Journal of Contemporary Urban Affairs

2026, Volume 10, Number 1, pages 79–110

Original scientific paper

Developing a Success Index for Urban Agriculture Implementation to Strengthen Food Security in Egypt

*[1] **Menatalla Ashraf** , [2] **Hussam R. Hussain**

[1 & 2] Department of Architecture and urban design program, Faculty of Engineering and material science, German university of Cairo, Cairo, Egypt

[1] E-mail: Menatalla.othman@gmail.com, [2] E-mail: H.rhm@outlook.com

ARTICLE INFO:

Article History:
Received: 08 March 2026
Revised 1: 22 April 2026
Revised 2: 07 May 2026
Accepted: 16 June 2026
Available online: 25 June 2026

Keywords:
Urban Farming;
Food Security;
Success Index;
Urban Agriculture;
Egyptian Cities.

ABSTRACT

This study develops and validates a Success Index for urban farming implementation in the Egyptian context, addressing the limited integration of urban agriculture within national food-security strategies. Egypt faces severe structural pressures, including desert-dominated land availability, water scarcity, agricultural land fragmentation, food waste, and rising dependence on imports, with wheat imports reaching 58% and agricultural land losses of approximately 74,500 hectares between 1992 and 2015. Using a mixed-methods design, the research combines literature-based analysis of food-security resources and pillars, comparative assessment of local and international urban farming cases, and semi-structured interviews with Egyptian practitioners, including Tulima Farms, Shagarha, VertiCairo, GrowPro, and private urban gardeners. The findings identify differentiated success conditions for professional urban agriculture and private urban gardening. For commercial farms, decisive indicators include strategic location, crop-yield efficiency, capital availability, licensing, water and electricity access, and problem-solving capacity. For household gardens, convenience of location, knowledge access, community support, time commitment, and safe cultivation practices are central. The study concludes that urban farming cannot replace rural agriculture but can complement Egypt's food system by activating underused urban spaces, reducing food miles, creating micro-enterprise opportunities, and strengthening local urban economic resilience significantly.

JOURNAL OF CONTEMPORARY URBAN AFFAIRS (2026), ***10***(1), 79–110.
https://doi.org/10.25034/ijcua.2026.v10n1-4

www.ijcua.com

Highlights:

-Institutional support improves professional urban farming viability across Egyptian cities.
-Capital availability increases crop-yield efficiency and commercial farm sustainability locally.
-Knowledge access strengthens household urban gardening success and food self-sufficiency.
-Underused spaces enhance local production, micro-enterprises, and urban economic resilience.

Contribution to the field statement:

This study advances urban agriculture research by developing a context-specific Success Index for Egyptian cities, linking food security, spatial planning, and implementation feasibility. It contributes to the urban economy by showing how underused spaces, local production, micro-enterprises, reduced transport costs, and community-based farming can strengthen economic resilience and inclusive urban development.

*** Corresponding Author:** Menatalla Ashraf
Department of Architecture and urban design program, Faculty of Engineering and material science, German university of Cairo, Cairo, Egypt
Email address: Menatalla.othman@gmail.com

How to cite this article? (APA Style)
Ashraf, M., & Hussain, H. R. (2026). Developing a Success Index for Urban Agriculture Implementation to Strengthen Food Security in Egypt. *Journal of Contemporary Urban Affairs, 10*(1), 79–110. https://doi.org/10.25034/ijcua.2026.v10n1-4

1. Introduction

1.1 Significance of the Study and Research Gap

Food security has become one of the most pressing challenges for rapidly urbanizing countries, particularly where population growth, land scarcity, water stress, and fragile food-distribution systems intersect. In Egypt, the issue is especially critical, as 44.7% of the population suffers from inadequate access to food (UNICEF, 2018). This condition reflects not only a problem of agricultural production but also a broader urban, spatial, and economic challenge linked to land-use change, infrastructure limitations, food accessibility, and the growing dependency of cities on distant food systems.

Egypt's dominant national response to food insecurity has been the reclamation of desert land and its transformation into food-producing landscapes (Alary, 2017). Although such strategies have expanded the physical area available for cultivation, their contribution to local food access remains contested. Reclaimed agricultural fields are often acquired or managed by large investors and international companies, while the food produced in these areas does not necessarily return to nearby communities or directly support vulnerable urban populations (Thill, 2012). Consequently, food-security planning in Egypt continues to rely heavily on large-scale agricultural expansion, while smaller, community-based, and urban-integrated food-production strategies remain underdeveloped.

Within this context, urban farming offers an alternative and complementary approach to food security by bringing food production closer to urban consumers. Urban farming can support fresh produce cultivation within the city, reduce pressure on water resources through more efficient production systems, and improve local access to food (Tawfic, 2025). However, despite its potential, limited scholarly attention has been given to urban farming as a strategic component of Egypt's food-security framework. Existing studies tend to focus narrowly on rooftop farming, water-saving systems, or crop productivity per square meter, rather than examining the broader conditions required for long-term implementation, scalability, governance, and economic sustainability.

This study addresses this gap by developing a context-specific Success Index for urban farming implementation in Egypt. The proposed index aims to provide strategic guidance for policy makers, urban farm owners, private citizens, and local institutions by identifying the critical indicators that influence whether urban farming projects can survive, expand, and contribute meaningfully to food security. In addition, the study positions urban farming as an urban economic issue, since productive use of rooftops, vacant plots, public green areas, and privately owned spaces can create micro-enterprise opportunities, reduce food transportation costs, support local employment, and strengthen urban economic resilience.

To ensure practical relevance, the proposed success indicators were validated through follow-up interviews with local urban farm owners and practitioners. Participants, including representatives from Tulima Farms, Shagarha, and VertiCairo, reviewed the indicators and assessed their applicability to real Egyptian urban conditions. This validation process ensured that the Success Index was not limited to theoretical assumptions but reflected operational challenges, market realities, resource constraints, and institutional barriers experienced by urban farming initiatives in Cairo.

1.2 Background and Context

Egypt faces severe food-security challenges shaped by water scarcity, limited arable land, agricultural fragmentation, population pressure, and inadequate food-system infrastructure. The country has an estimated population of approximately 119 million (World meter, 2026), while nearly 96% of its land is classified as desert (Radwan, 2019). This spatial imbalance places intense pressure on the narrow agricultural zones of the Nile Valley and Nile Delta, where fertile land is increasingly threatened by urban expansion, inheritance-based land fragmentation, and inefficient land-use practices.

The reduction and fragmentation of agricultural land have weakened productivity and limited the capacity of traditional agriculture to meet national food demand. At the same time, food availability is affected by deficiencies in harvesting, storage, cooling, and transportation systems, which contribute to food loss before products reach consumers (Verhoeven, 2018). These structural weaknesses reveal that Egypt's food-security crisis cannot be understood only as a rural production issue; rather, it is

closely linked to urbanization, infrastructure, governance, land economics, and the spatial organization of food systems.

The urgency of this challenge is reflected in national food-security indicators. Egypt ranks 63rd out of 127 countries in the Global Hunger Index, with 8.5% of the general population suffering from undernourishment (Global hunger index, 2025). In addition, 4.8 million children suffer from anemia, indicating persistent nutritional vulnerability among younger populations (UNICEF, 2021). These conditions show that improving food security requires not only increasing total production but also improving access, affordability, nutritional quality, and stability within urban food systems.

Urban farming can contribute to this agenda by integrating food production into the urban fabric. It has the potential to transform underused urban spaces into productive landscapes, shorten food-supply chains, reduce food miles, recycle organic waste, and improve access to fresh produce. From the perspective of ecological urbanism, urban farms are valuable green infrastructures because they can support organic waste recycling, reduce energy consumption associated with long-distance transportation, and reconnect urban residents with local food production (Zeeuw, 2000). Furthermore, urban farming can support low-income communities by improving access to food and creating opportunities for local participation, employment, and small-scale entrepreneurship (Zeeuw, 2000).

Despite these advantages, urban farming remains weakly integrated into Egypt's formal food-security policies and urban planning frameworks. Current strategies continue to prioritize rural agricultural improvement and desert reclamation, while the potential of urban rooftops, vacant land, institutional spaces, schools, compounds, and community gardens remains insufficiently explored. This study therefore investigates how urban farming can contribute to Egypt's food-security strategy by addressing the interrelated challenges of water scarcity, land-use inefficiency, food access, and urban economic resilience.

1.3 Problem Statement

This research examines the structural gaps that limit food security in Egypt and explores why urban farming has not yet become a recognized strategy within national or local planning frameworks. Although urban farming has been applied in several local initiatives, many projects remain isolated, short-lived, or unsupported by clear policy, financial, and technical systems. The absence of a formal implementation guide makes it difficult for policy makers, private investors, communities, and households to establish urban farms that are both productive and sustainable.

The study is guided by the following research questions:

1. What are the main gaps in Egypt's food-security system?
2. Why are urban farms not widely used as a food-security strategy in Egypt?
3. What implementation guide can support the creation of successful urban farms in the Egyptian context?

Since no pre-existing guide currently exists for establishing successful urban farms in Egypt, this research develops a Success Index that identifies the main factors affecting urban farming performance. The study focuses on the relationship between food security, urban farming, spatial planning, and urban economic development, with particular attention to how urban farms can activate underused spaces, reduce food-system costs, and support local economic opportunities.

1.4 Objectives and Hypotheses

The main objective of this study is to investigate the causes of Egypt's food-security challenges by examining the condition of agricultural land, food-system resources, and the potential role of urban farming as an experimental and complementary solution. The study evaluates Egypt's food-security gaps through the three main food-security resources and the four pillars of food security. Since urban farming has not been fully adopted by national policy as a food-security solution, this research considers food production within cities as a strategic intervention that may help address selected resource gaps.

The specific objectives are:

1. To investigate why current agricultural lands are insufficient to meet the food needs of Egypt's population.
2. To examine urban farming as an alternative and complementary solution for improving food security.
3. To identify the main challenges, setbacks, and success conditions affecting urban farming in Cairo.
4. To develop a Success Index for guiding future urban farming implementation in the Egyptian context.
5. To validate the proposed Success Index through interviews with local urban farming practitioners and experts.

The study is based on the analytical proposition that urban farming can contribute to food security when it is supported by suitable location selection, efficient resource management, sufficient capital, technical knowledge, community participation, and institutional support. It further argues that successful urban farming can contribute to the urban economy by generating small-scale employment, supporting local food markets, reducing dependency on long-distance supply chains, and improving the productive value of underused urban spaces.

To achieve these objectives, the article first reviews Egypt's food-security challenges in relation to land, water, infrastructure, and food-system management. It then analyses selected local and international urban farming case studies using indicators extracted from the literature. Finally, the findings are validated through interviews with local urban farm owners and experts. The main outcome of the study is a Success Index that can support urban farm owners, citizens, policy makers, and planning institutions in establishing and maintaining sustainable urban farms. This is particularly important because urban farms are flexible enough to operate at community, household, and individual levels, making them suitable as permanent productive green elements within the city (Zeeuw, 2000).

In order to fulfil the study objectives, this article follows the research structure illustrated in Figure 1.

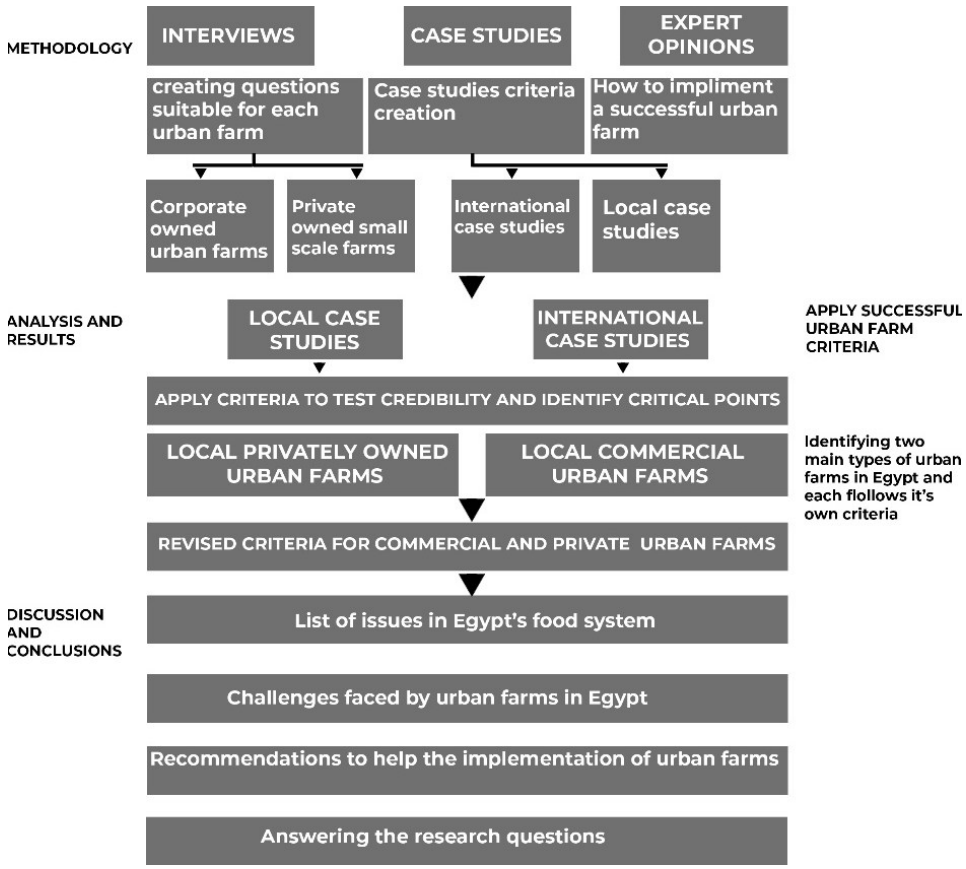

Figure 1. Structure of the Study (Developed by the Authors).

