conflict than in post-conflict situations. Moreover, this know-how is different in a household garden versus a commercial operation that would train its workers and divide responsibilities. The employees would not be expected to know everything about the design, installation, and operations of a CEUA.

As long as social obstacles in post-conflict are different from a non-conflict situation, UA would be more acceptable due to the high level of poverty. As Participant (2) says: *"In the post-conflict, it might be more acceptable."* Participant (7) elaborates why: *"Socially: In some cases, it would be less complicated in terms of social perspective to integrate into the field of UA, and it would be more acceptable by the citizens due to the high level of poverty and displaced and disabled people."* Also Adopting new technologies would be more acceptable due to the lack of energy resources, so that, renewable energy would be more viable. *"Now there will be a larger acceptance to this kind of technology, especially in a country such as Syria that suffers from the lack of energy resources and food insecurity,"* Participant (9).

However, not all the Syrian community would accept working in UA as a source of living in the post-conflict era as explained by participants. The crisis in Syria has caused a scattered society, ethical chaos, and religious discrimination. *"Some people might not like other people. Someone might come and destroy the field of another. Here what can UA do, it can bring the people together,"* Participant (6). And who can convince the burglars, *Shabiha*, to stop stealing and work on UA? *"People think that UA is not efficient as stealing,"* Participant (2). It might not be considered a prestigious or decent job. *"Some people do not want to farm. One might say that my grandfather did that,"* Participant (8).

4.5.1.5.3. Social Policies for Urban Agriculture:

1- The UA's sponsors should look for passionate people to adopt this new technology. It is true that the Syrian crisis has resulted in more than 90% of the citizens poor, but not all of them will be interested in working in farming. *"Find the most passionate and interested people to work on that,"* Participant (2).

2- Enable the farmers to grow their food and teach them the technical and soft parts of agriculture, i.e. teach them how to deal with the materials, pesticides, pathogens, and products with its processing throughout the governmental extension services. *"Enable vertical integration through the supply chain. So, farmers should be able to start the process themselves. So the government can through their extension officers for example be able to provide training or ideas to farmers for them to start doing their processing on their farms. Then they can sell the processed products for a higher price themselves,"* Participant (3).

3- The government's municipalities and institutions hand-in-hand with NGOs should familiarize the people with UA community projects. *"We need to know how to familiarize them with the sector. We need to implement community-based approaches and projects for that,"* Participant (7).

4- For the women's engagement, the supervisors of an UA project should choose the women carefully and ensure that the women are not the ones who have to take care of their children. *"It's no good saying "Oh" yes we would like women to come to training and then not having childcare provision,"* Participant (3). Another option is to provide supplementary childcare, rather than to exclude all women who have children.

5- Education and training are two critical aspects of practicing CEUA. All responsible sectors, governments, and NGOs should provide the soft and technical training of UA practice. They should teach them all the required skills. *"For CEA there are many techniques to be learned. They should learn business skills, not only the technical part. Education can be from farmer to farmer not only from the role of NGOs or governments,"* Participant (1).

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4.5.1.6. Accessible Lands for CEUA:

One of the benefits of CEA is that it does not require large land to grow. However, the required land might not be accessible to grow food in cities. It might be more profitable to have high buildings instead of leaving empty spaces to grow food that can be in the rural areas. Most of the participants assumed that water and energy would be available to grow food. However, they identified many challenges such as land tenure and ownership before considering UA in the governmental agenda, as well as suggested the best solutions for that purpose. This section presents the land barrier and the most needed land policies to implement CEUA in post-conflict Syria.

4.5.1.6.1. Land Barriers:

Participants were asked what the most appropriate area is to grow the food in urban areas, specifically whether building rooftops or empty spaces between buildings would be better suited for food production and environmental purposes. Some participants agree on producing food over buildings and balconies, and others do not agree with that as

it is hard to access the rooftops if they are not equipped well. *"It is quite hard to grow food over the rooftops. Some buildings are not highly equipped with elevators that ready to handle like there issues,"* Participant (2).

Also, empty spaces might not be available in the reconstruction era to grow food. So that, land might not be considered for agricultural purposes. *"It is not legally written in some cities, the land is not for agriculture,"* Participant (2). Land tenure is another critical issue that urban farmers might face. *"The farmers may not have a secure land tenure,"* Participant (3). Disagreement might occur due to the ethical and governmental chaos concerning land ownership and the right of accessing land. *"My guess would be potential challenges around land rights who has the right to use it? which areas of land? and land tenure is a critical issue. So a farmer may start to grow and someone might say no you can't use this land, it's mine. The conflict there have been disagreements over ownership or lands have been transferred to another owner with the absence of the Syrian migrants,"* Participant (3). Land in Syria is expected to become more expensive, and a land conflict of interest might happen. *"The land would become more expensive, and the pressure on land will be a phenomenon. So that, UA would be in competition with urbanization and reconstruction,"* Participant (4). In addition, assuming that the land would be rented, most participants clarified that renting land is different than before. The period should belong and that is not available in the 21st century. Rental periods have shortened in recent decades. It also has its relation to the kind of plant that the producer wants to grow. Participant (4) elaborated, saying: *"Before the year 2000, renting was longer than today. Nowadays, it is not more than 4 to 5 years. That will limit the producers to grow crops*

rather than fruit trees which need a longer period of time to start producing than vegetables."

4.5.1.6.2. Land Policies:

Land tenure and land policy is an incredibly complicated issue. Also, we have looked only at the UA side of things, and other issues are not considered such as housing use, commercial use, and public use. So that, the following recommendations are not for the entire urban area. Instead, they could be presented as initial ideas which could be considered or explored in further research and/or in roundtable discussions among different stakeholders.

1- The future government should promote green urban spaces in its urban development agenda. *"When they are looking to the reconstruction, they should take into consideration to promote green spaces for agricultural purposes,"* Participant (1). In addition, Digitalize via satellite images the empty spaces around cities. It is easier to grow the food around cities and in destroyed areas than inside already built areas. *"The government should preserve agricultural lands around the city which is easier than inside the city and emerging cities is easier than already existing cities,"* Participant (4). The participant also recommended dividing each property into 60% buildings and 40% for agricultural purposes.

2- The government should allow the producers to exploit public spaces and properties to grow food in cities. *"I was also thinking about the use of public lands or public*

infrastructure public buildings disuse buildings and they are allowing businesses to use areas which are not currently all occupied yeah yes so," Participant (3). However, if this is implemented, the public spaces need to be protected so that they are not captured by private individuals, which ends up being a transfer of public resources.

3- The future government should allow the real owners to control their lands. The old owners have the right to control their lands and have the right to grow their food within it, and the government has the responsibility to do that. *"The state has the responsibility to return the land to its owners with no negotiation. It requires a conflict specialist to negotiate it"* Participant (1).

4- Future urban planners should leave empty spaces to be multi-functional or multi-purposes. In addition, these spaces should be for free for public access. *"We need multifunctional spaces. Places for the environment and other for food security, and it is recommended to grow fruit trees and make it for free for its populations,"* Participant (5).

