GeoJournal of Tourism and Geosites
ISSN 2065-1198, E-ISSN 2065-0817

Year XV, vol. 45, no. 4spl, 2022, p.1726-1734
DOI 10.30892/gtg.454spl22-993

DEVELOPING SPATIAL TYPOLOGY FOR URBAN AGRICULTURE INITIATIVES TO ACHIEVE FOOD SECURITY IN JORDAN

Maisa Al SHOMALI*
Al-Balqa Applied University, Engineering College, Architecture Department, Salt, Jordan, e-mail: m_alshomali@bau.edu.jo

Ahlam Ammar SHARIF
The Hashemite University, Faculty of Engineering, Department of Architectural Engineering, Zarqa, Jordan, e-mail: ahlam_sh@yahoo.com

Omar Al OMARI
Al-Balqa Applied University, Engineering College, Architecture Department, Salt, Jordan, e-mail: Alomari.omar@yahoo.com

Citation: Al-Shomali, M., Sharif, A.A., & Al-Omari, O. (2022). DEVELOPING SPATIAL TYPOLOGY FOR URBAN AGRICULTURE INITIATIVES TO ACHIEVE FOOD SECURITY IN JORDAN. *GeoJournal of Tourism and Geosites*, 45(4spl), 1726–1734. https://doi.org/10.30892/gtg.454spl22-993

Abstract: The study investigates the current Urban Agriculture (UA) initiatives in Jordan on multiple spatial typology scales, addressing their different stakeholders and identifying the produced crops compared to their sufficiency level across the country, which is crucial to understanding the role of Urban agriculture in achieving food security and sufficiency in Jordan. The study is based on extensive desk research covering around 105 sources to identify the crucial dimensions of Urban agriculture. The study uses diagrammatic representations to analyze these dimensions and stimulate discussions through interviews conducted later with 12 key members. The study also uses thematic analysis to generate relevant themes that target Urban agriculture's main issues and opportunities in Jordan. The study discusses the levels of integration and continuity between the different Urban agriculture scales to achieve food security, the reasons for such distribution and spread, provided opportunities and faced challenges, as well as the key factors that resulted in success or failure along with the potential risks facing Urban agriculture in Jordan. Four themes were identified as a result of the interpretations of these discussions covering the needs and sufficiency, ownership, coordination between stakeholders, and the nature of products. The study addresses the main aspects, problems, and opportunities related to Urban agriculture in Jordan and integration between scales, stakeholders, and crops and provides recommendations for the key stakeholders on how to emphasize their contribution to the required level of Urban agriculture to achieve sufficiency and ensure local food security as an outcome. The study also provides a standing point to stimulate further research in these areas.

Key words: Spatial Typology, Urban Agriculture, Urban Planning, Food Security, UA initiatives, Jordan

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INTRODUCTION

In the last three years, countries turned towards the closure of their borders because of the global health crisis after decades of heading towards globalization, they had faced challenges pertaining to food security and agriculture, created a major disruption in the urban food systems (Aldazhanova et al., 2022; Altman, 2020). Countries have applied an internal policy focus on their own capabilities and self-sufficiency for each country and have rearranged their priorities accordingly, with food security being placed among the top ones. Jordan is considered of particularity in that regard, as it is ranked 64th out of 113 countries in terms of food security, according to the Global Food Security Index for the year 2019, issued by The Economist Intelligence Unit, Der Spiegel (2020). King Abdullah-II of Jordan revealed the national policy guidelines in an interview with Der Spiegel (2020), stating that; "Food security is the top priority", that the risk of starvation is considered greater than the risk of global health crises in many regions of the world, and therefore the investment is made in storing strategic foods, and strengthening strategic reserves for a minimum of one year, as is the case in European countries. From that respect, sufficiency of food products through Urban Agriculture (UA) as a type of spatial planning, has been advocated as a country-wide strategy to improve food security (Altieri, 2019; Otten, 2015). A comprehensive strategy is achieved by studying land resources on different spatial typologies and studying different scales, from the city down to the district, neighborhood and to the housing unit level. This study cannot be comprehensive without examining and investigating other important related factors; such as stakeholder's contribution on different levels, imported essential crops compared to the possibility of growing it locally, self-sufficiency achieving and maintaining, and UA local initiatives with their success rates.

Current studies on urban agriculture worldwide addressed the role of spatial typologies in achieving food security. Part of these studies emphasized specific spatial typology scales, which resulted in the limitation in separating them from other spatial typologies (Abelman, 2020; Cabannes and Marocchino, 2018; Meenar, 2017; Sanyé-Mengual et al., 2015; Philips, 2013). Other studies emphasized the multiplicity of spatial typology scales but rarely addressed the integration of spatial typologies in achieving food security, particularly when the diversity of crops that could be produced is concerned (see Kumalawati et al., 2020; De Vries and Fleuren, 2015; Pearson et al., 2010).

* Corresponding author

To achieve food security in the context of Jordan; this study emphasizes integrating all various components and identifying research gaps, by focusing on the integration of multiple spatial typology scales and the way this can enhance the management of the produced crops. Additionally, it maps current urban agriculture initiatives in Jordan on multiple spatial typology scales, addressing their different stakeholders, and identifying the produced crops compared to their sufficiency level across the country. In order to attain sufficiency and assure local food security as a result, the study concludes with recommendations for the stakeholders (planners, landscape architects, government, individuals, NGO's, etc.) on how to emphasize their contribution to the required UA balance.