2. Materials and Methods

2.1 Study Design and Setting

The research methodology of this study combines both quantitative and qualitative approaches. The quantitative content derived from existing studies was synthesized from the literature review, rather than collected through primary measurement, to provide comparative context for the qualitative insights, while qualitative data were gathered through interviews conducted with urban farm owners in Cairo, complemented by the analysis of case studies from within and outside Egypt.

At the start of the study 6 local urban farm case studies were found, then an additional 6 international case studies were added for comparison, however by the next stage of the study during the interview phase an additional 3 local case studies were found and were then included in the interview phase, (which helped validate the data concluded form this study). The 15 local and international case studies were selected to help analyze the potentials and challenges of urban farms in assisting food security, and to understand the historical importance of urban farming. Therefore, the selection includes historically significant case studies and several contemporary examples.

The research design is structured around three main stages:

(1) identifying the key elements and challenges of food scarcity in Egypt.

(2) analyzing both international and local urban farming case studies to derive and apply a Success Index framework, and

(3) validating the findings through interviews with local urban farm owners. This methodological structure ensures a balance between theoretical understanding and practical applicability, enabling the research to produce context-specific insights and evidence-based recommendations for urban agriculture development in Egypt.

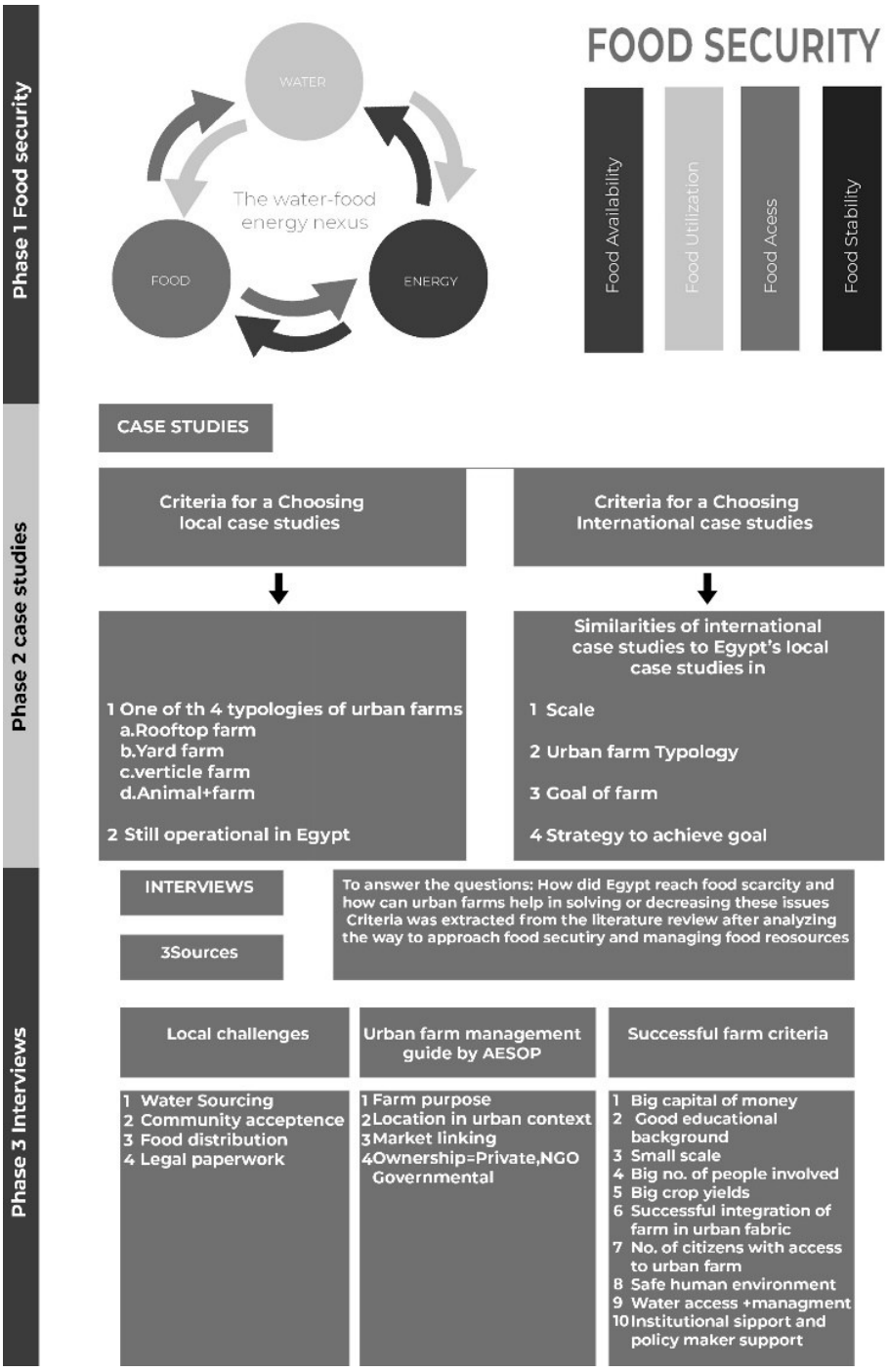

Figure 2. Structure of the material and methods chapter (Developed by the Authors).

2.2 Identifying the food scarcity elements in Egypt

To identify the food scarcity elements in Egypt, the following method was applied:
Identifying the gaps in the three food security resources, followed by identifying the gaps in the food management resources by looking at the four pillars of food security.
This was done through applying the three core resources of food security together with the four pillars of food security resource management and analyzing each resource and its corresponding management aspect was separately. Data extracted from the literature review were used to identify the main issues influencing the Egyptian food system.
The next step would be analyzing if urban farming can help ibn filling the gaps in Egypt's food security resources.

Urban farming is closely linked to food security, as it directly influences the three critical resources: water, energy, and food. The food-energy-water nexus defines the interdependence of these resources. When water resources are managed efficiently, both food and energy resources are also secured. Therefore, addressing the challenges in one resource can help resolve issues with the other two (Verhoeven S. , 2018).

Food, water, and energy resources are integral to the success of urban farming, with each resource having specific elements that influence its availability and sustainability. Food resources include land space available for cultivation and the policies that govern its use, such as land zoning codes, which determine where urban farming can take place. Water resources are defined by both water quality, which ensures it is suitable for irrigation, and water quantity, which impacts the ability to maintain consistent production. Energy resources encompass manpower, the labor force required to operate and maintain urban farms, as well as infrastructure, such as roads and pipes, that support the transportation of materials and water. Each of these resources plays a crucial role in determining the efficiency and sustainability of urban farming systems.

The diagram below shows how the three resources are interdependent (Verhoeven S. , 2018).

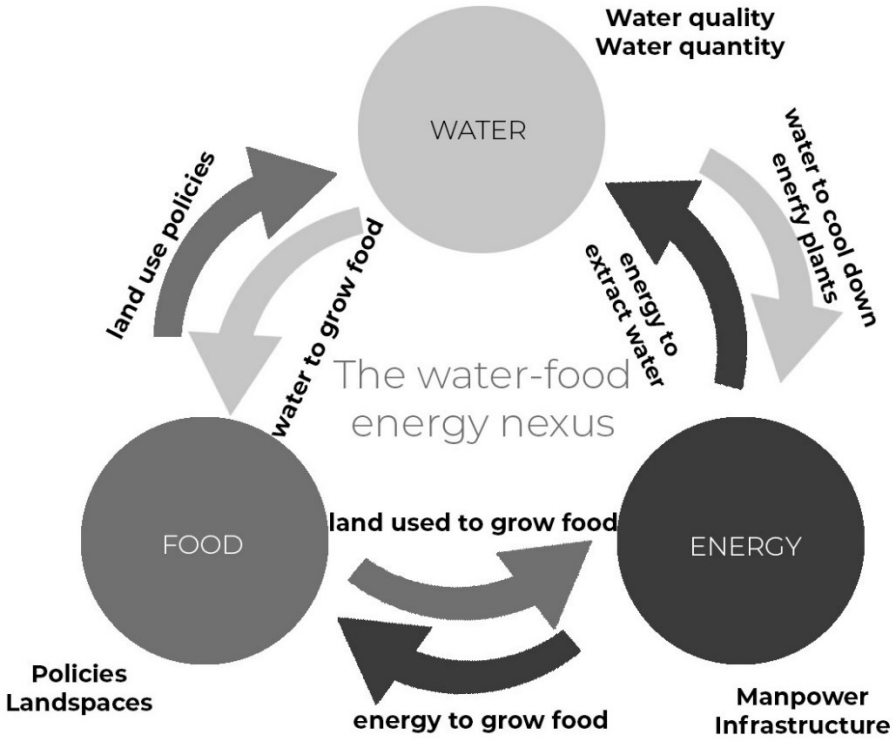

Figure 3 The Food–Energy–Water Nexus.
Note. Adapted from Verhoeven (2018) and further developed by the author.

Below is a diagram showing the four pillars of food security resource management. For each of the food security pillars, there are a number of steps or measures or activities accomplished by the citizens or the government to maintain that pillar (Food Security Cluster Handbook, 2023).

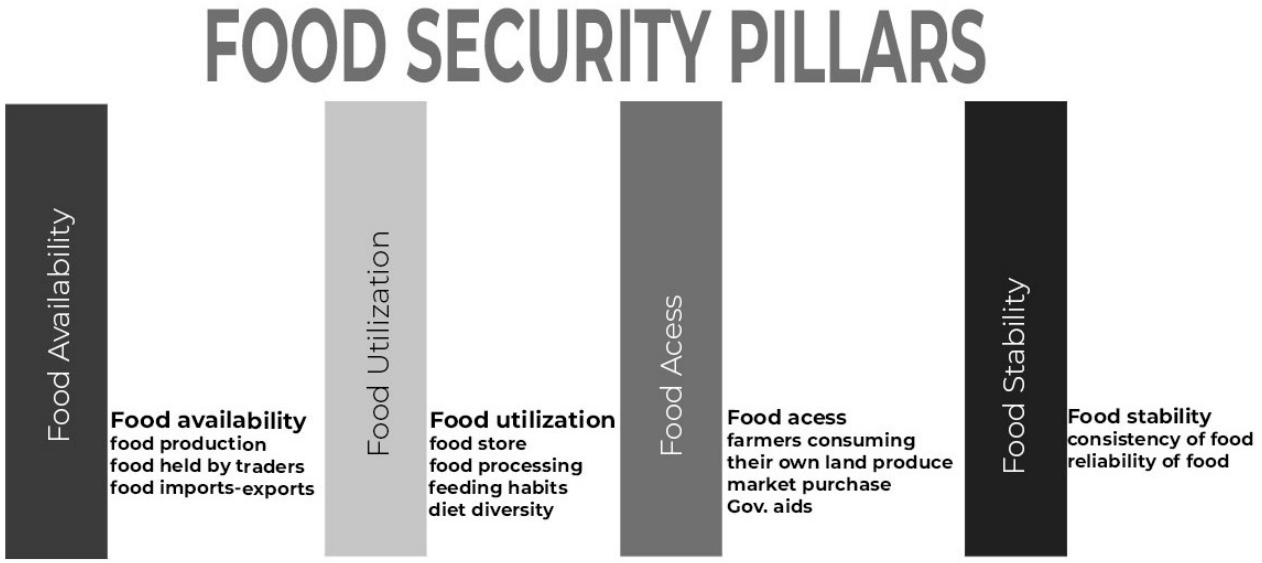

Figure 4. The Four Pillars of Food Security.
Note. Adapted from FSCH (2013) and further developed by the author.

2.2.1 Water resources in Egypt:

Egypt suffers from physical, economic and institutional problems that cause water scarcity. Egypt's location in a semi-arid region of the globe with little to no rainfall, add to that Egypt's inadequate infrastructure to deliver and filter water (Ding, 2017); (Tamburelli, 2013).

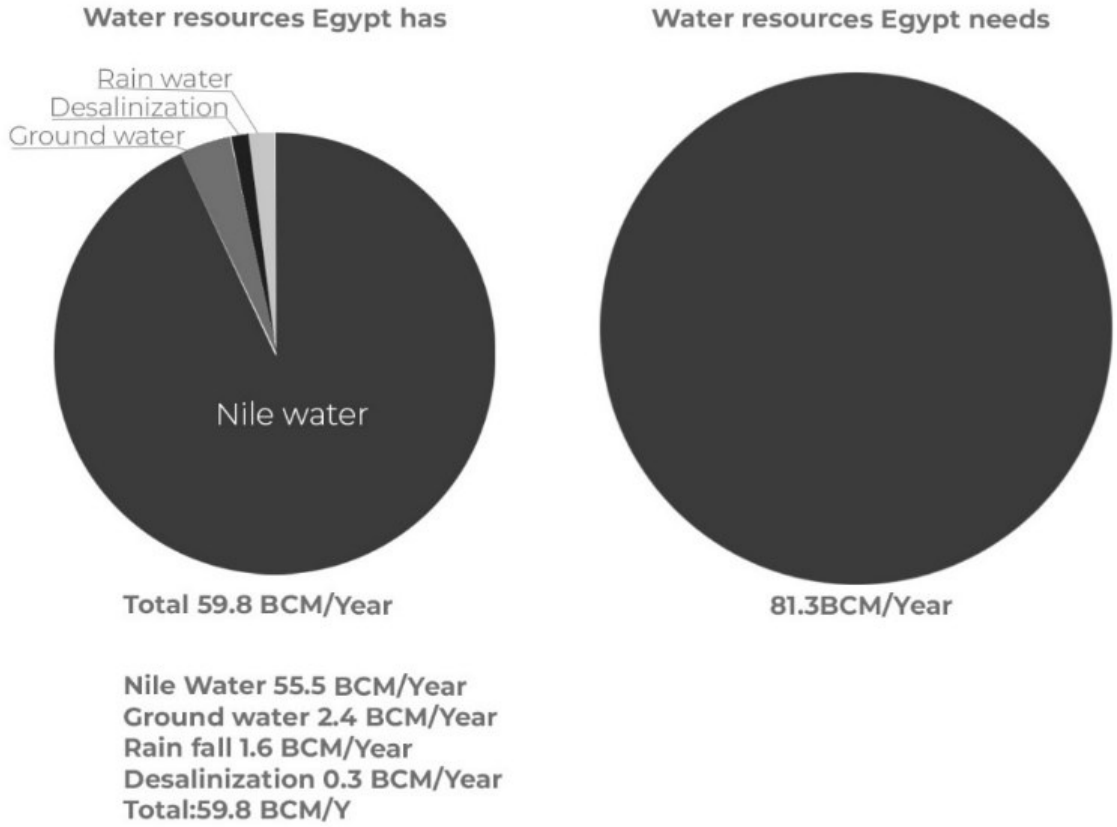

Figure 5. Water Sources Distribution.
Note. Numerical data extracted from Juttner (2020) and visualized by the author.