5- It is also recommended to expand the CEA to the peri-urban and rural areas where land is more accessible. *"Syria can expand its CEA in the rural areas and the peri-urban areas where land is cheaper and there is an opportunity to grow the food there,"* Participant (6). As long as all the cities are built on fertile lands, Participant (8) has another opinion to suggest. *"I would recommend growing the food not within the city but rather in the peri-urban areas,"* Participant (8).

4.5.1.7. Politics for CEUA:

An option to improve food security in post-conflict Syria is to support and expand UA. To do so requires institutional support from the Syrian government. UA is marginalized by the government, and it is considering an illegal activity. Most of the participants' opinions meet on this point. For example, "There is an institutional barrier," Participant (1), and "It is hard to access the governmental support," Participant (2). Most of the politicians and administrators of the Syrian institutions do not know that UA is healthy and safe to grow food in the city. They lack this knowledge. *"I think understanding by city governments that it is possible and that it is safe to produce food within the city. The politicians also have the perception that agriculture is a rural activity,"* Participant (3).

In addition to the economic and social policies, it is simple but important to say that UA should be recognized by political officials such as the ministry of water, the ministry of agriculture, and the ministry of economics. It also should be in the governmental plans, agenda, as well as in the urban development. *"It should be included in the governmental plans and should be considered in its governmental policies,"* Participant (7).

CHAPTER 5

DISCUSSION

CEUA is the kind of UFEs that is chosen in this study because most Syrian farmers in the coastal region are familiar with CEA. According to (Star-Times, 2010),. greenhouses began to be cultivated in Syria in the mid-seventies within the framework of an integrated project presented by FAO. So it would be more acceptable and viable comparing to the other UFEs. However, this agricultural system would not be installed in the coastal areas only, but rather in the major cities as a kind of advanced system of UA

The water and energy elements are keys in this research, and CEA is considered a manifestation of the WEF nexus. For the source of irrigation, water desalination, rain harvesting, and treated wastewater are suggested in this research as a water reinvestment. The source of energy is renewable, either generated from solar panels or wind turbines. Energy is needed to operate the factories that desalinate water, treat wastewater, and for water pumping. The water and energy elements are directed to produce vegetables and fruits in a controlled environment either in a hydroponics or aquaponics system.

5.1. Energy

Starting with renewable energy, the findings suggest that RE can be an important source for UA and for entire cities to cover the lack of electricity that happened due to the devastation of the country's electricity infrastructure. The findings also show that there is a

great chance for Syria to rebuild its devastated infrastructure and build renewable energies to power the country. However, there is a fear of the Syrian government to continue its electricity generations relying on fossil fuel instead of RE. For example, in Iraq, after the war ended in 2011, the country decided to renew its thermal electricity generation due to the lack of investment and support (PowerTechnology, 2017). In the context of post-conflict Syria, this obstacle, the lack of investment, was highlighted by most of the participants.

The need for renewable energy is urgent, and there are signs that despite challenges, investment in RE is beginning amid Syria's reconstruction. A Syrian private national company called VDRVM implemented a wind turbine and is installing another turbine nearby it in the city of Homs, where the highest wind speed exists among Syrian cities. See Picture 3. Media have reported that the CEO of WDRVM, Mr. Rabih Elias, said; "*The whole was done by Syrian workers, technicians, and engineers. Also, the materials are locally produced with the coordination between the company and the Energy Research Center at the Ministry of Electricity,"* (Alealam, 2019). So that, wide turbines can be implemented, and governmental support exists. This literature contradicts the finding that shows Syria cannot implement renewable energy because it requires experience and investment. Another highlighted obstacle in the results is that Syria lacks the wide areas to be implemented. However, according to Al-Mohamad (2001), Syria as a Mediterranean country has considerable potential for wind energy and an unlimited source of solar energy with a high level of solar radiation. It is worth mentioning that some Syrian farmers installed solar panels to pump water, but they are suffering from the high cost and the

Syrian pound fluctuations. That means decentralized solar panels are already installed in the rural areas, but there is observed UA production based on renewable energy.

We cannot rely on the energy of the past to power our future. The future of Syria requires more developed and advanced steps towards achieving the Sustainable Development Goals by 2030. Based on the findings, the future government should assess and analyze the potentiality of RE resources with a strategic plan for the centralized centers. the participants also recommended that the government should boost its support to the businesses to run the decentralized solar and wind plants and connect them to biodigesters to benefit from the biogas, where the biodigesters rarely exist in Syria.

Picture 3. The first wind turbine was implemented by WDRVM private company in Syria.

Source: (WDRVM, 2019).

5.2. Water

Based on the findings, desalination plants are not recommended in post-conflict Syria where Syria is economically exhausted due to the war, and installing desalination plants is highly costly. These findings are in line with (fanckWATER, 2019); Ma *et al.* (2008) who stated that desalination plants are highly costly and can be used only for drinking water not for agriculture. The results also show that the big cities – Damascus, Homs, and Aleppo – are far away from the coastal area which requires more energy and most cost to pump the water. The result is in parallel with another study conducted by Wardeh and Morvan (2005), who studied the potential implementation of desalination plants in pre-conflict Syria. They concluded that the mountains in Syria are in parallel with the coastal area, and it is hard to pump the desalinated water to the interior cities. This pumping, if needed, will cost more and deplete more energy. (Elhadj, 2004) estimated the cost of implementing desalination plants in Syria before the conflict and conveying it to Damascus would cost US$ 1.22 per CM. The same study shows that desalinated water-based food is costly and non-profitable for producers: Growing one ton of wheat would cost US$1,470 using desalinated water, whereas the global price of what was US$100. So that this study is in line with the evidence that growing food in UA systems will not be profitable based on the desalination process. Desalination is not a viable business to grow food in cities to improve the livelihoods of marginalized communities by desalinated water. However, as long as the cost of desalinating water has been decreased throughout the years, it can be a good solution to implement it for the long-term governmental goals. One of the obstacles that also the result present is that desalinating water gives the impression that water is abundant. so that there

would be excessive use of water. This is in line with the literature, according to Barton (2020), that informed that the implementation of desalination plants is an overuse of water resource in the MENA region. However, the implementation of desalination plants would be different in the future. For example, the cost future of desalination plants is expected to be reduced by 20% in the next five years and by 60% in the next twenty years. The cost, therefore, will be US$ 0.3 – 0.5 per CM desalinated freshwater (Voutchkov, 2016). In the long-term post-conflict therefore, the Syrian future can rely on desalination plants as a source of water due to the cost reduction.