LITERATURE REVIEW

a. Agriculture in Jordan

Jordan has an area of about 89 million square acres. Being dominated by an arid and semi-arid Mediterranean climate, about 5.5% of the area of Jordan is considered dry lands, with annual precipitation ranging between 200-300 mm. This rate exceeds 300 mm in no more than 4% of the country's area, which mainly comprises the northwestern highlands (Ministry of Agriculture, 2020). This reflects agricultural challenge in Jordan, where the total arable area, though not all cultivated, is about (8.9) million acres, representing a mere 10% of the country's area. The area used for cultivating field crops and grains in 2020 amounted to about 891967 acres, compared to 595655 acres cultivated with vegetables, and 377533 utilized for fruit trees (excluding olives). Accordingly, the total cultivated area in the Kingdom in 2018 was estimated at about 2732199.6 million acres, which comprises 3% of the total area, or 27% of the cultivable area (Ministry of Agriculture, 2020).

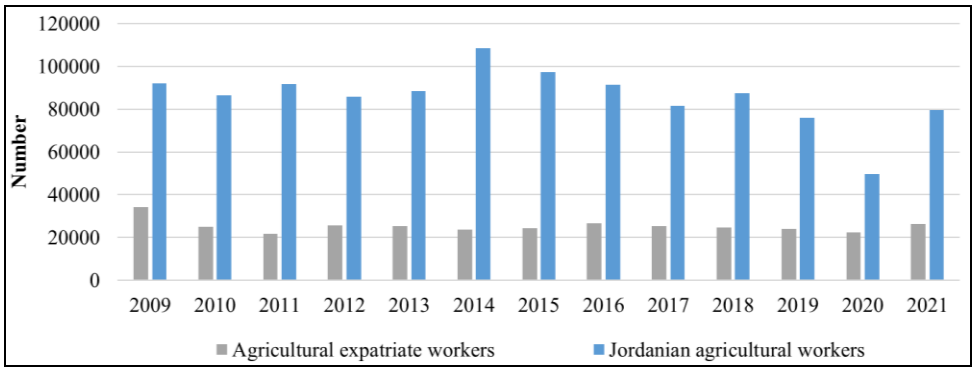

Figure 1. Number of Jordanian and expatriate workers diagram (Source: Ministry of Labor, Market Figure, 2022: 91)

The Jordanian community is not accustomed to working in agriculture, where such sector has significantly relied on expatriate workers, seen in Figure (1), which is a challenge facing agriculture in Jordan. While unemployment among the national youth reached 41% (Ministry of Labor, 2022), a clear aversion can be seen by the community from the demanding physical work associated with the agricultural sector, along with the social stereotypes and norms depreciating the stature of agricultural work. In response, the government has aimed to stimulate the national participation in agriculture by facilitating low-interest loans to farmers through the Agricultural Credit Corporation. This has backfired, where around 70% of the farmers struggled with debt that kept building up through the years due to a combination of higher costs and lower returns, ending up being pursued by the government for their repayment default (Al Odwan, 2018).

The reduction of the farmers' financial returns was due to a number of reasons, including the lack of their products quality, cultivation surplus in certain crop types such as tomatoes (market bottlenecks), and the reduction of other, though more demanded, with the lack of government support as importing such products was more affordable than growing them locally. This was exacerbated by difficulties faced with a fluctuating rainy seasons and rising costs of agricultural production. The outcome was the disappearance of 14,000 small farmers failing to cultivate their lands who, after a while, ended up selling their plots to new affluent-class owners. With the latter not actually working in agriculture, the purchased agricultural lands were turned into family farms for weekend leisure (Al Odwan, 2018). Farming as a profession was also affected by the rise in population and urban sprawl (Al-Koufahi et al., 2018), leading to land consumption for construction projects (Al Otoum, 2020). In addition to promoting farming as a profession, many municipalities have resorted to initiatives supporting land cultivation as a community initiative, covering areas such as pavements, roundabouts, and municipal gardens. Universities, schools, and mosques similarly resorted to comparable initiatives for different reasons related to leisure, education, beautification in addition to securing food. These initiatives, however, are rare and hardly successful due to the lack of community interest and collaboration in addition to other uncontrollable reasons. Alternatively, the most noticeable, widely spread, and probably considered successful agriculture initiatives were in house gardens (Department of Statistics, 2002), with people having special interest in gardening as a leisure and cooperative activity through which they share knowledge and expertise in addition to providing some types of food that they share with their neighbors (Dubbeling et al., 2009).

b. Self-sufficiency Production

Jordan maintains sufficiency in certain crops but is found severely lacking in others. There is a lack of balance between crops that are overly sufficient while other essential foodstuff is not even close to sufficiency. As Figure (2) demonstrates, two types of olive, olive oil and tomato crops have a self-sufficiency ratio that exceeds 100%. Potatoes are in a similar position with a self-sufficiency ratio of about 96%. Citrus fruits, such as lemons and oranges, have a self-sufficiency ratio of

about 57%. It is noticed that the self- sufficiency rates of the basic foodstuff in Jordan, are very low ranging between (2.3% to 8.2%) (Ministry of Agriculture, 2022). This was mainly due to the unremunerated compensation for prices, fluctuation of the rainy season, and rising costs of agricultural production, in addition to urban sprawl and growing population. As shown in Figure (2), it is clear that the proper consideration of a certain insufficient crop mandates addressing the opportunities and challenges in considering the country's ability to satisfy its demand by increasing its production in a manner that ensures its proper integration with different crops and other essential foodstuff such as rice, sugar, lentils, and dry beans, that face challenges with their self-sufficiency ratio ranging from 0-8.8%. Referring to table (1) and Figure (2), the urgency in tackling food production issues in Jordan is quite clear, particularly in terms of necessary products that are otherwise imported.