The figure above shows that with all of Egypt's water resources combined, it would add up to 59.8 BCM/Y (Juttner, 2020). However, with today's water demands for the current population Egypt is

actually using 81.3 BCM/Y and imports 61.5 BCM/Y of virtual water products (virtual water is buying food and commodities that use water instead of using our own water resources) (Nikiel, 2021).

2.2.2 Energy Resources in Egypt:

Looking at manpower and infrastructure in Egypt we will find that the country lacks green workers, in addition to, low quality of infrastructure and cooling transportation in rural area, which is a main reason for food waste (Abu-hashim, 2019); (Alary, 2017); (Diniz, 2013); (Ding, 2017); (Tamburelli, 2013); (Verhoeven S. , 2018).

2.2.3 Food resources in Egypt:

Looking at Egypt's agricultural land we will find that between the years 1992 to 2015 74,500 hectares of agricultural land was lost to urbanization where 3,108 hectares were lost per year (Radwan, 2019). Egypt's fertile agricultural land is fragmented and because of its fragmented state both agricultural productivity and economy has been negatively affected (Basel, 2015); (Thill, 2012).

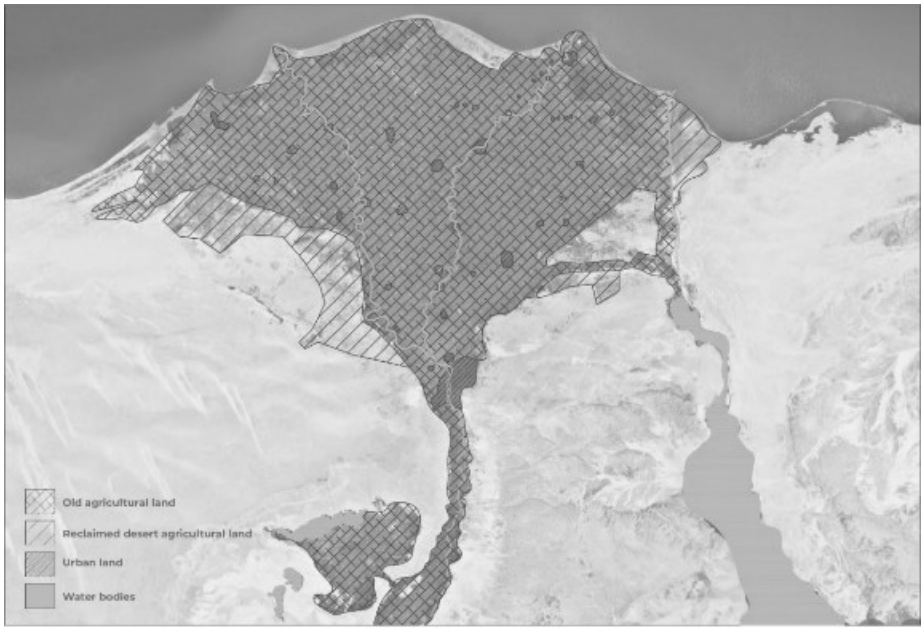

Figure 6. Reclaimed Land, Old Agricultural Land, and Urban Land in 1992.
Note. Developed by the author.

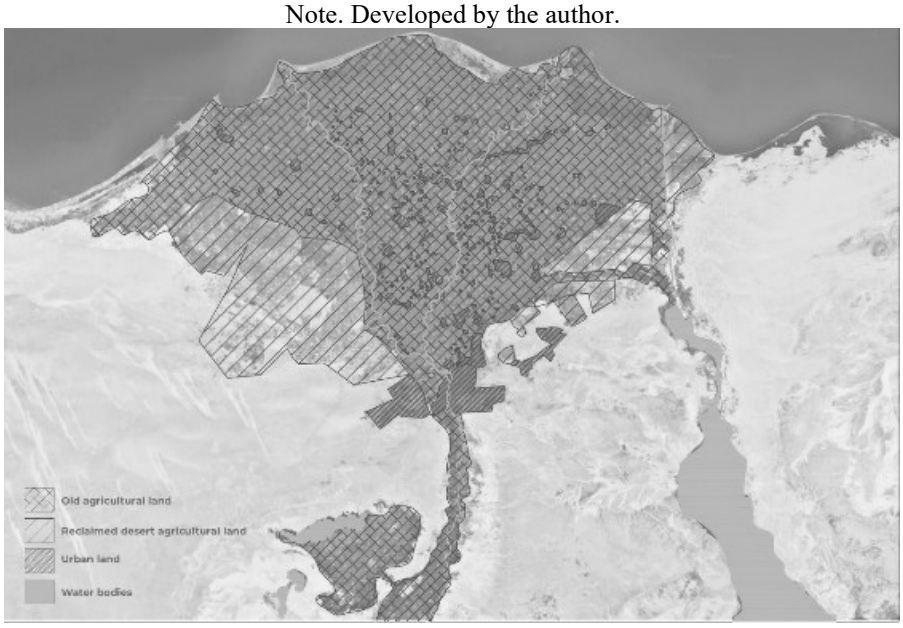

Figure 7. Reclaimed Land, Old Agricultural Land, and Urban Land in 2015.
Note. Developed by the author.

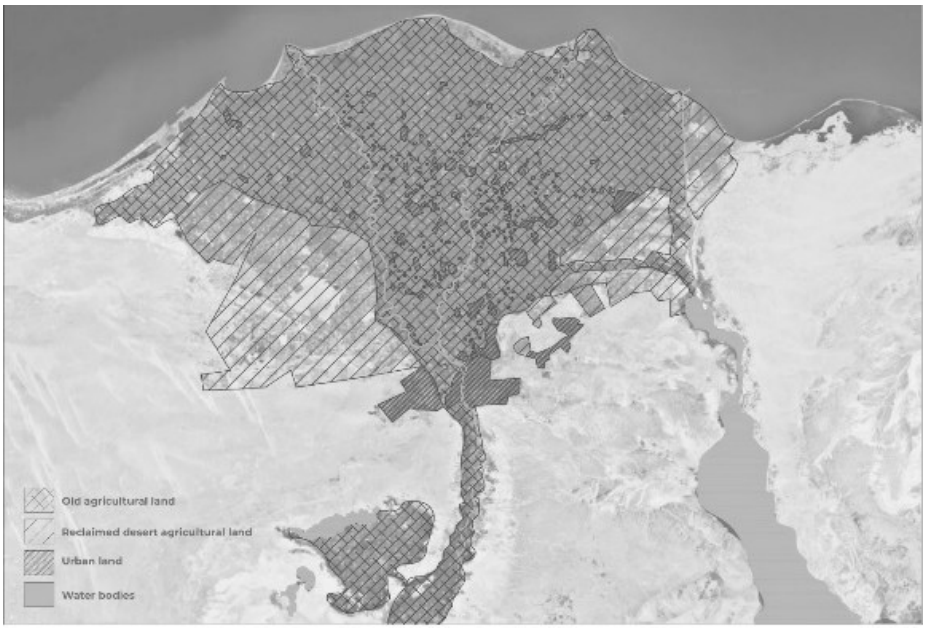

Figure 8. Reclaimed Land, Old Agricultural Land, and Urban Land in 2025.
Note. Developed by the author.

The three google images above are a comparative analysis between the old agricultural land, reclaimed desert land and urban areas between the years 1992, 2015 and 2025 (current state). The focus of this analysis was the Nile valley, since it had the most dramatic change observed in the urban vs agricultural land changes. Between the years 1992 and 2015 it is noticed that there was a boom of urban expansion, and it is also noticed the governments took quick steps to reclaim desert land to combat that agricultural land lost to urban expansion. Urban expansion slows down after 2015, and more desert land is reclaimed to produce food. The food produced in these reclaimed lands at the outskirts of the Nile valley is that it caters to export worthy crops. Crops there are chosen, grow and prepared to be sold out of Egypt. (Radwan, 2019).

This is the government's strategy implemented since 1982 to grow export worthy expensive fruits and vegetables, sell it out of Egypt and with the gained money buy cheaper products such as wheat (Singerman, 2009).

The issue with this strategy is that the reclaimed desert land usually requires a lot of irrigation and takes up to 10 years to produce a worthy crop (Basel, 2015). As for issues in policies implemented by the government, there were a few policies that were intended to improve the Egyptian citizen's life however, these rules caused problems in wheat production and wheat is the main item in the Egyptian's diet therefore very important for food security (Thill, 2012). There was the 1952 reformation law that caused agricultural land fragmentation (Margold, 1957). Then the 1954 law that relocated green workers from rural Cairo to be employed in construction projects. Which caused loss of green workers and in return a decrease in food production (Nicholas S. Hopkins, 1998).

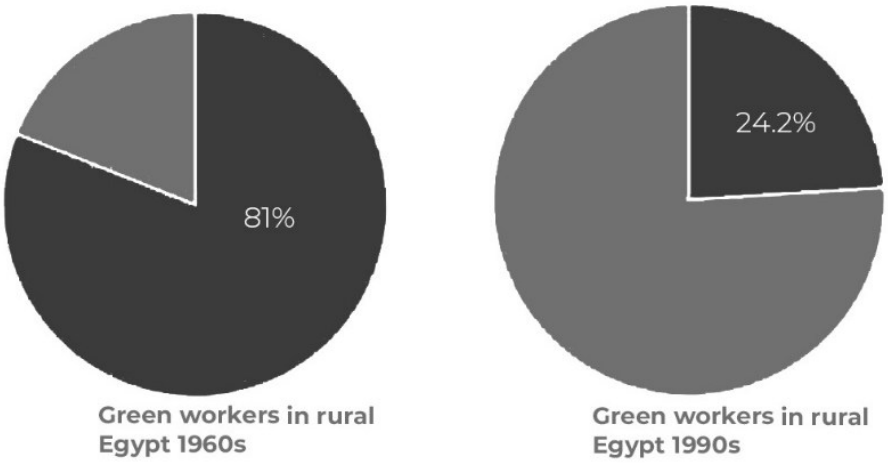

Figure 9. Green worker's percentage 1960s vs 1990s (Developed by the authors).

In 1982 agricultural model suggested by minister of agriculture Yusuf Wali to use local agricultural land to grow export worthy crops such instead of staple food. In 2023 more laws were introduced so that private mills can only use imported wheat. (Alarabiya, 2023).
The following section will analyze the gaps within the four pillars of food security in Egypt:

2.2.4 Food availability:
When it comes to food production, Egypt imports 58 % of its wheat (AMIS, 2025). Outdated irrigation techniques in the rural agricultural land leads to low crop yield, of that low crop yield, 60% of the production goes to European countries (Basel, 2015). As for training of farmers, there is a lack of regular training (Abu-hashim, 2019).

2.2.5 Food access:
Small harvest by small farms are usually sold overseas while these local farmers go buy their nutritional needs from corner stores that usually sell processed, low nutrition foods (Rouchdy, 2017).

2.2.6 Food utilization:
A general lack of proper cooling storage utilities, improper infrastructure for transport which created a food waste issue (Tamburelli, 2013; Verhoeven, S., 2018).

2.2.7 Food stability:
In 1991 Egypt's cereal imports were 34% which later in 2013 increased to 42% (Nikiel, 2021). In 2017 Egypt was importing 60% of its grains (Rouchdy, 2017). In 2019 imports 98% of its vegetables and 97% of its oil (ELwatanNews, 2019). Dependency on imports makes Egypt to any instabilities such as price changes (Sarant, 2017). Since wheat is an important part of Egypt's diet, fluctuations in its production and imports would directly affect Egypt's food stability.

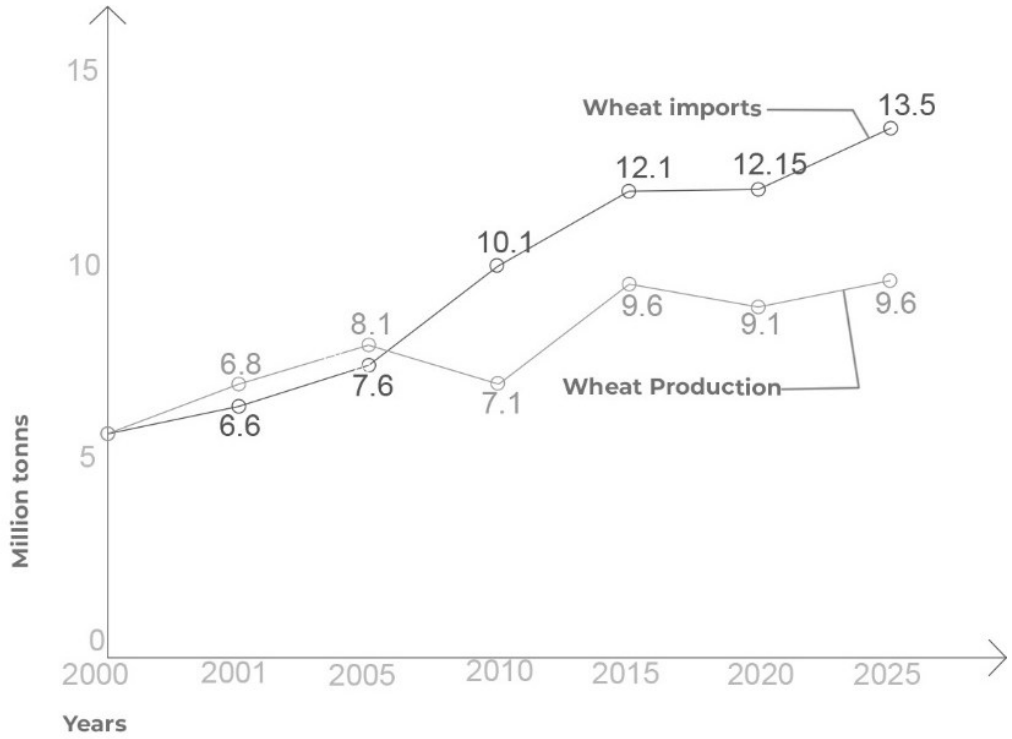

Figure 10. Wheat production vs wheat imports in the last 25 years (developed by Author)

The data presented in the graph above were extracted from the Agricultural Market Information System, which is partnered with the Food and Agriculture Organization of the United Nations and the World Trade Organization (AMIS, 2025). Although Egypt has successfully stabilized its wheat production over the last ten years, wheat imports are still increasing. If Egypt continues to depend on importing its food products, the country will remain at risk of food instability.