As another source of water, the findings show that treated wastewater could be an important source of drinking water and irrigation for UA in Syria which is located in an arid and semi-arid region. That goes hand-in-hand with Kaisi *et al.* (2005), who reported that the treated wastewater can play a significant role in sustainable food production in Syria. The findings also show that one of the obstacles of implementing WWT in post-conflict is the high cost. The literature found can add to that the lack of legislation and controlling mechanisms of the plants, lack of trained staff and experience, and overlapping among the governmental agencies in the plants (Kaisi *et al.*, 2005). The results recommend the policymakers reestablish and repair the existing WWT plants with the required infrastructure and plan the cities with empty areas to build new plants. According to FEMIP (2009), Syria has 40 WWT plants, but only three of them are located in urban areas. According to TheWorldBank (2017), the damage of the WWT plants in cities that faced conflict is partial. The old WWT can therefore be fixed to continue their work besides building new plants nearby cities for UA irrigation. Another recommendation is to take

safety as a priority. The finding is crucial and in line with Kaisi *et al.* (2005) where the researcher recommended developing laboratories that examine and test the treated wastewater. It is worth mentioning that the amount of treated wastewater reused per capita in Syria was ranked the ninth worldwide with 55.109 m^3/day per million capita, comparing to Tunisia, Egypt, Morocco, and Lebanon was 11th with 51,233, 15th with 26,301, 32nd with 3,358, 39th with 1,528, respectively. The first country was Qatar which ranked the highest with 170,323 m^3/day per million capita worldwide (FEMIP, 2009). Syria therefore can be reranked the ninth and higher worldwide in post-conflict.

According to the findings, another source of irrigation for UA can be rainwater harvesting. The finding shows that some participants view rainwater harvesting as a viable source of irrigating CEA as long as it does not require lots of water, unlike conventional agriculture. In a potential water-saving study conducted by Mourad and Berndtsson (2011), the researchers concluded that rainwater catchment can play a vital role in water savings in arid and semi-arid regions such as Syria. So that, the country can save up to 35 million cubic meters of water by rooftop rainwater harvesting in the cities. However, the findings of the analysis show that rain harvesting will be only sufficient in the coastal area. In the rest of the country, it should be Complemented with other water resources. So that, according to the recommendations in the finding, rainwater catchment implementation requires multidisciplinary sectors to work together from municipalities, meteorologists, engineers, NGOs, and the private sector to be more efficient. The recommendations are in line with Tohmé Tawk (2004) who concluded that mainstreaming UA in the MENA region

requires the provision of reused greywater and recycles, sewage water, and rainwater harvesting.

5.3. Food

The target of the water and energy cycle is food production. The kind of food production in this research is fruits and vegetables in a CEUA. Fruits and vegetables are more socially acceptable than raising animals in the cities in Syria. The proposal to implement CEUA in post-conflict Syria is consistent with earlier studies, like Davies and Garrett (2019) that identified CEA as one of 12 innovative technologies that can advance food ecosystems in developing countries.

The findings suggest that the simplified hydroponics systems are the most appropriate in the Syrian context. The expensive systems might fail. The expensive system is more complex. It is therefore at higher risk of failure in a poor country, in post-conflict Syria. The cheap systems would be wiser and more feasible in the post-conflict. FAO strongly encourages simplified hydroponics systems within micro gardens (FAO, 2011a). The results also are in line with Rios (2003), who argues that before identifying the best-controlled environment agricultural system, people should always consider the financial situation. Indeed, the participants compared Syria to the Palestinian context as it is closer to Palestine than the Gulf region. See Picture 4 and 5. Picture 4 was taken in Palestine and shows donor-sponsored projects establishing simplified CEA in the context of a marginalized economy. The system is simple and cheap and relies on sunlight for plant growth. Picture 5 was taken in Saudi Arabia, an oil-based economy, and shows a

governmental supported system. the system in the later is advanced and expensive and relies on light-emitting diodes (LEDs). Both countries are located over arid and semi-arid regions, but the CEA systems have been adapted to local economic conditions. Syria is more similar to Palestine than Saudi Arabia, given its weak economic conditions (hyperinflation), political divisions, and ongoing conflict. Because implementing advanced and expensive CEA projects might fail, the participants recommended simpler CEA systems to be adopted in post-conflict Syria.

Picture 4. Shows hydroponically grown food in Palestine in a simple way in CEA.

Source: Atlas of the Future (2017)

Picture 5. Advance CEA hydroponically grown food in Saudi Arabia.

Source: Desert Agriculture (2017)

However, the post-conflict in Syria might take multiple stages. It is not reaching out yet. The reconstruction did not start yet which might carry out a great and prosperous future for the Syrian economy in the long term if not in the short-term development process. Even though most of the study's participants only suggested the cheap and least advanced system to be implemented in the post-conflict, the advanced and expensive systems might be feasible for the Syrian UA future. According to Jensen (2002), CEA can increase production efficiency, improve production quality, optimize plant yield, and play a key role in commercial production in cities.

5.4. The Potential Impact of Urban Agriculture to Improve Syrian Food Security

The results suggest that the implementation of CEUA in the post-conflict period could potentially improve Syria's food security by enhancing its food availability and food accessibility at the household and macro levels. It can increase the amount of produced food which can create more diverse, fresh, nutritious food for the producers themselves. The producers can sell the surplus and gain profit out of that. The findings are in line with the existing literature (Dawson & Sanjuán, 2011; Gerstl, 2001; IMF, 2020; Mougeot, 2005; Zezza & Tasciotti, 2010).

At the household level, UA can create job opportunities, especially for women and youth. This finding is in line with earlier studies (Agbonlahor *et al.*, 2007; Armar-Klemesu, 2001; M. G. Badami & N. Ramankutty, 2015; Barthel & Isendahl, 2013; Smit *et al.*, 2001a) that demonstrate that UA can create a source of income by creating job opportunities to the youth and women. The results also suggest that UA can be a useful solution for the Syrian youth who were engaged in fighting and smuggling drugs. So that, it can be an alternative solution for the post-conflict instead of stealing and committing crimes. In this regard, no literature matched this finding. The result is in line with Maconachie *et al.* (2012), who studied the urban farming associations, youth, and food security in post-war Freetown, Sierra Leone. The researchers revealed that the significance of the associations relies where a large number of the youth who were ex-combatants got involved in UA associations to grow and sell their food to improve FS. UA can be significant for poor children to eat healthy and fresh food and other studies support this link. For example, in northeast Brazil, community gardens helped children to play in their gardens, allow them to help their

parents in agricultural activities, keep them far away from the streets and enrich their knowledge with biodiversity and other life sciences (FAO, 2005; Veenhuizen, 2006).

The results also suggested that women may be more interested in UA than men, which raises their spirits and boost gender equality. This result goes in hand with Veenhuizen (2006) who quantified the percentage of engaged women in the fields of UA and found that 65% of urban farmers are women. UA has been shown not only to increase gender equality but also to improve social integration among men and women (Novo & Murphy, 2000; Orsini *et al.*, 2009).