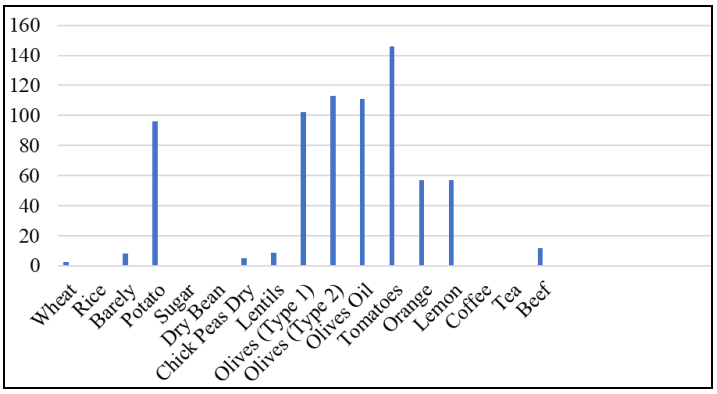

Figure 2. Self –Sufficiency Ratio Diagram (SSR) of Food Items, 2021

Table 1. Self –Sufficiency Ratio (SSR) of Food Items, 2021 (Source: Department of Statistics, Jordan Statistical Yearbook, 2022)

	SSR	Export	Import
Wheat	2.3	61213	1173392.4
Rice	0	2550.6	198784.1
Barely	8.2	0	854817.1
Potato	96.1	9926.1	2243.2
Sugar	0	449	281063.5
Dry Bean	0	0	4988
Chick Peas Dry	5.3	72.4	36345.9
Lentils	8.8	132.7	10115.1
Olives (Type 1)	102.4	3617.6	0
Olives (Type 2)	113	4840.1	1488.1
Olives Oil	111.1	2345.5	2.8
Tomatoes	146.1	224423.8	0
Orange	57.2	1852.1	34497.6
Lemon	57.1	391	22405.6
Coffee	0	2982.3	37827.9
Tea	0	3938.7	8219.9
Beef	11.5	12546.1	70864.5
Mutton	42.8	12.7	24928.1
Goat Meat	100	0	0
Chicken meat	79.3	9773.1	74077.9
Cow Milk	100	0	0
Table Egg	99.7	0	127.8
Fish	6.8	389.6	32517.3

c. Urban Agriculture (UA)

Urban agriculture is a modern trend in urban planning and city management. It is defined by researchers, such as Wagstaff and Wortman (2013) and Bailkey (2000), as the practice of cultivating, processing, and distributing food and non-food products, in or around urban areas (Al-Asad and Zureikat, 2018). Land-use planners and landscape architects emphasize encouraging UA to become engaged in the growth and change of cities, by including community farms, allotment gardens, rooftop gardening, edible landscaping, urban forests, and other productive components of the urban environment (Lovell, 2010). UA is acknowledged for the benefits of forming strong social relationships, supporting community interaction, and involvement in knowledge and expertise sharing. While considering the potential of UA as a means to achieving food security, reference is made to the numerous benefits associated with it, resulting in its growth in various parts of the world. These include access to healthy/organic food, clean living, and the greening of cities. (Aldazhanova et al., 2022; Al-Asad and Zureikat, 2018) UA is different from rural agriculture in local food systems, where it is integrated into the local urban economic and ecological system to actively contribute to achieving food security (Yan et al., 2022; Al-Asad and Zureikat, 2018). As it turns out, Jordan's issue is the decreasing amount of land and space available for urban agriculture. With this importance and associated benefits of urban agriculture, Jordan represents a case of rare and fragmented urban agriculture initiatives. This demonstrates the necessity of urban agriculture's revival and unification in Jordan in order to achieve its benefits, particularly in terms of food security.

d. Fragmentation and Integration of Urban Agriculture in Studies

- It was not easy to integrate and classify studies related to the UA, due to the different way of handling and studying different aspects, some studies look at spatial typology and its various kinds, while others look at stakeholders and crops.