The previous section of this study analyzed food security resources and their management through the main pillars of food security. Food security resources, together with the food security pillars, are translated into foodscapes, which are land areas used for growing food. Foodscapes manifest at different scales and are usually classified into two main categories: rural and urban foodscapes (Verhoeven, 2018).

Rural farms refer to land used for farming activities, such as growing food crops or raising cattle, in rural or semi-rural areas (Law Insider, 2025). In the case of Egypt, rural farms are mainly located in the Nile Valley and the Nile Delta (Abu-Hashim, 2019; Hopkins, 1998; Thill, 2012).

Peri-urban farming refers to the production, processing, distribution, and marketing of food on plots of land surrounding cities (FAO, 2025). Urban farming, on the other hand, refers to the use of any plot or space for growing food within a city or urbanized area (Unity Environmental University, 2023).

Urban farming can help shorten supply chains and make use of empty or underutilized spaces. When managed properly, urban farms have the potential to produce more food per unit area than traditional farms (Unity Environmental University, 2023). Other benefits include expanding the workforce (Singerman, 2009), as their locations allow a diversity of activities that respond to society's needs (Roggema, 2017). Water management in urban farms can also contribute to the use of rainwater (Stringer, 2010).

From the perspective of food security potential, urban farming contributes to the management of three main resources: water resources, energy and manpower resources, and land resources. Regarding the four pillars of food security, urban farms support food availability by promoting local food production. They also enhance food access by revitalizing small land plots, improve food utilization by providing fresh and nutritious food to urban dwellers, and strengthen food stability by enabling cities to develop their own sources of food production instead of depending entirely on imported products.

2.3 Selection of Urban Farming Case Studies

A total of twelve case studies, consisting of six local and six international examples, were selected to provide a balanced comparative sample representing both the Egyptian urban farming context and relevant international parallels. This number ensured diversity in farm typologies and ownership models while remaining manageable for in-depth qualitative analysis.

However, during the course of the research, three additional local cases emerged: VertiCairo, GrowPro, and an individual citizen-led urban farming initiative. Although it was challenging to identify directly comparable international cases for these three examples, they offered valuable contextual insights. Consequently, these cases were incorporated into the interview phase but were not included in the final analytical and results chapters.

Urban agriculture and rooftop gardens create work opportunities for local citizens and provide them with direct access to markets and street food stalls (Tawfic, 2025). Although the concept of urban farming is not new in Egypt, urban farms are not yet widespread. In more than one case, an urban farm opened but closed within a few years.

Therefore, the main challenge in the selection process of local examples was the limited number of active urban farms in Egypt. Although many NGOs and private owners have initiated such projects, most urban farms have eventually shut down due to persistent challenges. The list of urban farms below includes those that are still operating in Cairo.

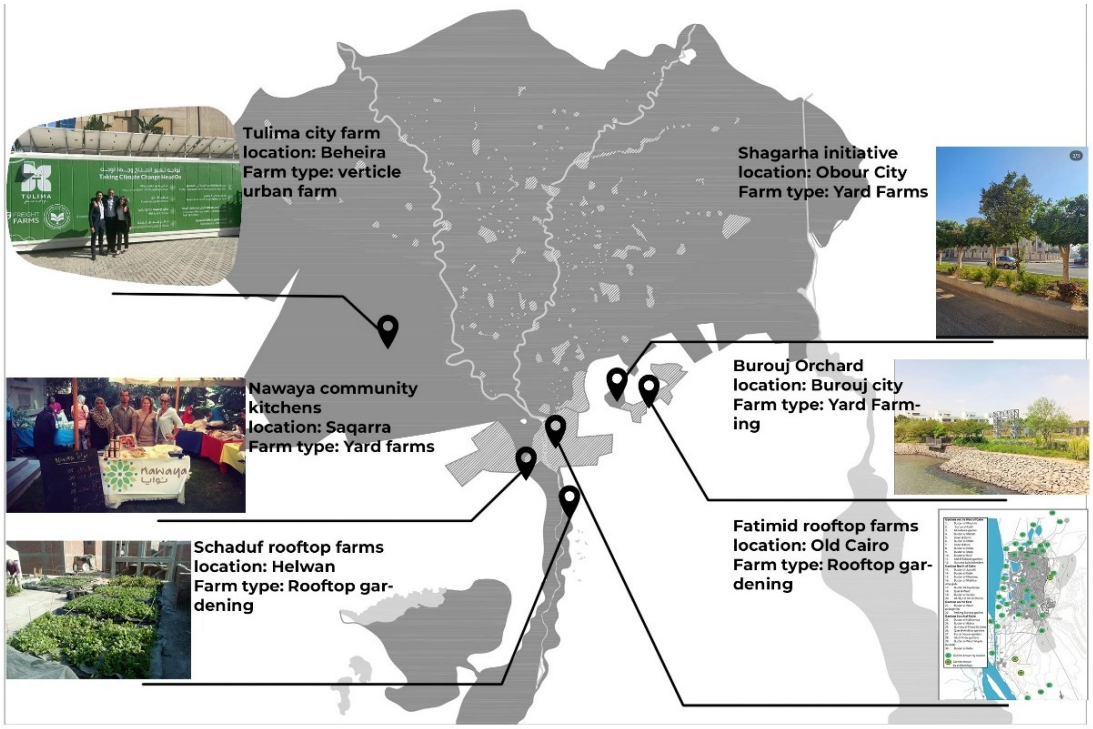

Figure 11. Local urban farms in Egypt (Developed by the Authors).

The figures above present detailed diagrams illustrating the selection process of the urban farms included in this study. The general selection criteria required that all farms be located within urban areas, remain operational at the time of study, and collectively represent the main typologies of urban farming examined in this research. With the exception of Tulima City Farm, all selected cases are located within the Greater Cairo region, encompassing El Obour, Helwan, Old Cairo, and other major districts. Tulima City Farm currently operates from a rural, soil-based site in Beheira Governorate, serving as an extension of its urban farming model. Although Tulima City Farm is currently based in Beheira Governorate, its model remains inherently urban and portable, with plans to establish similar

container-based farms within major Egyptian cities in the near future. Likewise, the Nawaya civic initiative, while presently collaborating with rural farms, embodies principles that could be adapted to urban contexts. Observations from comparable international initiatives revealed that civic organizations play a crucial role in aligning the goals and strategies of urban farms, fostering collaboration, and in some cases, influencing government policies to support urban agriculture development.

The four main types of urban farming are illustrated in the below diagram:

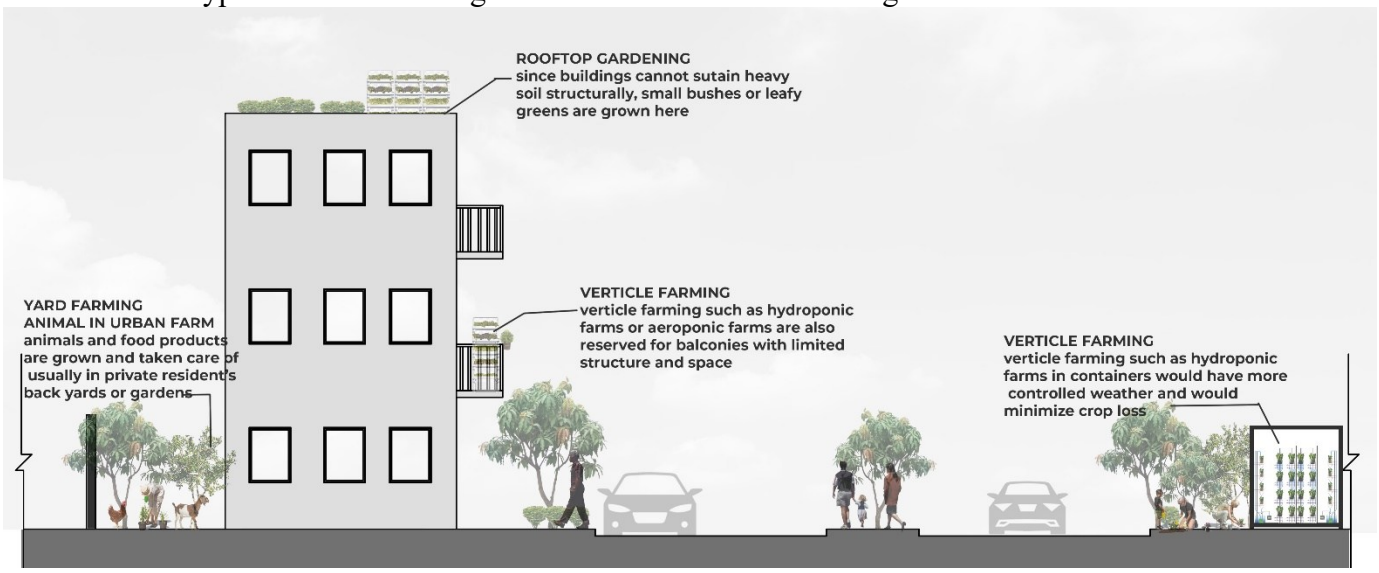

Figure 12. The four main urban farm types (Developed by the Authors).

On the other hand, the six international case studies were selected based on their similarity to the Egyptian context in terms of urban density, economic conditions, social dynamics, and climate. The selection criteria illustrated in the figure below outline the method used for selecting the international case studies.

	Fatimid rooftop garden VS Paris's kitchen garden	Shagarha initiative VS One million NY trees	Burouj orchard VS Eden fruit colony
Scale	City wide small area	City wide Public spaces	Over 10acres
Typology	Roof top-Yard farming	Yard farming	Yard farming
Goal	Leisure	Community gardens	Leisure+Profit
Strategy	Citizens used their private land for their self sufficiency and social fulfilment	City geverments assited initiative to provide greenery for citizens	Citizens used their land for making profit and for social fulfilment plus self sufficiency

	Tulima vs Aerofarms	Nawaya civic intiative VS Bristol civic intitative	Schadul rooftop VS Waraqet Rayhan
Scale	Flexible in size and can fit in any space	City wide initiatives	one square meter
Typology	Verticle farming	Yard farming	Rooftop farming
Goal	Creating profit by professional urban farm-	Feeding their cities	Creating farms to feed low income families
Strategy	Using aquqponics farming with controlled weather to have several harvests per year	Creating rules to unite different urban farms together to create enough momentom	Using very small spaces to produce food with limited technology to create food

Figure 13. Selection criteria applied on international case studies selection (Developed by the authors).

The location of the international urban farming case studies is illustrated in the below diagram:

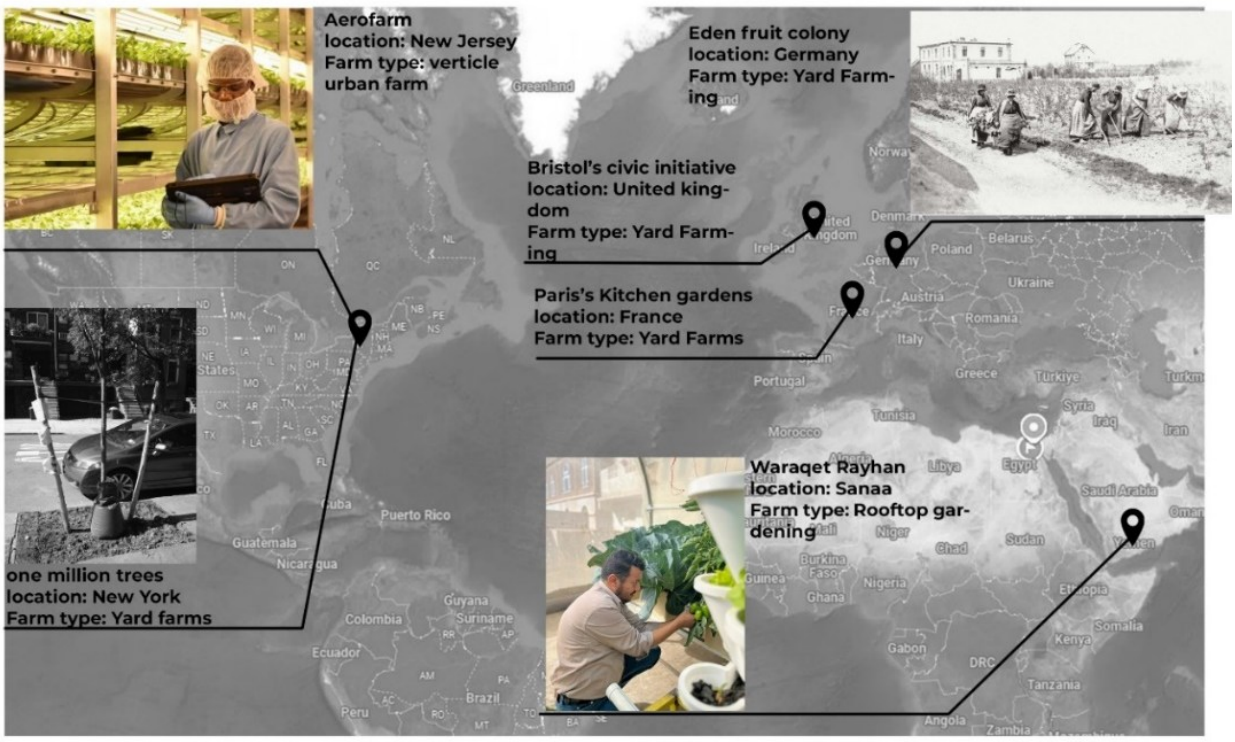

Figure 14. Location for international urban farm case studies (Developed by the authors).