UA has a partial potentiality to improve the Syrian economy and its FS if it would be legislated, legalized, and implemented in the post-conflict. The results also confirm that GDP may not be considered, but that the CEAU's role with related industries should not be undermined, which opens the door for companies and entrepreneurs. Therefore, the economy will be powered by the local production of whole materials required to produce food in a controlled environment. Unlike conventional farming, which does not require iron and plastic production, special fertilizers, and more seeds. The analysis results also confirm that CEUA will allow local companies to expand their work, new businesses to join the UA market, and create new entrepreneurs. The finding meets the literature with (Thornton, 2020) who said that UA can be sustainable and leave a macroeconomy impact once it opens the chance for businesses to expand their work and for entrepreneurs to create and develop new models to fight global warming and climate change as well as poverty. For that the policies most needed to improve the Syrian economy via UA are as follow:

1- The creation of a comprehensive and strategic plan to conclude all business practitioners from the producer, distributor, exporters, importers, and peasants.
2- Regular invitations by the government to all stakeholders from universities, entrepreneurs, businesses, NGOs, and governmental stakeholders such as the ministries of Water, Irrigation, and Agriculture.
3- Provision of water, energy, and land to grow the desired food.
4- According to Tohmé Tawk (2004), mainstreaming UA in the MENA region, and Syria, requires supporting farmer markets and fairs to ensure optimal profit for urban producers. In addition, enhancing access to credit is significant, which is particularly important in achieving technical and/or government improvements along the market chain.

5.6. Social Barriers and Social Policies

The findings present that farming in cities is a reminder of rural life. Some of the Syrians might think that they would be redirected to rural life to produce only their food and nothing more. This finding is in line with Thornton (2008) who studied the barriers of UA and concluded that there is a perception that agriculture is considered a rural activity. According to the findings from Kaufman and Bailkey (2000), the lack of knowledge of practicing agriculture is another barrier toward implementing UA. According to the findings, there are also other challenges expected in the post-conflict such as the lack of ethics, discrimination, and social disparities. So that, the CEUA of someone might be destroyed by another person from a different category or religion due to malice and hatred.

The results also stated that it would be hard to convince the burglars, *Shabiha*, to get engaged in UA. They stole lots of money out of homes and shops and built wealth. However, based on the findings, UA would be more acceptable due to the high level of poverty as well as the high number of disabled and displaced persons. For that, the findings provide policymakers with the following guidelines to adapt to overcome the social barriers:

1- The suggestion of UA to only passionate people to adopt this new technology.
2- Enabling the farmers to grow their food and teaching them the technical and soft parts of agriculture. This recommendation is in line with Tohmé Tawk (2004) who concluded that to mainstream UA in the MENA region it is a strategic agenda to support urban producers by providing them with adequate extension service and training. It is also important to strengthen their organizational skills.
3- Introduction of the people to community gardens by NGOs and governmental stakeholders.
4- Selecting women with no young children. If the children exist, the project supervisors should ensure that there is another one who can take care of their children. It is also recommended to provide the head women with supplementary childcare.
5- Provision of agricultural extension to all practitioners by NGOs and agriculture extension service centers.

According to the findings, social cohesion would be achieved in a region affected by political and religious segregation. This result is in line with the literature studied by Zeeuw and Drechsel (2015), who discussed that UA can create social integration and cohesion.

5.7. Land Barriers and Land Policies

The results show that rooftops are not perceived to be appropriate to grow food because they might not be equipped well with empty spaces to grow food or with elevators to raise the materials. However, rooftop gardens have a potential reduction of heating around buildings (Peck *et al.*, 1999). Rooftop gardens also improve the quality of urban life throughout contributing to biodiversity in the urban environment (Miller, 2005; Sanye-Mengual *et al.*, 2013). The results revealed that the farmers might not have legal permission to grow over a specific land as it might be considered for the reconstruction not for agricultural purposes. The farmers also may not have secure land tenure. This finding goes in line with Kirschbaum (2000) and Badami and Ramankutty (2015) who concluded that urban farmers might not have land accessibility which impedes them to grow their food.

The findings also document that with the absence of the Syrian migrants, the government might control the land or the real estate of an owner if she/he does not provide the required documents in a specified period. In fact, according to Human Rights Watch (2018), the Syrian government issued Law No. 10 of 2018 on April 2, which permits the establishment of planning zones throughout Syria dedicated to reconstruction. The law does not specify criteria for classifying an area as a zoning zone or a timetable for designated

zones. Instead, the zones are designated as zoning by decree. Within a week of the issuance of the decree to rebuild an area, local authorities should request a list of real estate owners from government real estate agencies operating in that area. Bodies must submit the lists within 45 days of receiving the local authorities' request. If the property of the area's owners does not appear on the list, they will be notified, and they will have 30 days to provide proof of ownership. If they do not do so, they will not be compensated, and ownership of the property will revert to the town, district, or city in which the property is located. In the event that the owners show proof that they own a property in the regulatory area, they will receive stakes in the area (Human Rights Watch, 2018).

To overcome the aforementioned land obstacles, the findings recommend that:

1- Promoting urban empty spaced customized for agricultural purposes.
2- Permitting urban producers to grow food in public spaces.
3- Acknowledging the right of old basic owners to exploit their lands however they want.
4- Preservation of agricultural lands around cities and in destroyed areas rather than inside cities and already built areas.
5- Expansion of CEA to peri-urban areas where the land is cheaper and more accessible.
6- Provision of secured land tenure to businesses, entrepreneurs, and farmers to sustain the UA production.

5.8. Political Barriers and Institutional Policies

One of the hardest obstacles to implementing UA is the lack of legislation and political support. Once the future government of Syria is institutionalized, there could be an increase in UA with a corresponding (if delayed) FS impact. For example, from the literature, in the study conducted by Tohmé Tawk *et al.* (2014), the researchers confirmed that the improvement of FS in Jordan (in Amman) comparing to Lebanon (in Bebnine-Akkar) was attributed due to the governmental support in the city of Greater Amman based on a multi-stakeholder policy formulation and action planning approach. The researchers argue that improvement because the UA project lacked institutional support and regulations in Lebanon. Other evidence from the MENA region suggests that institutional support can contribute both to UA and overall food security. For example, comparing to the GCC countries, the countries occupy the first FS rank among the MENA countries due to the governmental financial support of energy and water to the agricultural producers. For example, the minister of the Future of Food Security, Mariam Al Mehiri, plans to create a "Technology Hub" or "Food Valley" to develop food and farming automation. The idea aims to attract and enable a new generation of farmers to help build a better future (iGrow Reporter, 2017). In addition, according to Tohmé Tawk (2004), the installation of UA in the MENA region countries requires analyzing existing regulations and laws relevant to UA and introducing new laws. This recommendation can be useful in the Syrian case where the municipality's water is only for drinking. Therefore, a new law is needed to amend this law to make it legal to grow food in cities and irrigate it by drinking water if not by reused water.

In the result, it is mentioned that UA is an illegal activity due to the use of municipal water. As long as the source of water is either desalinated water, TTW, or harvested water, based on this research, UA should be legal. This can be supported by Lefers *et al.* (2020) who concluded that the future of CEA will not compete with fresh and municipal water and can be readily integrated into the human food chain.