d. 1. Multiple studies have addressed the topic of UA with reference to its **spatial typologies** and their role in achieving food security. 1) Some focused on a specific spatial typology through work on the neighborhood scale including community farms and rooftop gardens (Abelman, 2020) as well as the city and urban scale (Cabannes and Marocchino, 2018; Meenar, 2017; Sanyé-Mengual et al., 2015; Philips, 2013). These studies present the importance of each of these spatial typology scales and their contribution to urban agriculture, they had their limitations in not considering the multiplicity and combined effect in addressing UA (Cabannes and Marocchino, 2018). 2) A second research category focused on multiple spatial typologies. This includes the work of de Vries and Fleuren (2015) on individual gardens, semi-public urban spaces, and green infrastructure, the work of Newell et al. (2022) on community and private gardens, as well as the work of Pearson et al. (2010) on the social and economic concerns of urban agriculture. These studies present the multiplicity of spatial typology scales in addressing UA but do not take into account their combined effect (Cabannes and Marocchino, 2018). 3) A third category focused on the combined effect of the spatial typologies, these studies present the integration of the food system on the city, urban neighborhood, private parcel, and built structure scales (Kasper et al., 2017; Lovell, 2010). 4) Other studies also addressed the effect of considering the initiatives taken on different scales; micro, mezzo, and macro, such as the works of Wang (2016) on edible landscapes in China and the study

of Specht and Sanyé-Mengual (2015) on the risks pertaining to urban rooftop farming in Barcelona and Berlin. This category, in specific, presents and draws attention to (i) the way the various spatial typologies can be taken into account, and (ii) the ways the different spatial scales can complement each other and contribute to UA problems, whether we consider the house with its balconies and sometimes it's back and front yard gardens; housing tenements with possibly green roofs and façades; neighborhoods with food assets on their streets, pavements or open spaces; or districts with possibly larger parks, whether cultivated or not; cities as a whole, with open fairs, supermarkets, food hubs or wholesale markets; or peri-urban areas that may have cultivated areas and a rural hinterland (Cabannes and Marocchino, 2018).

d. 2. The multiplicity and combination of these typologies situate UA at the intersection and as a product of the integration of these spatial typology scales, reflecting **the necessity of cooperation between the different stakeholders responsible for these initiatives**.

Where most studies comprised the different spatial typology scales of urban agriculture and the means of addressing them separately or in combination**, the distribution and integration of the produced crops** were, in most cases, left out. The studies of Abelman (2020); Wang (2016); Sanyé-Mengual et al. (2015); Cabannes and Marocchino (2018); Philips (2013) went through the crops commonly farmed within the different addressed cases of home gardens, roof gardens, community, and peri-urban gardens, in a fragmented manner that did not attach such crops to a particular spatial typology scale. On the other hand, de Vries and Fleuren (2015) provided a more holistic account of the **crops produced per spatial typology scale** but did not emphasize the means of their inter-scale integration. Although there are some studies that provided insights into the role of UA in tackling food security (The Arab Group for the Protection of Nature, 2019; Al-Asad and Zureikat, 2018).

- The argument here is that addressing different spatial typology scales and the collaboration between different stakeholders should take into account the types of crops produced, how they compare to the needs, and how they are integrated with other crops to achieve sufficiency, which is still lacking.
- The current UA studies in Jordan are no exception. These studies are still fragmented in terms of addressing different spatial typology scales, stakeholders and produced crops. This is exacerbated by considering the multiplicity of initiatives that are not still documented, which adds to the fragmentation and lack of possible combination or integration.
- This study is only an attempt to combine such documented/undocumented initiatives while particularly focusing on produced crops. The study proceeds to compare the produced crops with the self-sufficiency ratios to identify ongoing issues.

METHODOLOGY

The research relies on an in-depth diagrammatic analysis of a number of UA initiatives that took or are currently taking place on multi-scales in Jordan. A multidimensional analysis was utilized, starting with a long list of dimensions that were tested on a multiplicity of existing cases (considering spatial typology scales, locations, drivers, limitations, involved stakeholders, contribution of and effects on governance and local community, types of products, time of initiation, duration, and continuity) (Figure 3). These dimensions were then refined to address the main concerns of the research, connecting the multiple spatial typologies of UA initiatives, their stakeholders and the associated crops with the level of spread and factors of success of each spatial typology scale, leading to a better understand of the food security reality in Jordan.

The study relied on a combined approach that started with an extensive desk research incorporating a review of circa (40) research papers as well as (65) press-releases and (50) governmental announcements and issued statistics covering local plans and initiatives in Jordan for the period from 2005 to 2021. The study further relied on reports and market surveys developed by a number of none-governmental organizations estimating the spread levels (spatial typology scale) and success rates (stakeholders) of UA initiatives. Accordingly, the UA initiatives and attempts were collected and analyzed on the basis of the following criteria:

(i) the coverage of multiple spatial typology scales of UA, (ii) the variety of stakeholders involved, (iii) the types of crops produced, and (iv) the incidents of continuity/discontinuity, success/failure, opportunities/challenges, among other considerations.