Starting with the historical case studies, the Fatimid Gardens and the Parisian Kitchen Gardens demonstrate how, in both contexts, citizens sought to emulate the royal gardens by cultivating exotic fruits and vegetables similar to those grown by the elite. In both countries, it is evident that promoting the benefits of locally grown produce can effectively encourage people to cultivate their own food. However, in the Parisian case, the government actively supported this movement by implementing rules and regulations and encouraging dietary changes that incorporated the produce of these gardens. This international case study demonstrates the significant impact that government support can have on the success and expansion of urban agriculture.

Shagarha and the MillionTreesNYC initiative are both examples of yard-based urban farming, where food-producing trees were planted in public green spaces. The primary difference is that Shagarha is a volunteer-based civic initiative, whereas the MillionTreesNYC initiative was established through a collaboration between NGOs and the government. Another notable aspect of the MillionTreesNYC initiative is that citizens were actively engaged by being given the opportunity to sponsor or adopt trees, thereby strengthening public participation.

The Burouj Orchard and the Eden Fruit Colony are both gated residential communities established to provide middle- and upper-income residents with access to their own food production. The main difference is that the green spaces in Burouj Orchard were maintained by employed landscape workers, whereas residents of the Eden Fruit Colony remained actively involved in the farming process with the support of professional workers.

Tulima and AeroFarms both employ vertical farming techniques and cultivate leafy greens in controlled environments for commercial purposes. Both initiatives have established partnerships with hotels and cafés to market their produce, and only minor differences were identified between the two case studies.

Both the Nawaya and Bristol initiatives are civic efforts aimed at supporting agricultural production; however, their scopes differ. Nawaya focuses primarily on supporting rural farms and promoting food sovereignty, defined as "the right to define their own food and agricultural systems" (Rosset, 2003, p. 1), whereas the Bristol initiative focuses on strengthening urban farming as a means of improving food security. This international case study was selected because the Bristol model successfully influenced legislation and regulations that promoted and protected urban agriculture. Adopting a similar approach for initiatives such as Nawaya could contribute to the development of a unified framework for urban farming in Egypt. In this comparison, the international case study provides valuable lessons that can inform the local context.

Finally, the Schaduf Rooftop Gardens and Waraqet Raihan projects share similar objectives and scales, as both utilize small rooftop spaces for food production. Each initiative was designed to support household food needs. However, Schaduf was established by an NGO to empower low-income households, whereas Waraqet Raihan was independently initiated by a low-income family to meet its own food requirements.

One notable aspect of Waraqet Raihan is that it was implemented in Yemen, a country that shares many similarities with Egypt, including water scarcity and economic challenges. The project's owners demonstrated strong critical thinking and entrepreneurial skills, supported by their educational background in business, which enabled them to overcome many of the challenges they encountered and produce sufficient food for their family while generating surplus production. In contrast, many of the low-income families participating in the Schaduf project had limited educational backgrounds and faced numerous challenges that eventually became difficult to overcome. These two case studies begin to highlight the indicators that may be critical to the long-term success and sustainability of urban farming initiatives.

2.4 Success Index of an Urban Farm Strategy

What determines a successful urban farm? How can successful urban farms be implemented? This section discusses how experts and policymakers have developed strategies and guidelines for establishing sustainable food-producing landscapes within urban environments.

In New York City, urban farming initiatives were developed following a comprehensive design strategy. This strategy was proposed by the Manhattan Borough President, Scott M. Stringer, in 2010 as a blueprint for sustainable urban food production.

When addressing food production systems through urban agriculture at the city scale, the strategy should include:

1. Assessing land availability for food production.
2. Ensuring the long-term sustainability of available land.
3. Implementing educational urban agriculture programs.
4. Ensuring that urban farms remain permanent components of the local community.
5. Facilitating access for city residents to establish rooftop gardens and urban greenhouses for food production (Stringer, 2010).

When addressing urban agriculture at the regional scale, the strategy should include:

1. Assessing the potential and capacity for urban food production throughout the region, including land-use suitability, soil quality, transportation systems, and available infrastructure.
2. Developing a sustainable food production strategy by identifying farmland resources and matching them with urban food demand.
3. Protecting existing and future agricultural land within the region (Stringer, 2010).

Moreover, any urban farming strategy should consider the strategic location of urban farms within the city, together with appropriate water sourcing and water management practices. Resource management through the cultivation of diverse crop types is another essential consideration. Flexible and innovative solutions, together with strong problem-solving skills, are critical attributes of successful urban farmers. This also requires personnel with marketing and business management expertise. Furthermore, successful strategies should actively engage surrounding communities through educational workshops, guided tours, and training programs (BPlan, 2025).

Urban farms enable citizens to reconnect with food production, fostering self-sufficiency while empowering residents to grow food in public spaces, balconies, and rooftops. However, beyond the challenge of successfully integrating urban farms into the urban environment, additional considerations must be incorporated into urban farming strategies. These include resource accessibility and management, such as soil quality, appropriate soil selection for different crops, and efficient water management to minimize water waste, particularly in urban areas where water resources are limited.

Urban farming also faces significant economic challenges. In addition to the initial cost of acquiring land (when the site is not already privately owned), considerable investment is required for irrigation systems, tools, agricultural equipment, and other farming infrastructure. Another major challenge is generating sufficient income from crop production to ensure long-term financial sustainability. Since vacant land within dense urban areas is both scarce and expensive, innovative approaches are required to maximize productivity in limited spaces. Consequently, most urban farms are relatively small in scale. Furthermore, many urban residents lack practical knowledge of food cultivation, making community education and engagement essential components of successful urban farming initiatives. Finally, because urban land is governed by planning regulations and land-use policies, urban farming strategies must comply with all applicable laws and regulations (Seedy.Farm, 2025).

According to Gulyas (2021), the resilience of an urban farm depends on five principal factors: farm scale, crop production efficiency, integration within the urban fabric, community participation, and a safe environment for human activities. Urban farming can therefore be viewed as an alternative to conventional large-scale rural agriculture. Rather than maximizing production on extensive agricultural land with limited emphasis on quality, urban farming prioritizes smaller-scale production with greater attention to food quality and sustainability (Imbert, 2015).

In summary, the success of an urban farm can be evaluated using the following success index:

1. Appropriate farm scale, particularly small-scale farms (Gulyas, 2021; Imbert, 2015; Seedy.Farm, 2025).
2. Strategic location within the urban environment (BPlan, 2025; Seedy.Farm, 2025).
3. Production efficiency and crop yields (BPlan, 2025; Gulyas, 2021; Seedy.Farm, 2025).
4. Accessibility for citizens (BPlan, 2025; Gulyas, 2021; Seedy.Farm, 2025).
5. Environmental sustainability and resource safety (Gulyas, 2021).
6. Number of people employed by the farm (BPlan, 2025).
7. Policies and institutional support (Seedy.Farm, 2025).
8. Water availability and management (BPlan, 2025; Seedy.Farm, 2025).
9. Availability of sufficient financial capital (Seedy.Farm, 2025).
10. Critical thinking and problem-solving skills (BPlan, 2025).

2.5 Analyzing the case studies

The selected case studies were analyzed using the urban farm success index proposed by experts and practitioners in the field. The analytical framework consists of the following criteria:

1. Appropriate farm scale, particularly small-scale farms (Gulyas, 2021; Imbert, 2015; Seedy.Farm, 2025).
2. Strategic location within the urban environment (BPlan, 2025; Seedy.Farm, 2025).
3. Production efficiency and crop yields (BPlan, 2025; Gulyas, 2021; Seedy.Farm, 2025).
4. Accessibility for citizens (BPlan, 2025; Gulyas, 2021; Seedy.Farm, 2025).
5. Environmental sustainability and resource safety (Gulyas, 2021).
6. Number of people employed by the farm (BPlan, 2025).
7. Policies and institutional support (Seedy.Farm, 2025).
8. Water availability and management (BPlan, 2025; Seedy.Farm, 2025).
9. Availability of sufficient financial capital (Seedy.Farm, 2025).
10. Critical thinking and problem-solving skills (BPlan, 2025).

Figure 15. Ten success indicators of an urban farm—framework used to evaluate each case study (Developed by the authors).

The purpose of the success indicators is to provide strategic guidance and reference points for establishing urban farms in Egypt, where no formal framework currently exists. These indicators aim

to support the development and sustainability of successful urban farms. Urban farms can generally be classified into two main categories. The first category, Professional Urban Agriculture, focuses primarily on the economic profitability of food production and operates as a commercial enterprise aimed at generating income. The second category, Urban Gardening, refers to small-scale cultivation undertaken by citizens on their private property, emphasizing social fulfilment, self-sufficiency, and the personal satisfaction associated with food production (Roggema, 2017).

A successful urban farm is one that effectively fulfils its intended purpose. For professional urban farms, success is measured by their ability to generate sufficient income from crop yields, whereas for privately owned urban gardens, success is defined by the satisfaction and self-fulfilment of the owner, whether through recreational engagement or by producing enough crops for personal consumption.

While reviewing the literature and extracting data, it became evident that information for several indicators was either missing or inconsistently reported. Consequently, the four indicators below were excluded from detailed analysis to maintain data reliability and ensure valid comparison among the remaining indicators. However, these indicators were revisited in the final discussion, as they were addressed by participants during the follow-up interviews.:

1. Water access and management
2. Number of people working in a farm
3. Access to citizens
4. Safe human environment

Figure 16. The excluded indicators of a successful urban farm.

For the six indicators retained in this study, a detailed explanation is provided below to clarify their relevance and contribution to the assessment of urban farm performance. Additionally, the "Project Period" indicator was included to assess the sustainability of the urban farms. This indicator evaluates whether the farm is still operational and, if so, how long it has been functioning. The length of time a farm has been in operation is an important measure of its resilience, adaptability, and long-term viability, providing insight into its ability to withstand challenges and contribute to sustainable food production over time.

Scale of a farm: The scale of a farm refers to the size or total area of the farm, since it was mentioned that due to the compactness of the city, and expensive land prices, an urban farm is better to be "small" in size (Imbert, 2015; Seedy.Farm, 2025). A farm is considered a small farm when the farm ranges from 5acres (or 2 hectares) to 24 acres (equivalent to 10 hectares) (Heifer International, 2025).

Owners' critical thinking skills: This indicator refers to the owners' ability to have enough critical thinking skills to implement smart, flexible solutions (BPlan, 2025). Each farm owner either sought additional education to improve their urban farming practices or, when facing potential closure, demonstrated creativity and critical thinking by developing innovative solutions or seeking professional assistance.

Sufficient capital: The availability of sufficient capital is essential both to purchase the initial materials required to establish an urban farm and to enable the farm to generate income from its produce (Seedy.Farm, 2025).

Crop yields: This indicator refers to the ability of an urban farm to produce sufficient crop yields to meet the food needs of its owners.

Farm location in the city: Since the location of an urban farm plays a crucial role in providing access to existing urban infrastructure, such as sewage networks, water systems, road connections, storage facilities, and cooling units, as well as ensuring accessibility for people (Gulyas, 2021), this indicator examines whether a strategically located urban farm with strong infrastructural access contributes to its overall success.

Policies and institutional support: Since cities are governed by rules and regulations for land uses, each type of urban farm needs to file the proper paperwork to ensure that the farm wouldn't be removed.

Project Period: This indicator refers to the duration for which an urban farm has been in operation. This indicator helps assess the sustainability and long-term viability of the farm. A longer project period typically reflects the farm's ability to endure over time, adapt to changing conditions, and overcome challenges such as resource constraints, policy shifts, and market fluctuations. By evaluating the operational lifespan, this indicator provides valuable insights into the resilience and continued success of urban farming projects.

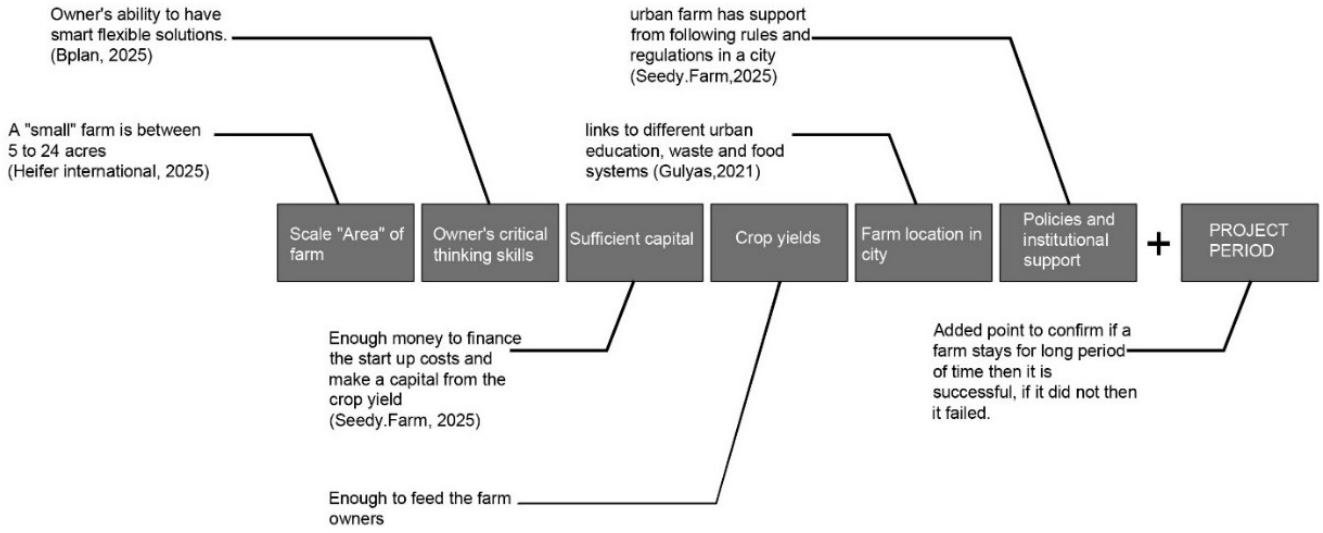

Figure 17. Explanation of the 7 indicators that will be used to analyse case studies (Developed by the authors).