5.9. Significance of the Study

The research is important for several reasons. First, it provides basic information to the future Syrian governmental agencies that are responsible to improve Syria's FS. The research also focuses on the essential elements of food production which are the water and energy to be sustainably used for the new generations to have a more prosperous life. The study can open the door to revitalize UA in cities in Syria which rarely exist in an era where poverty and hunger are very high. The revitalization can be in an environmentally friendly and modern way.

The data of the research and the findings are highly reliable because they are imported out of experts and professionals in the field with a high level of education. The majority education level is Ph.D. with significant professional experience.

The main purpose of this research is to offer insight into the potential contribution and feasibility of UA and its reinvestment in post-conflict Syria. So far, we have found that UA can potentially contribute to FS in multiple ways. The constructed framework can help to map out these contributions. Through the literature review and expert consultation, the

researcher identified several potential barriers (e.g., legal, economic) to the application of UA in post-conflict Syria. This leaves new questions and areas for exploration in future research. For example, what are the specific laws that prohibit UA? Is the potential for UA greatest in urban or peri-urban areas? Should UA be practiced at a household or commercial scale? What are the real attitudes of government officials towards UA?

5.10. Limitations of the Study

This research is subject to several limitations. First, due to resource and time constraints as well as ethical restrictions, the research team reached a limited number of experts. For example, one more person Specialized in CEA, hydroponics, was needed to get more data about its equipment, materials, and conditions. The researcher had prepared a list of 27 respondents to participate in the interviews and secured IRB approval for the list. Three of the targeted respondents are Syrian agricultural engineers working in the field of UA, however, they refused to participate for multiple reasons. Their engagement would have enriched the research with more information about its implementation in Syria, the obstacles that they face, and what do they need out of the government to provide and support them. A further extension of this research would seek to include views from additional experts such as in-country UA experts.

A separate but related limitation concerned reaching Syrian officials to serve as key informants. Syrian government officials were ideally needed to provide the researcher with more realistic information about the current agricultural situation and how they look at some other initiatives that occurred during the COVID-19 pandemic to implement UA

projects. However, the research team had to comply with AUB/IRB guidance to not talk to Syrian government officials who might be under U.S. sanctions, such as the current minister of agriculture is under sanctions. As a result, this gap in perspectives remains an area for future research when regulations permit.

Finally, the research is limited by the lack of published literature on UA in Syria in both languages Arabic and English. The existence of the literature would have helped the researcher to identify the real cost of the implementation of CEA, the social acceptance, its food production, and the contribution to FS. This is a secondary result of the weaknesses of scientific research in Syrian universities.

CHAPTER 6

CONCLUSION

To our knowledge, the present study is the first to examine the potential implementation of UA, its promising impact on FS in post-conflict Syria, and the most needed and required policies to implement UA. Uniquely, this study does so by presenting a framework linking UA with its interconnectedness to the reinvestment in human waste such as food and water.

The objectives of the research were successfully achieved by conducting an extensive literature review, which was then supported and extended through nine online interviews with key informants, professionals, and experts in the fields of UA and water and food reinvestment, as well as the use of RE. The interview data were analyzed qualitatively with the aid of Quirkos software that is a useful tool to gather the data into themes, sub-themes, and codes.

The findings show that if UA were institutionalized in the post-conflict based on this research, the vegetables and fruits would be grown in the cities in a controlled environment, irrigated by TWW and rain harvesting, as well as desalinated water in the long term once the cost is reduced. And the source of energy would be solar panels or wind turbines to operate the WWT plants, desalination plants, pump irrigation. The potential benefits would be producing more food nearby the cities' centers, decrease transportation costs and environmental footprint, decrease food loss, and provide the producers with fresh, diverse, and nutritious food. Adding to that, it would contribute to create more job

opportunities and improve the FS at the household level and in the short term and at the macro level in the long term.

Further research is needed to dive more into the technical part of CEA, the damage of the WWT and desalination plants and their infrastructures, quantitative surveys on the social acceptance, land used for CEUA, and the cost of implementing CEUA. It is also important to validate the initially recommended policies.

APPENDIX

Interview Guide:

(English Version)

The Research Questions and Objectives:

The main question:

Will urban agriculture be a useful option to achieve food security (Food availability and food accessibility) in post-conflict Syria?

Research Objectives:

1- Assess the potential of Urban Food Ecosystems (UFEs) (Controlled Environment Agriculture (CEA)) practices, methods, and reinvestments in terms of Water-Energy-Food (WEF) nexus to improve food security in post-conflict Syria.

2- Make recommendations to policy guiding urban agriculture in post-conflict Syria.

Demographic Information:

Interviewer: _____

Interviewee: _____

Age: _____

Country: _____

City: _____

Job Position: _____

Affiliation: _____

Education Level: _____

Date: _____

Start Time: _____

End Time: _____

Before starting the interview, I would like to remind you that you have the right to refrain from answering any or even all of the questions that will be asked. Also, you can skip any question you want and we can take a break whenever you need.

Questions:

Introduction/Rapport

1. Please introduce yourself and your engagement in the field of UA.

Other General Questions:

2. What is the potential role of urban agriculture (UA) in improving food security (FS) in post-conflict contexts?
3. What are the behavioral or social barriers to the practice of UA, if any? In other words: why people resist or do not grow their food in cities?
    a. Are these barriers different in non-conflict and post-conflict contexts?
4. What are the economic challenges of implementing UA?
    a. Are these challenges different in non-conflict and post-conflict contexts?
5. What are the political obstacles in implementing UA?

a. Are these obstacles different in non-conflict and post-conflict contexts?

Objective one's questions:

6. At what percentage or level the controlled environment agriculture is needed as a tool to improve food security in post-conflict Syria?
7. Do you think that CEA is significant in a country like Syria with a wide arable land? If yes or no, please clarify why.
8. What economic benefits can it provide to the Syrian economy if it happens? If there is any, are these benefits reasons for implementing CEA?
9. What is the required source of water for irrigation? How significant planning cities with wastewater treatment plants and food waste composting plants?
10. What role can renewable energy play with reinvestment and irrigation? And what is required to implement it?
11. What is a potential role can it play in improving nutrition security as long there is no need for the use of chemicals due to the reinvestment of food waste and neglection of pesticides, and most importantly the plants are fruits and vegetables?
12. For the reconstruction, is there a need to leave arable lands, empty spaces for UA, or do you recommend growing on rooftops and balconies? Please, justify why in the case of Syria.
13. Do you consider UA is just s means of survival and the responsibility of NGOs, or it should be a strategic governmental policy?
14. What role can education, training, and workshops play in implementing and practicing UA?

Objective two's questions:

15. What policies are most needed to implement UA in post-war Syria?
16. What role can businesses and entrepreneurs play in promoting UA?
    a. What incentives are required to increase the role of businesses and entrepreneurs in implementing UA post-conflict?
17. What challenges expected for the implementation of UA post-conflict?

Wrap Up/Conclusions

18. Do you have any final observations or thoughts before we conclude this interview?

Thank you for your participation in this interview. I appreciate your participation.