The outcomes of the desk research went through three levels of interpretation and investigation, using diagrams to organize the data and assist the researchers in formulating ideas and stimulating discussions through the interviews that followed (see Buckley and Waring, 2013). The usage of diagrams was not limited to visual representation of what is being discovered through analysis, but also as generative/analytical techniques and communicative tools to achieve the following:

- Mapping the different UA initiatives in order to associate them with the available typologies in Jordan, their stakeholders, and cultivated crops. To understand the effectiveness of these associations, the study also mapped the level of spread of each initiative on the associated scale while pointing out the level of success of each initiative based on continuity. Mapping was done manually by the researchers as usage of software packages offering visual displays of semantic nets, concept diagrams and graphs did not necessarily enable deep reflection on the data, its interpretation, or criticism (Radnofsky, 1996).
- Utilizing the provided diagrammatic analysis and providing critical reflections regarding the produced associations. The provided diagrams helped the researchers become more reflexive as they stimulated thoughts through a transparent process, reducing the potential for reductionism (Buckley and Waring, 2013).
- Utilizing the diagrammatic analysis as tools for communication and further exploration with the main stakeholders (Buckley and Waring, 2013; Crilly et al., 2006). This entailed conducting semi-structured interviews with (12) of the key members involved in the selected UA initiatives to provide insights into the subject matter as well as validate the outcomes of the analysis. Each interview lasted around 30-120 minutes to stand on the levels of integration and continuity between the different scales to achieve food security, the reasons of such distribution and spread,

provided opportunities and faced challenges, as well as the key factors that resulted in success or failure along with the potential risks facing UA in Jordan going forward. The usage of diagrams was beneficial to focus the discussion on the common framework (Crilly et al., 2006; Ford and Sterman, 1998).

It should be acknowledged, however, that these methods could be embedded with some limitations, where (i) prepared diagrams have the potential to influence or restrictively bias interviewees' thinking, rather than help stimulate, expose or reflect it (Crilly et al., 2006; Larkin and Simon, 1987), and (ii) diagrams are most useful to those who have the ability and skill to quickly interpret them. To overcome these limitations, we followed Crilly et al. (2006) in suggesting that diagrams were merely a work in progress and could still be amended with any newly reported data or further insights. Furthermore, the diagrams were shared with architects, landscape designers and other experts who acquired the knowledge and capability to effectively read into and interpret visual data. Data analysis utilized NVivo (10) software to analyze the interview results through familiarizing with the data, identifying initial codes, grouping codes to generate themes, evaluating the produced themes to reach the finalized themes that would be based upon in providing relevant recommendations.

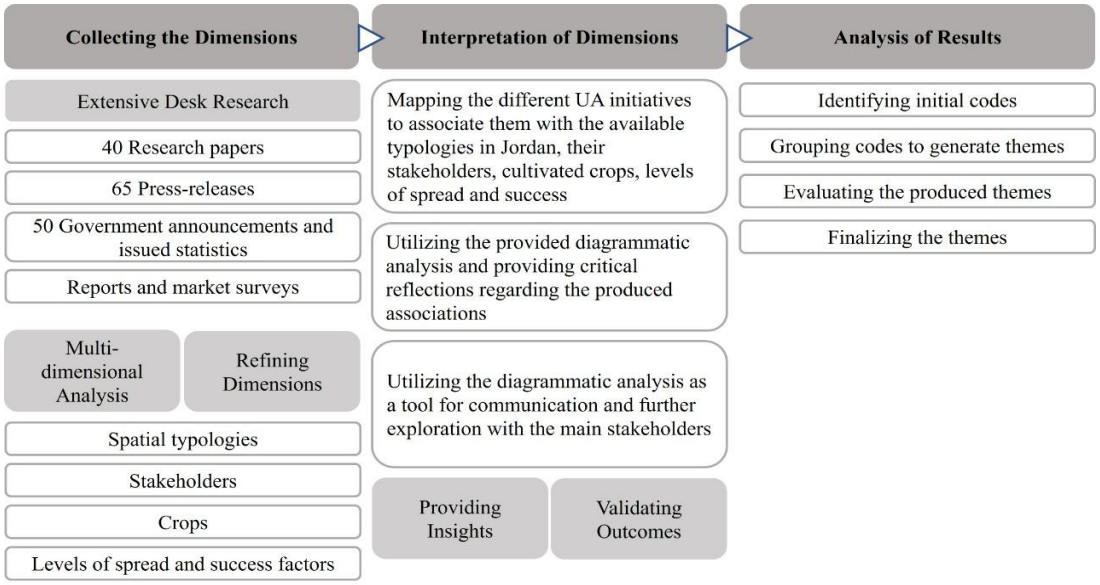

Figure 3. Flow chart of the adopted methodological steps

RESULTS AND DISCUSSION

The first part of the discussion includes the mapping of UA initiatives and their analysis (shown in Figures 4 and 5), covering their spatial typologies scale that were classified depending in Jordan context (home, neighborhood, district and city), associated stakeholders and crops along with their level of spread and success. The main focus was on the integration between these aspects. Numbers of spread levels and success rates were deducted from previous market surveys and reports developed by NGO's to help in better understanding the effectiveness of these associations (The Arab Group for the Protection of Nature, 2019).

1- Spatial Typology Scale and Spread: The findings demonstrate that the house scale had the highest spread among other UA forms, with focus on the backyard (with a percentage of 70%) followed by the front yard (with a percentage of 40-50%). The spread within the house scale also revealed a minimum usage of facades, balconies and green roofs. Conversely, the findings showed that the neighborhood scale had the lowest spread, with sidewalks having the highest percentage in this scale (reaching 40%) while other spaces, including open spaces and roundabouts, did not exceed 7%. The spread on the district scale was barely different than the neighborhood, reaching a maximum percentage of 45% at universities while not exceeding 20% in other spaces. Finally, on city scale, while attaining a relatively high value of spread through farms, did not reflect a proper utilization of leftover spaces, with a spread value not only 3%.