The diagram below illustrates the evaluation framework applied to the selected case studies, showing how each success indicator is assessed to determine whether it demonstrates a positive (√) or negative (×) outcome.

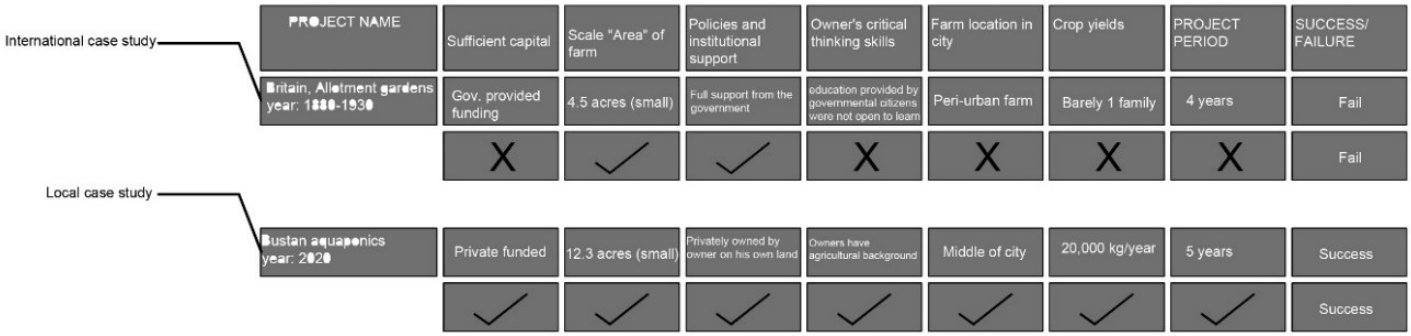

Figure 18. Applying the criteria of the success index to the case studies (Developed by the author).

These analytical patterns were later reflected and validated in the interviews with farm owners, who identified the same critical indicators as decisive for their projects' success. The consistency between case-based results and practitioner feedback strengthens the reliability of the success index as a diagnostic and planning tool.

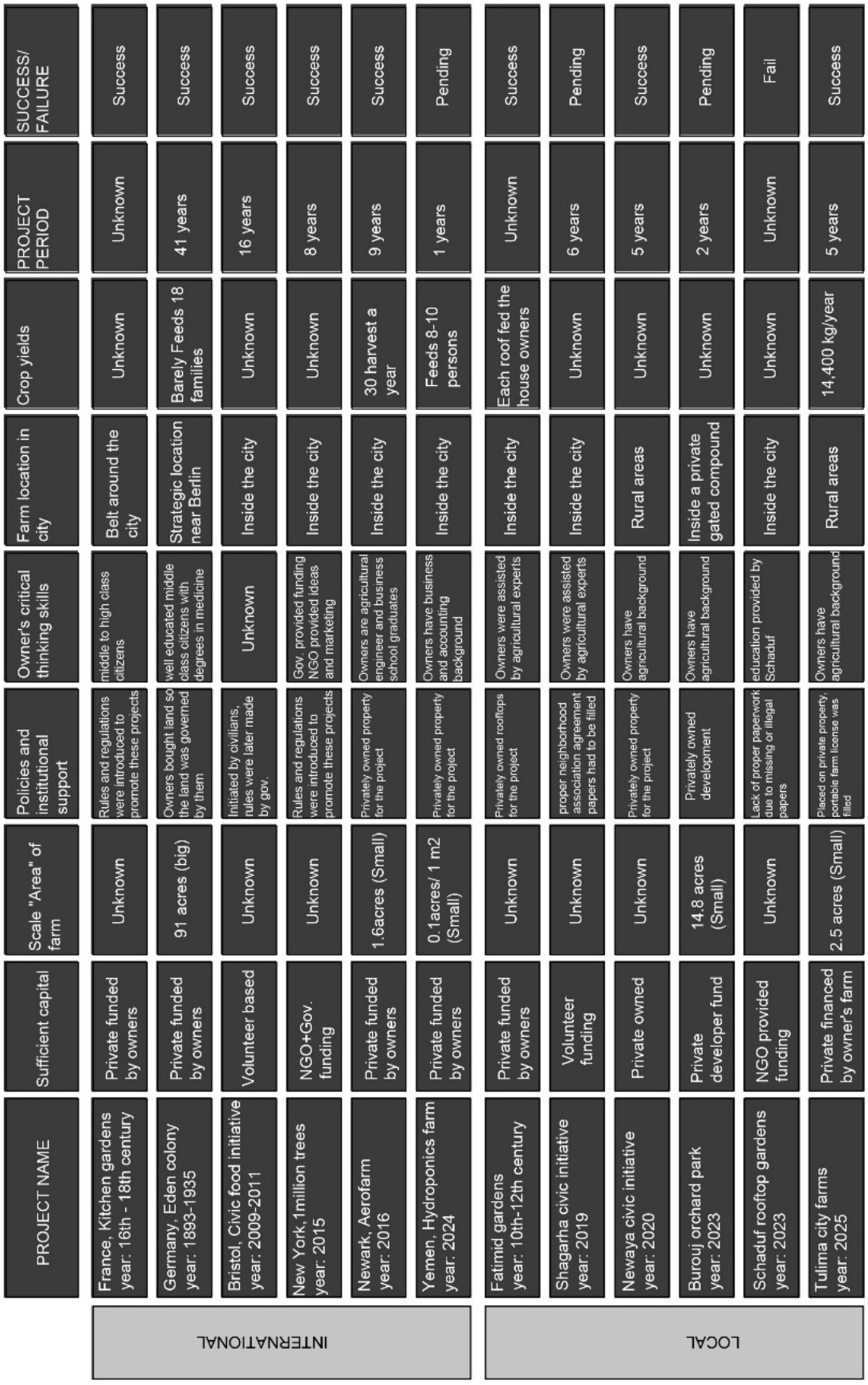

Figure 19. Extracted data from local and international urban farming case studies (Developed by the authors).

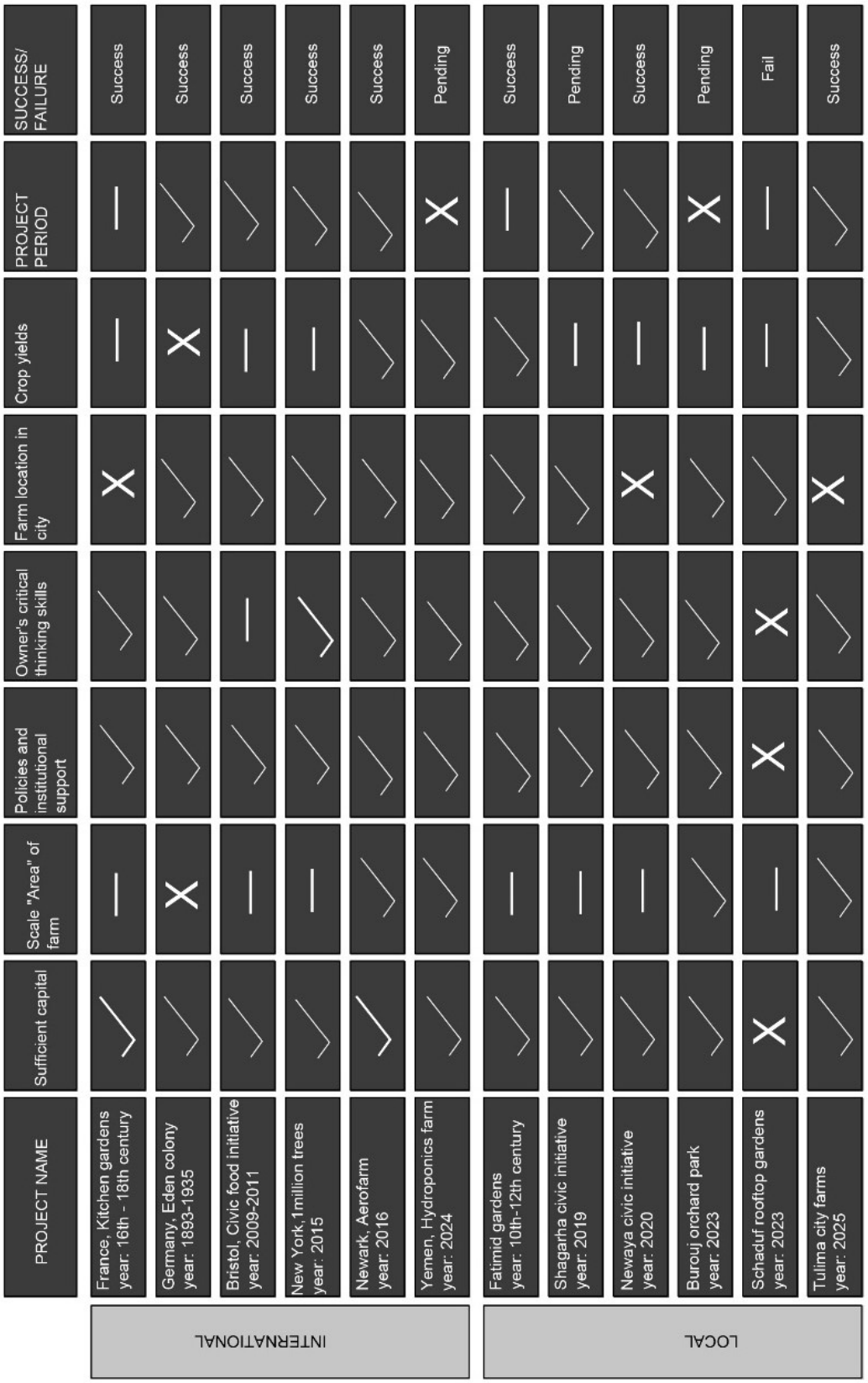

Figure 20. Comparative table between case studies after applying criteria (Developed by the authors).

2.6 Summary and implications after analyzing the case studies

The application of the six refined success indicators to the selected case studies revealed clear differences between international and local urban farming experiences. Approximately two-thirds of the international cases achieved positive results in at least four indicators, whereas less than half of the Egyptian local cases reached the same level. This comparative outcome indicates that the limited performance of local urban farming initiatives is not necessarily related to the concept of urban farming itself, but rather to broader structural constraints within the Egyptian context. These constraints are particularly evident in relation to water access, institutional support, technical capacity, and financial sustainability.

The comparative analysis further showed that the most successful urban farming cases shared three main characteristics: strong institutional and policy support, access to technical knowledge and educational resources, and adequate financial investment. These findings suggest that successful international models cannot be directly transferred to Egypt without contextual adaptation. Their implementation requires not only technical modification according to local climatic, spatial, and resource conditions, but also the establishment of an enabling policy and socio-economic framework. Therefore, urban farming in Egypt should be approached as an integrated planning strategy that combines spatial suitability, governance support, community participation, and economic feasibility.

*2.*7 Interview analysis phase

To validate the proposed Success Index, the findings and criteria derived from the case study analysis were presented to local urban farm owners and practitioners through follow-up interviews. Participants included representatives from Tulima Farms, Shagarha, VertiCairo, GrowPro, and private citizen-led urban farming initiatives. This validation process ensured that the proposed indicators reflected practical on-ground realities rather than remaining limited to theoretical interpretation. The interview questions were developed based on the case study findings, the challenges identified in the literature review, and the urban farm management guidance discussed within the AESOP framework on sustainable food planning (Roggema, 2017). The interviews were semi-structured to allow flexibility while maintaining consistency across the main analytical themes. Although each question set was tailored to the scale, type, and purpose of the respective project, all interviews addressed policy environment, resource management, technical feasibility, ownership structure, market linkages, community involvement, and the social and economic benefits of urban farming.

The interview with Zeina Salama, co-founder of Tulima Farms, provided important insight into the operation of urban hydroponic farming in Egypt. Tulima City Farm addresses several critical urban food-system challenges, including water scarcity, food waste, bureaucratic procedures, and public engagement with food production. As a commercially oriented model, Tulima demonstrates how controlled-environment farming can reduce resource consumption and improve production continuity, although it also requires considerable initial investment and technical management. The interview with Eng. Omar El Deep, founder of the Shagarha civic initiative, highlighted the potential of low-cost, community-supported urban farming to provide food-producing trees within the city. According to the interviewee, fruit-producing trees require careful site selection, particularly in areas away from pollution, such as new cities or schools, and must have access to suitable irrigation water rather than wastewater. This case illustrates how civic initiatives can mobilize public participation and social support, even with limited financial resources.

The third interview was conducted with the Chief Science Officer of VertiCairo, an urban farm and café that has experimented with several urban farming typologies, including aquaponics, hydroponics, and aeroponics, mainly for mint production. VertiCairo is also developing a locally sourced vertical farming system as an alternative to expensive imported systems. Instead of purchasing ready-made systems at high cost, the project sourced pipes, motors, and sensors locally, thereby reducing investment requirements and supporting local technical adaptation. These three interviews represent commercial local urban farms whose main objective is to sell the produce generated on-site. Together, they show that professional urban agriculture in Egypt depends on capital availability, technical

experimentation, access to infrastructure, crop-yield efficiency, and the ability to adapt imported models to local environmental and economic conditions.