المقابلة

(النسخة العربية)

أسئلة البحث وأهدافه:

السؤال الرئيسي للبحث:

هل ستكون الزراعة الحضرية خيارًا مفيدًا لتحقيق الأمن الغذائي (توافر الغذاء وإمكانية الوصول إليه) في سوريا ما بعد الصراع؟

أهداف البحث:

1) تقييم احتمالية تنفيذ وتبني النظم البيئية الحضرية التكنولوجية العصرية (الزراعة البيئية الخاضعة للرقابة) الممارسات والأساليب وإعادة الاستثمار من حيث العلاقة بين المياه والطاقة والغذاء لتحسين الأمن الغذائي في سوريا ما بعد الصراع؛

2) تقديم توصيات لصانعي السياسات والقرار لتنفيذ الزراعة الحضرية في سوريا ما بعد الصراع.

المعلومات الديمغرافية:

اسم المحاور: .....

اسم الخبير (ضيف المقابلة): .....

العمر: .....

البلد: .....

المدينة: .....

المنصب الوظيفي: .....

المؤسسة أو الشركة التي ينتمي إليها المقابل: .....

المستوى التعليمي: .....

تاريخ إجراء المقابلة: .....

وقت البدء: .....

وقت النهاية: .....

قبل البداية بالمقابلة أود تذكيرك أنك تملك الحق في التمنع عن الإجابة عن أي سؤال أو حتى كافة الأسئلة المطروحة. كما أنه يمكنك تخطي أي سؤال تريد و يمكننا أخذ قسط ن الراحة وقت تشاء.

الأسئلة:

مقدمة\افتتاحية لطيفة:

السؤال الأول: يرجى تقديم نفسك وانخراطك ولمحة عن خبرتك في مجال الزراعة الحضرية؟

بعض الأسئلة العامة حول الزراعة الحضرية:

السؤال الثاني: ما هو الدور المحتمل للزراعة الحضرية في تحسين الأمن الغذائي في سياقات ما بعد الصراع؟

السؤال الثالث: ما هي العوائق السلوكية أو الاجتماعية التي تحول دون ممارسة الزراعة الحضرية، إن وجدت؟ بمعنى آخر: لماذا يقاوم الناس أو لا يزرعون طعامهم في المدن؟

- هل تختلف هذه المعوقات في سياقات قبل أو بعد الصراع؟

السؤال الرابع: ما هي التحديات الاقتصادية لتنفيذ الزراعة الحضرية؟

- هل تختلف هذه التحديات في سياقات قبل أو بعد الصراع؟

السؤل الخامس: ما هي التحديات السياسية لتطبيق الزراعة الحضرية؟

- هل تختلف هذه التحديات في سياقات قبل أو بعد الصراع؟

الأسئلة المتعلقة بالهدف البحثي الأول:

السؤال السادس: ما هي النسبة المئوية أو على أي مستوى سوريا تحتاج للزراعة البيئة الخاضعة للرقابة اللازمة كأداة لتحسين الأمن الغذائي ما بعد الصراع؟

السؤال السابع: هل تعتقد أن البيئة الخاضعة للرقابة تعتبر مهمة في بلد مثل سوريا يتميز بمساحة واسعة من الأراضي الصالحة للزراعة؟ إذا كانت الإجابة بنعم أو لا، يرجى توضيح السبب.

السؤال الثامن: ما هي الفوائد الاقتصادية التي يمكن أن توفرها للاقتصاد السوري إذا حدث؟ إذا كان هناك أي منها، فهل هذه الفوائد هي أسباب لتطبيق الزراعة البيئية الخاضعة للرقابة؟

السؤال التاسع: ما هو مصدر المياه المطلوب للري؟ ما مدى أهمية تخطيط المدن مع محطات معالجة مياه الصرف الصحي ومحطات تجميع مخلفات الطعام وتحويلها لأسمدة؟

السؤال العاشر: ما هو الدور الذي يمكن أن تلعبه الطاقة المتجددة في إعادة الاستثمار والري؟ وما المطلوب تنفيذه؟

السؤال الحادي عشر: ما هو الدور المحتمل الذي يمكن أن تلعبه في تحسين الأمن التغذوية طالما لا توجد حاجة لاستخدام المواد الكيميائية بسبب إعادة استثمار مخلفات الطعام وإهمال المبيدات الحشرية، والأهم من ذلك النباتات هي الفواكه والخضروات؟

السؤال الثاني عشر: لإعادة الإعمار، هل هناك حاجة لترك الأراضي الصالحة للزراعة (مساحات فارغة للزراعة الحضرية) أو هل تنصح بالزراعة على أسطح المنازل والشرفات؟ برجاء تبرير السبب في حالة سوريا؟

السؤال الثالث عشر: هل تعتبر الزراعة الحضرية مجرد وسيلة للبقاء ومسؤولية المنظمات غير الحكومية، أم ينبغي أن تكون سياسة حكومية استراتيجية؟

السؤال الرابع عشر: ما هو الدور الذي يمكن أن يلعبه التعليم والتدريب وورش العمل في تنفيذ وممارسة الزراعة الحضرية؟

الأسئلة المتعلقة بالهدف البحثي الثاني:

السؤال الخامس عشر: ما هي السياسات التي تمس الحاجة إليها لتنفيذ الزراعة الحضرية في سوريا ما بعد الحرب؟

السؤال السادس عشر: ما هو الدور الذي يمكن أن يلعبه القطاع الخاص ورياديي الأعمال في تعزيز الزراعة الحضرية؟

وما هي الحوافز المطلوبة لدعم القطاع الخاص ورياديي الأعمال لتبني الزراعة الحضرية و تنفيذها؟

السؤال السابع عشر: ما هي التحديات المتوقعة لتنفيذ الزراعة الحضرية بعد الصراع؟

في الختام:

السؤال الثامن عشر: هل لديك أي ملاحظات أو أفكار نهائية قبل أن نختتم هذه المقابلة؟

لك مني فائق الشكر والتقدير على مشاركتك.

Invitation:

Invitation to Participate in a Research Study

This notice is for an AUB-IRB Approved Research

Study for Dr. Rabi Mohtar & Mr. Ali Alhasan at the

American University of Beirut (AUB).

(Lebanon – Beirut - The Faculty of Agricultural and Food Sciences at AUB - Dean's Office)

It is not an Official Message from AUB

I am inviting you to participate in a research study about (contribution of urban agriculture on food security in post-conflict Syria with the aim at 1) assess the potential of Urban Food Ecosystems (UFEs) (Controlled Environment Agriculture (CEA)) practices, methods, and reinvestments in terms of Water-Energy-Food (WEF) nexus to improve food security in post-conflict Syria; 2) make recommendations to policy guiding urban agriculture in post-conflict Syria.

You will be asked to complete a short-ended-open list of questions with your demographic information, job position, affiliation, and most importantly to your experience and knowledge in the related field of the study. During the COVID-19 pandemic, it is preferred that to conduct it online via easy and accessible online platforms, such as Zoom, WebEx, Skype, etc.