2- Stakeholders: The findings revealed seven key stakeholders that are mainly connected to different types of spaces. The government is responsible for farms, leftover spaces, large parks, and mosques. Municipalities are responsible for large parks, open spaces, roundabouts, in addition to cultivating municipal gardens. Schools and universities are responsible for their own gardens as well. NGOs and communities are responsible for sidewalks and sometimes collaborate with other stakeholders to achieve their goals. NGOs could also collaborate with individuals on different private house and neighborhood spaces. While communities are responsible for sidewalks, individuals are in charge of all house-level spaces, where other individuals (mainly farmers) are responsible for farms. These types of stakeholders have been found always connected to different levels of success or failure. Initiatives supported by individuals (excluding farmers) achieved the highest level of success (100%). Initiatives supported by universities achieved a 70% success level while the ones supported by schools attained a lower rate (20%). Initiatives supported by NGOs acquired a 50% level of success, depending on the other party collaborated with. Finally, no proof of success was found in any of the initiatives supported by municipalities or communities. Figure (6) below demonstrates the level of success and failure based on stakeholders.

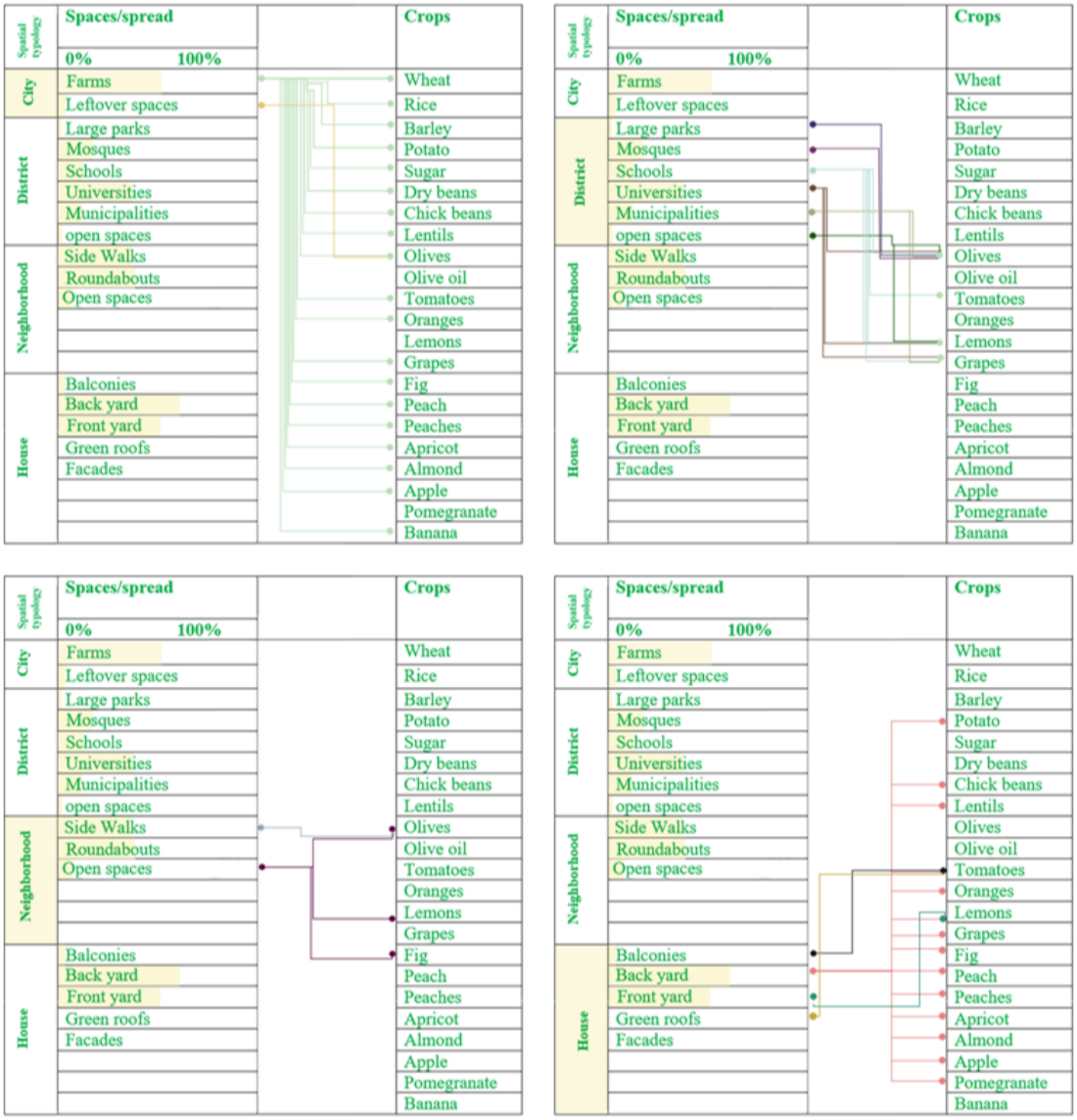

Figure 4. Mapping outcomes of UA; the integration between each spatial typology scale and crops

3- Crops: The findings show that the crops associated with the house scale were potato, tomato, peach, apricot, apple, grapes, oranges and pomegranate. Notably, most of these crops are considered demanding in terms of continuous care, irrigation and fertilizing. On the neighborhood level, the most dominant crops were olive, lemon, and fig. Notably, these are the crops that do not need as much care. On the district level, crops varied between the ones that demand care (grapes, peach) and others that do not (figs and lemon). On the city scale level, comparatively, crops were primarily rice, barely, and wheat, which are crops regarded as demanding continuous care and irrigation.