The following interviews focused on privately owned urban farms, where citizens used the produce for personal consumption, self-sufficiency, or self-fulfillment rather than commercial sale. An interview was conducted with Moustafa Sayed, founder and CEO of GrowPro, a company that transforms privately owned spaces such as balconies, yards, and rooftops into productive urban gardens. The interview revealed several barriers faced by citizens, including limited knowledge of food cultivation, insufficient time and effort for maintenance, lack of support from some private compounds, and limited availability of green workers capable of responding to food-production needs. Mr. Sayed also emphasized the importance of creating communities that exchange produce, knowledge, and practical experience. He further noted that the convenience of the farm location is essential, as citizens need quick and easy access to monitor and maintain their plants. The interview also indicated that crop selection is strongly influenced by sunlight exposure, farming typology, whether soil-based or water-based, and the dietary preferences and consumption patterns of the household.

A final interview was conducted with a citizen who attempted to grow food in a private yard but was unable to sustain the project due to limited access to proper knowledge and qualified green workers. Collectively, the interviews confirm that there is growing interest in urban farming among Egyptian practitioners and citizens; however, this interest is constrained by systemic barriers, particularly the lack of technical knowledge, limited funding, weak institutional support, and insufficient regulatory clarity. At the same time, the optimism expressed by participants indicates a degree of social readiness for urban agriculture. If supported by educational programs, financial incentives, clearer regulations, and community-based knowledge-sharing networks, urban farming could become a more scalable and economically relevant component of Egypt's urban food-security strategy.

3. Results

The analysis of the interviews and case studies revealed that urban farms in Cairo cannot be evaluated through a single unified set of indicators, as each category operates according to different objectives, spatial conditions, management capacities, and expected outputs. The findings therefore distinguish between two main categories: professional urban agriculture and privately owned urban gardening. Professional urban agriculture refers to urban farms established primarily for income generation through the sale of food products, while urban gardening refers to small-scale food-growing practices developed by private citizens for household consumption, self-sufficiency, leisure, and personal fulfilment. Based on this classification, the Success Index shows that each category requires a specific set of critical indicators rather than a generalized model.

For professional urban agriculture, the most significant success indicators include crop-yield efficiency, sufficient capital investment, strategic location, legal and licensing requirements, technical expertise, and problem-solving capacity. The results show that crop yield is more important than farm size alone, since economic viability depends on the quantity and market value of the produce. Location also plays a decisive role because commercial farms require accessibility to consumers, markets, restaurants, or distribution channels. The cases of Tulima and Shagarha demonstrate that some professional farms require formal licensing and institutional coordination, while farms located on private property, such as VertiCairo, may operate with fewer legal procedures. In contrast, privately owned urban gardens depend more on convenience of location, access to knowledge, time availability, household consumption needs, and continuous maintenance. Roofs, yards, and balconies are successful only when they allow easy access for observation, irrigation, disease detection, and crop care. The results further indicate that lack of technical knowledge remains one of the main barriers for citizen-led urban gardening, particularly in relation to plant nutrition, irrigation timing, pest control, and appropriate crop selection. Figure 56 summarizes the comparative Success Index for urban gardening and professional urban agriculture.

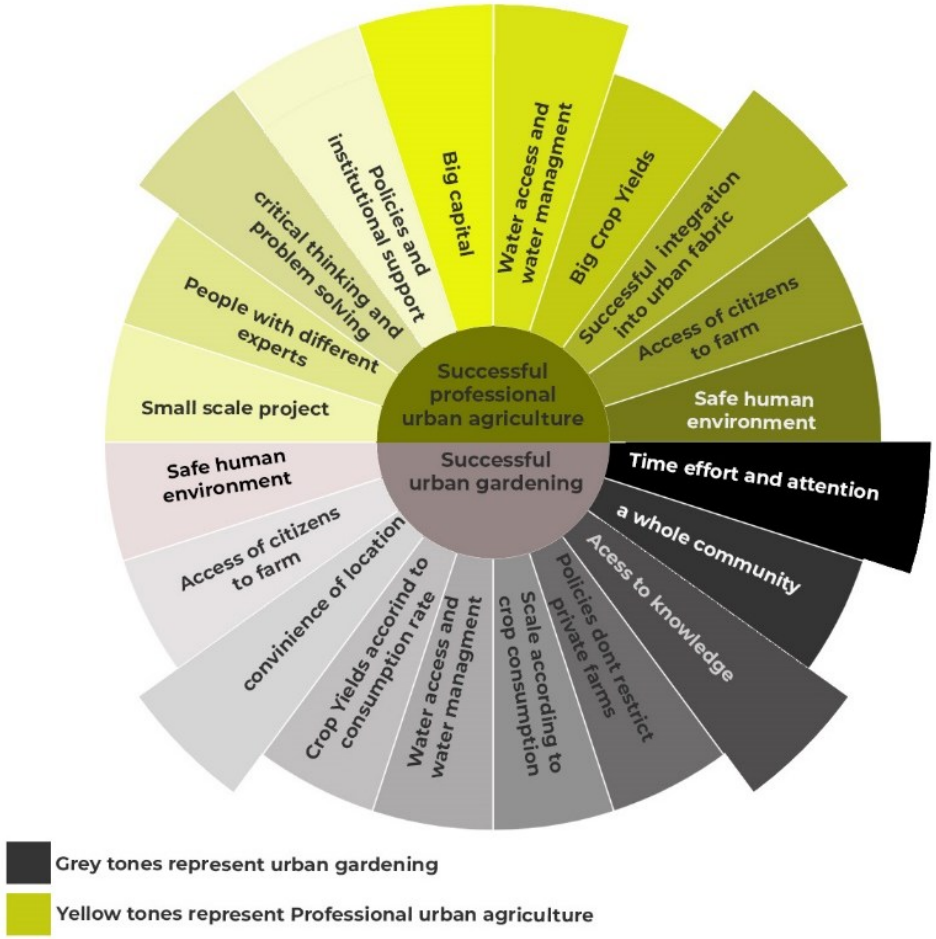

Figure 21. success index of urban gardening vs professional agriculture (developed by author)

4. Discussion

4.1 Practical Interpretation of the Success Indicators for Professional Urban Agriculture

The findings indicate that urban farming in Egypt should not be treated as a single uniform practice, but rather as two distinct implementation categories: professional urban agriculture and private urban gardening. Professional urban agriculture is primarily market-oriented and capital-driven, whereas private urban gardening is more closely associated with household consumption, community participation, and small-scale food access. Accordingly, the Success Index was developed separately for each category in order to reflect their different objectives, operational requirements, and success conditions.

For professional urban agriculture, location emerged as a decisive factor because commercial farms require strong integration within the urban fabric, direct accessibility, and proximity to potential consumers, restaurants, markets, or distribution points. The location of the farm also determines the most appropriate farm typology, whether it is a rooftop farm, yard farm, vertical farm, soil-based farm, water-based hydroponic system, or shipping-container farm. For example, sites located near streets or dense commercial areas may be more suitable for controlled container farming, while larger private plots or institutional lands may support soil-based production. Therefore, location is not only a spatial decision, but also an economic and operational decision that affects accessibility, infrastructure needs, production costs, and market performance.

Farm size is directly connected to expected crop yield, investment capacity, and the type of product to be grown. The area available for cultivation determines whether the project can operate as a small local production unit or as a larger commercial model capable of generating continuous income. Crop selection must therefore be aligned with both farm size and farm typology. Crops with higher yield, shorter production cycles, lower maintenance requirements, and stronger market demand are more

suitable for commercial urban agriculture because they improve capital return and reduce operational risk. However, the findings also show that certain systems, especially hydroponic and container farms, are limited in crop diversity because they are more suitable for small-root plants and leafy greens.

The case of Tulima illustrates the economic potential and limitations of container farming. Although the initial investment is high, controlled-environment agriculture can reduce long-term costs related to pesticides, transportation, water use, food waste, and space consumption. It can also support continuous yearly production, which improves commercial stability. However, the limited range of suitable crops remains a constraint. Shagarha, by contrast, demonstrates the social value of productive tree planting and free access to food, but its non-commercial orientation and lack of income data make it difficult to evaluate its economic sustainability. VertiCairo highlights another important challenge: locally sourced hydroponic systems may reduce dependence on imported technologies, but they require time to reach maximum productivity, and their performance remains vulnerable to humidity, high temperature, and insufficient artificial lighting for some crops such as mint.

The success of professional urban agriculture also depends on the skills and managerial capacities of farm owners. These skills include legal awareness, licensing procedures, financial planning, technical knowledge, crop-management expertise, problem-solving capacity, and the ability to coordinate specialists from different fields. Professional urban farming requires more than agricultural knowledge; it requires business planning, regulatory understanding, infrastructure management, and continuous technical adaptation. This is especially important in Egypt, where urban farming is still weakly supported by formal policy frameworks.

Water and electricity access are among the most critical implementation indicators. Access to drinkable or safe irrigation water gives greater flexibility in crop selection and farm typology, while lack of reliable water access significantly restricts food-producing systems. Similarly, electricity is essential for vertical and container farms, particularly those that depend on pumps, nutrient circulation, artificial lighting, cooling, and controlled-environment systems. Without stable electricity, shipping-container farms and advanced hydroponic systems become difficult to operate. Once location, water, and electricity access are secured, licensing and legal documentation become the next essential step, as formal recognition can reduce uncertainty and support long-term investment.

The practical sequence for establishing a professional urban agriculture project can therefore be understood as a staged process. First, the farm location must be selected according to accessibility, ownership conditions, and integration into the urban fabric. Second, water and electricity access must be evaluated. Third, the appropriate farm type should be selected according to the available budget and site conditions. Fourth, the required legal paperwork and licensing procedures should be completed according to the selected farm type. Finally, crop types should be chosen based on the farm system, expected yield, production cost, market demand, and available capital. This sequence demonstrates that the Success Index is not only an evaluation tool, but also a practical implementation guide for professional urban agriculture in the Egyptian context.

From an urban economic perspective, professional urban agriculture can contribute to local economic resilience by converting underused urban spaces into productive assets. It can reduce food transportation costs, create small-scale employment, support local agribusiness models, supply restaurants and markets with fresh produce, and reduce waste associated with long-distance supply chains. However, these benefits depend on proper location selection, investment capacity, technical efficiency, and institutional support.

4.2 Practical Interpretation of the Success Indicators for Privately Owned Urban Gardens

The second category identified in this study is privately owned urban gardening, which differs from professional urban agriculture in purpose, scale, investment level, and management structure. While professional urban agriculture is mainly driven by income generation and market supply, privately owned urban gardens are usually motivated by household consumption, food self-sufficiency, leisure, environmental awareness, and community interaction. For this reason, the success indicators for

private urban gardens are more closely related to daily usability, knowledge access, time availability, community support, and safe cultivation practices.

Crop yield and consumption rate are central indicators for private urban gardens. Unlike commercial farms, where crop selection is guided by market demand and capital return, household gardens should be planned according to the dietary needs, consumption patterns, and preferences of the family. Crop quantity and plant choice should therefore correspond to how much a household consumes and how much each plant can realistically produce (Sayed, 2025). This makes the garden more practical and prevents unnecessary waste, overplanting, or disappointment caused by low productivity.

Convenience of location is another major success factor. Urban gardens require continuous observation, regular watering, pest control, pruning, and early detection of plant diseases. Therefore, the most successful location is usually the one that is easiest for the owner to access and monitor, such as a rooftop, balcony, courtyard, or private garden close to the household (Ragaey, 2025; Sayed, 2025). If the garden is physically inconvenient or difficult to reach, maintenance declines and productivity becomes less stable.

The findings also show that private urban gardening should not be understood as an isolated individual activity. Urban gardens are more successful when they are supported by community participation, shared labor, exchange of knowledge, and neighborhood cooperation. Since food cultivation requires time and effort, community-based support can reduce the burden on individual owners and increase the continuity of the project. This is particularly important in dense urban contexts where residents may lack time, experience, or confidence in growing food (Sayed, 2025).

Safe cultivation practices are essential because private urban gardens are usually located close to residential areas, children, families, and shared community spaces. For this reason, the use of chemical pesticides or unsafe treatments should be avoided. The indicator of a safe human environment is therefore not only environmental, but also social and medical, because urban gardens are directly embedded in everyday living spaces. This reinforces the need for public education on safe food-growing methods, pest management, harvesting practices, and plant maintenance.

Water access and management also shape the feasibility of private urban gardening. Two main options were identified: manual irrigation through buckets and small containers, or more advanced watering systems connected to domestic water pipes, such as sprinklers or drip irrigation. The choice depends on the garden scale, household budget, technical knowledge, and available infrastructure. However, even small gardens require consistent water access, and poor water management can quickly lead to crop failure.

Policies and institutional support remain important even for small private gardens. The findings indicate that, as long as the farm is located on private property, there is no clear evidence that private rooftop or garden cultivation is legally prohibited. However, some gated communities may restrict urban gardening for aesthetic reasons or due to concerns about insects and maintenance. Therefore, owners should check compound or neighborhood regulations before establishing an urban garden (Sayed, 2025). This finding is important because misinformation and fear of tree removal can discourage citizens from growing food, even when no formal prohibition exists.

Scale is another practical indicator. The size of a private urban garden should be determined by the household's consumption needs, available time, and maintenance capacity. A larger garden does not necessarily mean a more successful garden if the owner cannot maintain it. Therefore, scale should be realistic, manageable, and connected to household food needs rather than symbolic greening. Time and effort are also critical, as the success of private urban gardens depends less on formal education and more on regular care, observation, and willingness to learn (Sayed, 2025).