You are invited because we are targeting i.e. researchers, experts, professionals, professors in the field, etc. (you are eligible for this study if you are aged over 18, work, have professional experience within the field of urban agriculture and its interconnectedness to the water-energy-food nexus approach and controlled environment agriculture, able to communicate orally in either English or Arabic, as well as having a stable internet WIFI connection.

The estimated time to complete this interview is approximately 40 minutes. The research will be conducted online and is hosted on the AUB server.

Please read the consent form and consider whether you want to be involved in the study.

If you have any questions about this study, you may contact the investigator (Dr. Rabi Mohtar) at:

Email: mohtar@aub.edu.lb

Telephone: +01 350 000 ext. 4400

And the co-investigator (Ali Alhasan) at:

Email: aha106@mail.aub.edu

Phone Number: +963-930599756

دعوة للمشاركة في بحث

دعوة للمشاركة في دراسة بحثية

هذا الإشعار خاص بدراسة بحثية معتمدة من الجامعة الأميركية في بيروت
ومجلس الهجرة واللاجئين للدكتور عميد كلية الزراعة والعلوم الزراعية
ربيع مختار والسيد علي الحسن في الجامعة الأميركية في بيروت **(AUB)**

ليست رسالة رسمية من الجامعة الأمريكية في بيروت

أدعوكم للمشاركة في دراسة بحثية حول "مساهمة الزراعة الحضرية في الأمن الغذائي في سوريا ما بعد الصراع" بهدف: 1) تقييم احتمالية تنفيذ وتبني النظم البيئية الحضرية التكنولوجية العصرية (الزراعة البيئية الخاضعة للرقابة) الممارسات والأساليب وإعادة الاستثمار من حيث العلاقة بين المياه والطاقة والغذاء لتحسين الأمن الغذائي في سوريا ما بعد الصراع؛ 2) تقديم توصيات لصانعي السياسات و القرار لتنفيذ الزراعة الحضرية في سوريا ما بعد الصراع.

سيُطلب منك إكمال قائمة قصيرة من الأسئلة المفتوحة مع معلوماتك الديموغرافية، والمنصب الوظيفي، والانتماء ، والأهم من ذلك خبرتك ومعرفتك في مجال الدراسة ذي الصلة. أثناء جائحةCOVID-19 ، يُفضل إجراء ذلك عبر الإنترنت عبر منصات إلكترونية سهلة الوصول، مثل Zoom و WebExو Skypeوما إلى ذلك.

أنت مدعو لأننا نستهدف أيًا من الباحثين والخبراء والمهنيين والأساتذة في هذا المجال، وما إلى ذلك (أنت مؤهل لهذه الدراسة إذا كان عمرك يزيد عن 18 عامًا، وتعمل ، ولديك خبرة مهنية في مجال الزراعة الحضرية وترابطها مع نهج العلاقة بين الماء والطاقة والغذاء والزراعة البيئية الخاضعة للرقابة ، قادرة على التواصل شفهيًا إما باللغة الإنجليزية أو العربية ، فضلاً عن وجود اتصال WIFI ثابت بالإنترنت.

الوقت المقدر لإكمال هذه المقابلة حوالي 40 دقيقة. سيتم إجراء البحث عبر الإنترنت ويتم استضافته على خادم الجامعة الأمريكية في بيروت.

يرجى قراءة نموذج الموافقة والتفكير فيما إذا كنت تريد المشاركة في الدراسة.
إذا كان لديك أي أسئلة حول هذه الدراسة، يمكنك الاتصال بالباحث (د. ربيع مختار) على:
بريد إلكتروني: mohtar@aub.edu.lb
الهاتف: + 01350000
ext. 4400

وشريك المحقق (علي الحسن) في:
بريد إلكتروني: aha106@mail.aub.edu
رقم الهاتف: +963930599756

Oral Consent

Consent to Participate in the Following Study:

THE CONTRIBUTION OF URBAN AGRICULTURE TO FOOD SECURITY IN POST-CONFLICT SYRIA

(Qualitative Research Study)

Principal Investigator: Dr. Rabi Mohtar

Dr. Rabi Mohtar is the Dean of the Faculty of Agricultural and Food Sciences at the American University of Beirut.

Co-Investigator: Ali Alhasan

Hello. My name is Ali Alhasan. I am a graduate student in the Department of Food Security at the American University of Beirut (AUB). I would like to invite you to participate in a research study about the contribution of urban agriculture on food security in post-conflict Syria with the aim at 1) assessing the potential of Urban Food Ecosystems (UFEs) (Controlled Environment Agriculture (CEA)) practices, methods, and reinvestments in terms of Water-Energy-Food (WEF) nexus to improve food security in post-conflict Syria; 2) making recommendations to policy guiding urban agriculture in post-conflict Syria.

Before we begin, I would like to take a few minutes to explain why I am inviting you to participate and what will be done with the information you provide. You are invited because you are expected to be adults over the age of 18 who have professional working experience within the field of urban agriculture and its interconnectedness to the water-energy-food nexus approach, as well as controlled environment agriculture. You are also

expected to be able to communicate orally in either English or Arabic, as well as having a stable internet WIFI connection. While the study will exclude children under the age of 18, there is otherwise no specific demographic exclusion criteria.

You will be asked to participate in a remote interview to provide the interviewer (co-investigator, Ali Alhasan) with knowledgeable information based on your experience in the aforementioned field. The questions will be ended-open. There is no survey. The interview will be conducted as a one-on-one conversation via an appropriate technology platform (Zoom, WebEx, WhatsApp).

Your participation should take approximately 40 mins. Please understand your participation is entirely voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. And before the start of the interview, you have the right to refrain from answering and skipping any question you dislike answering. If at any time you would like to stop participating, please tell me, you have the right to do that. We can take a break, stop and continue at a late date, or stop altogether. There is no sensitive or personal question. You will be just asked about your demographic information to meet the participation criteria. There are no potential research risks or discomforts to participants. Accordingly, no action is required to minimize. The participants may benefit indirectly from this research insofar as the research can advance the practice of urban agriculture - in which the participants are themselves, experts - in Syria. Participants are not expected to derive any direct benefit from this research.

I would like to tape-record this interview to make sure that I remember accurately all the information you provide. The data (the audio recorded) will be stored until the thesis defense on OneDrive and accessible by the research team, principal investigator (Dr. Rabi Mohtar), and the co-investigator (Ali Alhasan). All audio recordings will be deleted by the co-investigator with the supervision of the principal investigator after this research, not later than May 31, 2021. However, transcriptions and hand-written notes will remain secured on OneDrive between the research team as well as to inform future studies related to this topic, i.e., all data will be deleted in three years right after the start of data collection for scientific publications. The expected date to delete is May 31, 2024.

Direct identifiers (such as their names) will not be recorded as part of the data collection. The direct identifiers will be used only to schedule the interviews. Once the interview is conducted, it will be anonymized (Participant 1, Participant 2, etc.) such that the participant cannot be linked to his/her direct identifiers. Also, indirect identifiers will not be kept, shown, disseminated to the public or in the manuscript of the thesis (such as job position, affiliation, contact information, etc.).