As an outcome of the distribution of crops, it is worthy to note the exclusive association of some crops with a single spatial typology scale, such as wheat (on the city scale). Other crops, comparatively, were associated with multiple spatial typology scales, such as olive, which could be found on the

Figure 5. Mapping outcomes of UA; the association between spatial typology scale, stakeholders and success

neighborhood, district and city scales. This can be justified as some crops (e.g. wheat, rice and barley) need large areas to be farmed while others (olive for example) can be planted in its singularity. Furthermore, crops that need processing after their cultivation (except for olives) are mostly farmed on larger scales (mass production). Table (2) demonstrates the distribution of key crops investigated among the different spatial typology scales. The following part of the discussion includes the interviews analysis, focusing on the main themes resulting from discussing the diagrammatic representations, the justification of distribution, and explanation of the levels of spread and success ratios. Four main themes were identified:

Table 2. The distribution of studied crops among the different spatial typology scales

Crop	Classification	Spatial Typology Scale
Tomato	Multi-scale	House – Neighborhood – District - City
Potato	Multi-scale	House – Neighborhood – District - City
Lemon	Multi-scale	House - Neighborhood – City
Orange	Multi-scale	House - Neighborhood – City
Olives	Multi-scale	All scales
Barley	Single scale	City

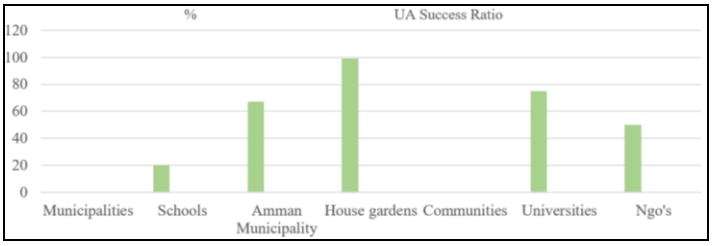

Figure 6. Level of success and failure diagram based on stakeholders (ratios deducted from market studies and reports by NGO's)

1- Needs and sufficiency

The interviews revealed a lack of integration between stakeholders, resulting in the excessive supply of some already-sufficient crops at the expense of others. This highlights the need to reorganize the crops with respect to the different spatial typology scales depending on their availability. The interviews showed that cultivating crops in many spatial typology scales, such as house and neighborhood was disconnected from their current availability. On the house level, for instance, the decision on cultivating a specific crop depended on the preferences of tenant, as the decision was driven by factors that exceeded securing that crop as food, where certain crops might be selected for beautification, providing aroma or shade. On the neighborhood scale, however, it became common to cultivate similar crops mostly because people were used to them or because they do not require continuous care from adjacent residents, as such care relied on the dedicated effort of members that were not always available. The distribution of significant crops across Jordan reveals a multiplicity of agricultural crops with varying availability levels. Availability, in that regard, relies on two factors; the spatial typology scales and stakeholders suitable to cultivate and maintain such product and the probability of success each scale/ stakeholder group affords.

Here we realize that some crops are associated with one spatial typology scale, such as wheat, along with a particular stakeholder, which sharply determines their level of success or failure. Other crops, such as olives, are found on multiple spatial typology scales associated with a variety of stakeholders, which renders their level of success reliant on multiple variables. These results could be associated with the actual crop sufficiency, marked by a number of products that are excessively available compared to other barely sufficient crops. Wheat, for example, is associated with one spatial typology scale and particular stakeholders with a level of sufficiency around 1.1%. Olive, which is associated with many spatial typology scales and a variety of stakeholders, justifies a higher level of 112.3%. Lemon, similar to olive (found on multiple spatial typology scales and stakeholders) has a sufficiency rate of 68.5%. In addition, most crops (tomato, potato, orange) found on the house scale have a sufficiency rate that exceeds 60%, mainly due to the high rate of success, as well as the spread, on that spatial typology scale. In light of the distribution shown in table (2), a number of discrepancies were found reflecting (i) the excessive farming of certain crops despite their general availability and, sometimes, their abundance, and (ii) the growth of certain crops on multiple spatial typology scales at the expense of other crops that are restricted by nature to a particular spatial typology scale. This reveals the need to realign the distribution of agricultural crops in order to reach a better multi-scalar integration of UA in a manner that better contributes to food security nationwide.