Access to knowledge is one of the most decisive indicators for private urban gardening in Cairo. Many citizens are interested in growing food but lack the technical knowledge required to start and maintain productive gardens. In addition, many green workers in Cairo are more experienced in maintaining ornamental plants than food-producing crops. This creates a knowledge gap that can lead to low productivity, plant disease, early failure, and discouragement (Ragaey, 2025; Sayed, 2025). Training

programs, public workshops, community manuals, and demonstration gardens could therefore significantly improve the success of household urban farming.

The practical interpretation of the Success Index for private urban gardens suggests that successful implementation depends on selecting crops according to household consumption, choosing a convenient location, ensuring safe water access, avoiding harmful chemicals, checking local property regulations, involving the community, matching garden scale to available time and capacity, and improving access to cultivation knowledge. These indicators show that private urban gardens are not only food-production spaces, but also social, educational, and economic micro-spaces.

From an urban economic perspective, private urban gardens can contribute to household-level resilience by reducing food expenditure, increasing access to fresh produce, and encouraging informal exchange of crops, seeds, tools, and knowledge among neighbors. Although they may not generate direct commercial income, they can reduce household vulnerability to food-price fluctuations and support a more localized food culture. When multiplied across rooftops, courtyards, balconies, and private plots, these small interventions can collectively improve urban food resilience and activate underused residential spaces within the city.

5. Conclusion

This study examined the structural causes of food insecurity in Egypt and assessed the potential of urban farming as a complementary strategy within the national food-security framework. The findings confirm that Egypt's food scarcity is not caused by a single production deficit, but by the combined effect of fragmented agricultural land, illegal urban expansion, inheritance-related land division, water scarcity, limited rainfall, restricted Nile water availability, inadequate infrastructure for storage and transportation, food waste, population pressure on a limited agricultural area, and long-term policy shifts that have increased dependence on imported food. These challenges were analyzed through the three-core food-security resources of water, energy, and food, and through the four pillars of food security: availability, access, utilization, and stability. This classification demonstrates that Egypt's food-security crisis is simultaneously a resource-management problem, an urban-planning problem, and an economic resilience problem.

The research further shows that urban farming can help address selected gaps within these resources and pillars by activating underused urban spaces, shortening food-supply chains, improving local access to fresh produce, and reducing pressure on conventional agricultural systems. However, the study also confirms that urban farming cannot replace traditional rural agriculture. Rather, it should be understood as a supportive urban strategy that strengthens food availability and accessibility at the local scale, especially when rooftops, vacant plots, institutional lands, private gardens, public green areas, and compound landscapes are transformed into productive spaces.

Based on the classification of urban farming typologies, the study demonstrates that rooftop farming, yard farming, vertical farming, and animal-related urban farming each have different implementation requirements and limitations. The analysis of professional commercial farms, including Tulima, Shagarha, and VertiCairo, revealed that success depends on capital availability, technical knowledge, water and electricity access, appropriate crop selection, operational management, and adaptation to local climatic conditions. Tulima illustrates the economic potential of controlled-environment container farming, particularly through savings in pesticides, transportation, water consumption, food waste, and space use, although its high initial investment and limited crop range remain important constraints. Shagarha demonstrates the social value of productive trees and public access to food, but also reveals the limitations of models that lack income data or commercial return. VertiCairo highlights the opportunities and challenges of locally sourced hydroponic systems, where crop yield, humidity, temperature, and artificial lighting remain decisive factors for productivity.

The interviews with private citizen-owned urban farms revealed a different set of success conditions. Citizens showed interest in growing food, but their participation is restricted by limited access to knowledge, lack of time, insufficient technical skills, and the continuous maintenance required to prevent contamination, disease, or low productivity. The findings also show that private urban farming

is rarely an individual activity only; it is more successful when supported by community participation, shared knowledge, collective labor, and long-term commitment. Misconceptions regarding the removal of fruit trees from private properties further discourage citizens, although the study found no evidence that private rooftop or garden trees are legally prohibited. This finding highlights the importance of public awareness, legal clarity, and educational programs as essential components of urban farming implementation.

The proposed Success Index contributes to the field by translating these findings into an implementation framework that can guide policy makers, government officials, private investors, urban farm owners, and citizens. It identifies the critical indicators required for successful urban farming in Egypt, including location suitability, resource availability, licensing clarity, financial support, crop-yield efficiency, knowledge access, community engagement, maintenance capacity, and safe cultivation practices. By validating the index through local practitioners and case studies, the research provides a context-specific tool rather than a general model imported from international experience.

From an urban economic perspective, the findings are significant because urban farming can transform inactive urban assets into productive economic spaces. By using rooftops, vacant plots, green areas, and private properties for food production, cities can generate micro-enterprise opportunities, reduce food transportation costs, support small-scale employment, minimize food losses, and strengthen local economic circulation. Commercial models such as container farming and hydroponic production may create new urban agribusiness opportunities, while community and household farms can reduce household food expenditure and improve neighborhood-level resilience. Therefore, urban farming contributes not only to food security but also to urban economic diversification, inclusive local development, and more efficient use of urban land.

Overall, the study concludes that urban farming should be integrated into Egypt's urban and food-security policies as a complementary and scalable strategy. Its success depends on coherent regulations, financial incentives, technical training, community participation, and greater public awareness. Future implementation should move beyond beautification-oriented greening and consider food-producing landscapes as part of urban infrastructure. In this sense, urban farming offers Egypt an opportunity to connect food security, urban planning, environmental sustainability, and urban economic resilience within a single integrated development approach.

Acknowledgements

The author would like to express sincere gratitude to all those who contributed to the completion of this research. Special appreciation is extended to Dr. Hussam Riyad Hussein for his continuous guidance, support, and valuable feedback throughout all stages of the study, which were instrumental in bringing this research to fruition. The author also gratefully acknowledges Heba Dewedar for her insightful advice, encouragement, and practical expertise, which significantly enriched the development of this work. Appreciation is further extended to the late Dr. Holger Gladys for his contributions to academic knowledge and resources that inspired this research, particularly literature related to foodscapes and urban agriculture. The author would also like to thank the many scholars whose work has advanced the fields of urban agriculture and food security, with special recognition to Dr. Cornelia Redeker and Monique Jüttner for their influential publication Landscaping Egypt: From the Aesthetic to the Productive, which provided valuable insights for this study. Finally, the author acknowledges all researchers, practitioners, and participants whose efforts and dedication to sustainable food systems have contributed to the knowledge base upon which this research is built.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of Interest
The author(s) declare(s) no conflicts of interest.

Data availability statement
The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Institutional Review Board Statement
Not applicable.

Credit author statement
All authors contributed substantially to the conception and design of the study, data analysis and interpretation, manuscript preparation, and approval of the final version for publication. All authors have read and agreed to the published version of the manuscript.

References:

Al Arabiya. (2023, April 23). مصر تُلزم مطاحن القطاع الخاص ومنتجي الدقيق الحر بتوفير احتياجاتهم من القمح المستورد [Egypt obliges private-sector mills and free-flour producers to secure their needs from imported wheat]. https://www.alarabiya.net/aswaq/economy/2023/04/23/مصر-تُلزم-مطاحن-القطاع-الخاص-ومنتجي-الدقيق-الحر-بتوفير-احتياجاتهم-من-القمح-المستورد

Abu-hashim, A. M. (2019). *Sustainability of agricultural environment in Egypt: Part I*. Springer. https://doi.org/10.1007/978-3-319-95345-8

Alary, V. (2017). Desert land reclamation programs and family land dynamics in the Western Desert of the Nile Delta (Egypt), 1960–2010. *World Development, 104*, 140–153. https://doi.org/10.1016/j.worlddev.2017.11.017

Agricultural Market Information System. (2025, July 2). *Crops at a glance*. https://www.amis-outlook.org/statistics/crops

ETH Studio Basel. (2015). *Nile Valley—Urbanization of limited resources*. ETH Studio Basel. https://studiobasel.ethz.ch/publication/nile-valley-urbanization-of-limited-resources

BPlan. (2025, April 6). *Urban micro farming: How to succeed in business*. https://bplan.ai/blogs/succeed-business/urban-micro-farming-succeed-business

Ding, G. K. (2017). Sustainable water management: A strategy for maintaining future water resources. In *Encyclopedia of sustainable technologies* (Vol. 4, pp. 91–103). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.10171-X

Diniz, F. H. (2013). Livelihood strategies in settlement projects in the Brazilian Amazon: Determining drivers and factors within the agrarian reform program. *Journal of Rural Studies, 32*, 196–207. https://doi.org/10.1016/j.jrurstud.2013.06.005

ELwatanNews. (2019, November 22). نقيب الفلاحين: المزارعون غير راضين عن أداء وزارة الزراعة [Farmers' syndicate head: Farmers are dissatisfied with the Ministry of Agriculture's performance]. *El Watan News*. https://www.elwatannews.com/news/details/4434316

Food and Agriculture Organization of the United Nations. (2025). *Urban and peri-urban agriculture*. https://www.fao.org/urban-peri-urban-agriculture/en

Food Security Cluster. (2023, December 15). *2.3.1 The four pillars of food security*. https://handbook.fscluster.org/docs/231-the-four-pillars-of-food-security

Global Hunger Index. (2025, February 13). *Egypt*. https://www.globalhungerindex.org/egypt.html

Gulyas, B. Z. (2021). Increasing city resilience through urban agriculture: Challenges and solutions in the Global North. *Sustainability, 13*(3), Article 1465. https://doi.org/10.3390/su13031465

Heifer International. (2025, September 17). *What is a smallholder farmer?* https://www.heifer.org/blog/what-is-a-smallholder-farmer.html

Imbert, D. (Ed.). (2015). *Food and the city: Histories of culture and cultivation*. Dumbarton Oaks Research Library and Collection. https://doi.org/10.2307/j.ctt1rfsqp4

Juttner, C. R. (2020). *Landscaping Egypt: From the aesthetic to the productive*. Jovis. https://doi.org/10.1080/01433768.2026.2663225

Law Insider. (2025). *RURAL FARM definition*. https://www.lawinsider.com/dictionary/rural-farm

Margold, S. (1957). Agrarian land reform in Egypt. *The American Journal of Economics and Sociology, 17*(1), 9–19. https://doi.org/10.1111/j.1536-7150.1957.tb00212.x

Nicholas S. Hopkins, K. W. (1998). *Directions of change in rural Egypt*. The American University in Cairo Press.

Nikiel, C. A. (2021). Past and future trends of Egypt's water consumption and its sources. *Nature Communications, 12*, Article 4508. https://doi.org/10.1038/s41467-021-24747-9

Radwan, T. M. (2019). Dramatic loss of agricultural land due to urban expansion threatens food security in the Nile Delta, Egypt. *Remote Sensing, 11*(3), Article 332. https://doi.org/10.3390/rs11030332

Roggema, R. (Ed.). (2017). *Agriculture in an urbanizing society: Volume two: Proceedings of the Sixth AESOP Conference on Sustainable Food Planning*. Cambridge Scholars Publishing.

Rouchdy, M. S. (2017). *The food question in the Middle East*. The American University in Cairo Press.

Sarant, L. (2017). Egypt: Space to grow. *Nature, 544*, S14–S16. https://doi.org/10.1038/544S14a

Seedy.Farm. (2025, April 7). *Urban farming: The ultimate guide to sustainable city growing*. https://seedy.farm/urban-agriculture/urban-farming-ultimate-guide

Singerman, D. (Ed.). (2009). *Cairo contested: Governance, urban space, and global modernity*. The American University in Cairo Press. https://doi.org/10.5743/cairo/9789774162886.001.0001

Stringer, S. M. (2010). *FoodNYC: A blueprint for a sustainable food system*. Manhattan Borough President Scott M. Stringer. https://farmlandinfo.org/wp-content/uploads/sites/2/2019/09/NYC_blueprint_food_2010_1.pdf

Tamburelli, P. P. (2013). *The Nile Metropolitan Delta*. The Berlage Center for Advanced Studies in Architecture and Urban Design.

Tawfic, A. (2025, February 13). *Food security: "Urban Greens" cultivates resilience on the rooftops of Cairo*. The Urban Activist. https://theurbanactivist.com/climate/food-security-urban-greens-cultivates-resilience-on-the-rooftops-of-cairo/

Thill, P. P. (2012). *900 km Nile City: A strategic design proposal for a rural metropolis*. Berlage Institute.

Today, E. (2026, May 23). Over 200K trees planted under Phase 4 of Egypt's "100 Million Trees" Initiative. *Egypt Today*. https://www.egypttoday.com/Article/1/147359/Over-200K-trees-planted-under-Phase-4-of-Egypt%E2%80%99s-%E2%80%98100

UNICEF. (2018). *Nutrition*. https://www.unicef.org/egypt/nutrition

UNICEF. (2021). *Child nutrition and health: Current and future trends*. https://www.unicef.org/egypt/media/12166/file/Effect%20of%20Population%20Trends%20on%20HealthNutritionSnap-EN.pdf.pdf

Unity Environmental University. (2023, September 10). *What is urban farming?* https://unity.edu/careers/what-is-urban-farming/

Verhoeven, J. S. (2018). *Flourishing foodscapes: Design for city-region food systems*. Amsterdam Academy of Architecture. ISBN 978-94-92095-38-1

Verhoeven, S. (2018). *Flourishing foodscapes: Design for city-region food systems*. Valiz.

Worldometer. (2026, January 4). *Egypt population*. https://www.worldometers.info/world-population/egypt-population/

Zeeuw, H. d. (2000). The integration of agriculture in urban policies. In N. Bakker, M. Dubbeling, S. Gündel, U. Sabel-Koschella, & H. de Zeeuw (Eds.), *Growing cities, growing food: Urban agriculture on the policy agenda* (pp. 161–182). Deutsche Stiftung für Internationale Entwicklung. https://hdl.handle.net/10568/63737

How to cite this article? (APA Style)
Ashraf, M., & Hussain, H. R. (2026). Developing a Success Index for Urban Agriculture Implementation to Strengthen Food Security in Egypt. *Journal of Contemporary Urban Affairs, 10*(1), 79–110. https://doi.org/10.25034/ijcua.2026.v10n1-4