Are you interested in participating in this study?

1) do you consent to participate in the interview?
2) do you consent to the audio recording?

If you accept to participate, please respond to the email that you received by showing interest in participating. After that, I will send you another email to schedule a meeting at your availability on a Doodle link.

If you have any questions, you are free to ask them now. If you have questions later, you may contact me at:

Dr. Rabi Mohtar

Email: mohtar@aub.edu.lb

Telephone: +01 350 000 ext. 4400

If you have questions about your rights as a participant in this research, you can contact the following office at AUB:

Social & Behavioral Sciences Institutional Review Board

American University of Beirut

P.O.Box 11-0236, Riad El-Solh, Beirut 1107 2020, Lebanon

Telephone: 01-350000 ext. 5445

Email: irb@aub.edu.lb

الموافقة الشفهية

الموافقة على المشاركة في الدراسة التالية:

حول:

مساهمة الزراعة الحضرية في الأمن الغذائي في سوريا ما بعد الصراع

(دراسة بحثية نوعية)

الباحث الرئيسي: د. ربيع مختار

الدكتور ربيع مختار هو عميد كلية الزراعة وعلوم الأغذية

في الجامعة الأمريكية في بيروت

الباحث المشارك: علي الحسن -

مرحبا. اسمي علي الحسن. أنا طالب دراسات عليا في قسم الأمن الغذائي في الجامعة الأمريكية في بيروت. أود أن أدعوكم للمشاركة في دراسة بحثية حول مساهمة الزراعة الحضرية في الأمن الغذائي في سوريا ما بعد الصراع بهدف: 1) تقييم احتمالية تنفيذ وتبني النظم البيئية الحضرية التكنولوجية العصرية (الزراعة البيئية الخاضعة للرقابة) الممارسات والأساليب وإعادة الاستثمار من حيث العلاقة بين المياه والطاقة والغذاء لتحسين الأمن الغذائي في سوريا ما بعد الصراع؛ 2) تقديم توصيات لصانعي السياسات والقرار لتنفيذ الزراعة الحضرية في سوريا ما بعد الصراع.

قبل أن نبدأ، أود أن أستغرق بضع دقائق لشرح سبب دعوتي للمشاركة وما الذي سيتم عمله بالمعلومات التي تقدمها. أنت مدعو لأنه من المتوقع أن تكون بالغًا فوق سن 18 عامًا وتتمتع بخبرة عملية مهنية في مجال الزراعة الحضرية وترابطها بنهج العلاقة بين المياه والطاقة والغذاء، فضلاً عن الزراعة البيئية الخاضعة للرقابة. من المتوقع أيضًا أن تكون قادرًا على التواصل شفهيًا باللغة الإنجليزية أو العربية، بالإضافة إلى وجود اتصال WIFI ثابت بالإنترنت. بينما ستستبعد الدراسة الأطفال دون سن 18 عامًا، لا توجد معايير استبعاد ديموغرافية محددة.

الوقت المتوقع للمقابلة حوالي 40 دقيقة. يرجى فهم أن مشاركتك تتم على أساس طوعي تمامًا ولديك الحق في سحب موافقتك أو التوقف عن المشاركة في أي وقت دون عقوبة. وقبل بدء المقابلة، يحق لك الامتناع عن الإجابة وتخطي أي سؤال لا يعجبك إجابته. إذا كنت ترغب في أي وقت في التوقف عن المشاركة، من فضلك قل لي، لديك الحق في القيام بذلك. يمكننا أخذ قسط من الراحة والتوقف والاستمرار في موعد متأخر أو التوقف تمامًا. لا يوجد سؤال حساس أو شخصي. سيتم سؤالك فقط عن المعلومات الديموغرافية الخاصة بك لتلبية معايير المشاركة. لا توجد أخطار بحثية محتملة أو مضايقات للمشاركين. وفقًا لذلك، لا يلزم اتخاذ أي إجراء للتقليل من الخطورة. قد يستفيد المشاركون بشكل غير مباشر من هذا البحث بقدر ما يمكن أن يعزز البحث ممارسة الزراعة الحضرية - التي يكون المشاركون فيها هم خبراء - في سوريا. لا يُتوقع من المشاركين استخلاص أي فائدة مباشرة من هذا البحث (فائدة مالية مثلا).

أود تسجيل هذه المقابلة على شريط للتأكد من أنني أتذكر بدقة جميع المعلومات التي تقدمها. سيتم تخزين البيانات (الصوت المسجل) حتى مناقشة الرسالة على OneDrive ويمكن الوصول إليها من قبل فريق البحث (المحقق الرئيسي د. ربيع مختار) والباحث المشارك (علي الحسن) فقط. سيتم حذف جميع التسجيلات الصوتية بواسطة المحقق المشارك بإشراف المحقق الرئيسي في ختام هذا البحث، في موعد لا يتجاوز 31 أيار 2021. ومع ذلك، ستظل النسخ والملاحظات المكتوبة بخط اليد مؤمنة على OneDrive بين فريق البحث فقط وكذلك لإثراء الدراسات المستقبلية المتعلقة بهذا الموضوع، أي سيتم حذف جميع البيانات في غضون ثلاث سنوات مباشرة بعد بدء جمع البيانات للمنشورات العلمية. التاريخ المتوقع للحذف هو 31 مايو 2024.

لن يتم تسجيل المعرفات المباشرة (مثل أسماء المشاركين بالبحث) كجزء من عملية جمع وتحليل وإظهار البيانات. سيتم استخدام المعرفات المباشرة فقط لأغراض تحديد مواعيد المقابلات. بمجرد إجراء المقابلة، سيتم إخفاء الهوية (المشارك 1، المشارك 2، إلخ) بحيث لا يمكن ربط المشارك بمعرفاته المباشرة. بالإضافة إلى ذلك، لن يتم الاحتفاظ بالمعرفات غير المباشرة أو عرضها أو نشرها للجمهور أو في الأطروحة (مثل الوظيفة، الانتماء، معلومات الاتصال، إلخ).

هل أنت مهتم بالمشاركة في هذه الدراسة؟

السؤال الأول: هل توافق على المشاركة في المقابلة؟

السؤال الثاني: هل توافق على التسجيل الصوتي؟

إذا قبلت المشاركة، فيرجى الرد على البريد الإلكتروني الذي تلقيته بإبداء الاهتمام بالمشاركة. بعد ذلك، سأرسل إليك بريدًا إلكترونيًا آخر لجدولة اجتماع عند توفرك على رابط Doodle.

إذا كان لديك أي أسئلة، فأنت حر في طرحها الآن. إذا كانت لديك أسئلة لاحقًا، فيمكنك الاتصال عبر:

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إذا كانت لديك أسئلة حول حقوقك كمشارك في هذا البحث، يمكنك الاتصال بالمكتب التالي في الجامعة الأميركية في بيروت:

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