2- Ownership (care)

The interviews showed that the ownership and the level of management and care is one of the significant factors that affect the success of the concerned crop. For example, the spread of the house scale as the most seen amongst other typologies (around 70% in backyards and 40-50% in front yards) can be attributed to the self-awareness and interest maintained by individuals, especially when such activity is under their total control and for their own benefits. The role of NGOs associated with house scale initiatives is vital as they are able to provide the required coordination and support. This results in a very high success rate of these initiatives (99%) with a high sufficiency rate (exceeding 60%) for most crops associated with that scale. The spread of initiatives on the city level, particularly farms, is found to be 60%. This is the outcome of associating farm success with farmers' benefits, though it depends on the level of government support. The case of farms is critical due to their connection to their direct benefits and the lack of government support in some cases. For example, farmers became less interested in cultivating wheat because of government orientation towards importing such product. This disinterest resulted in dropping the success rate on that scale, resulting in a low sufficiency of wheat (1.1%), which was eventually replaced with potato that is also cultivated at other spatial typology scales, reaching a sufficiency of 93.1%. This is important to note as a crop like wheat cannot be cultivated by stakeholders other than farmers, while potato can be, and is already being cultivated by others.

3- Coordination between stakeholders

The interviews showed a lack of integration between the multiple stakeholders at different spatial typology scales. The crops were mostly chosen according to stakeholder preference without coordination with other stakeholders in light of their availability and sufficiency. This emphasizes the need for more coordination amongst stakeholders through a deeper

understanding of their areas of interest and, at the same time, in alignment with the most imminently needed crops. In some cases, individuals on the house scale were found to cultivate the same crop and exchanging it with their neighbors as a cultural norm rather than being driven by the need to satisfy a crop that is lacking in their area.

The spread over the neighborhood and district scales was the least (ranging from 0% to 40%). The neighborhood case, in particular, is linked to the lack of coordination in between the neighborhood community members, in light of the lack of support from the municipalities and/ or NGOs to enable the proper management of such shared areas, or the facilitation of the required tools for the neighborhood community to autonomously handle that responsibility. The neighborhood members were less interested because there were no clear criteria for sharing the benefits. This resulted in a success rate of 0% in cases that relied on the local communities. The spread of the district scale was linked to the lack of coordination and continuous monitoring, although district scale stakeholders showed more interest because the benefits were directly connected to them, though not in clear or structured ways. Most of the failing initiatives were attributed to the lack of irrigation and access control of animals to the gardens. In some cases, particularly within schools, continuous care was generally lacking due to the summer break, when nobody would be available to ensure the watering or care for the plants. The random and less controlled access of school children is a potential contributor to this failure. Only a few examples on the district scale witnessed more success. In universities, there is a collaboration between students to care for available gardens, while in Greater Amman municipality, there is good management, care, protection, and irrigation.

4- Nature of products

The interviews also showed that the nature of the crop is a very important influencer of that crop's success. According to the interviewees, some products could need continuous irrigation such as rice while others, such as olive, would not. Some products could only be planted on large spatial typology scales, such as wheat and rice. Others needed processing after their cultivation, such as wheat and sugar. At the neighborhood scale, such as pavements where the olive crops are planted, very little care is provided by the municipality or the surrounding residents. However, it is still considered a success simply because of the durability of the crop itself, which does not need large amounts of water to grow. Municipalities are aware about this important fact and have accordingly provided recommendations on what would be most suitable to grow at that scale. At the city scale, particularly in farms, where rice and sugar are planted, a comprehensive need for continuous watering is a must and little care or management would affect the product comprehensively because of its sensitivity.

CONCLUSION

The study represented a collaborative effort to map current UA initiatives in Jordan on multiple spatial typology scales, addressing their different stakeholders and identifying the produced crops compared to their sufficiency level across the country. The study contributed to current UA research by focusing on the integration between spatial typology scales/stakeholders and crops, an aspect that is lacking in previous research. The study was conducted to address problems of food security and sufficiency in Jordan and provide recommendations for the key stakeholders on how to emphasize their contribution to the required level of UA to achieve sufficiency and ensure local food security as an outcome. Accordingly, and based on the finding, the research provides the following recommendations:

1- As the house scale was found to be quite prominent with the highest rates of success, it would be advisable to think of ways of expanding its contribution by utilizing other available components such as facades, balconies and roofs along with the already used front and backyards.

2- UA on the neighborhood and district scales should be considered extensions to the house scale, where the motivation of tenants and homeowners can play a key role in revitalizing UA on that level. This can happen through further incentives that can be provided to their associated stakeholders in order to maintain a larger role in its development.

3- Continuing the support of initiatives owned by the successful stakeholders such as individuals and universities and standing on the reasons of failure for other stakeholder-steered initiatives.

4- Further integration is required between stakeholders to enhance the distribution of crop cultivation between the different spatial typology scales depending on their level of sufficiency. This entails realigning the mapping of agricultural crops in order to reach a better multi-scalar integration of UA in a manner that better contributes to food security nationwide. This can be supported by establishing a semi-governmental body that is "flexible and duly supported" to lead UA affairs in Jordan and ensure the coordination between multiple parties.

5- Stimulating the feeling of ownership among community members and securing more involvement, contribution, and buy-in is quite necessary. This could be achieved by emphasizing the particular features of the targeted crops and, accordingly, raising the levels of interest of the concerned stakeholders. Such features can include aesthetics, health, nutrition, and other aspects.

6- Creating a digital agricultural map for Jordan that contains on-line necessary statistics, including related to UA to stand on the current situation in a dynamic and lively manner.

7- Understanding that the success of UA initiatives is associated with the ability to go about them in parallel to daily activities maintained by the community. This aligns with the local view on agriculture as a cultural leisure activity that people usually enjoy. Associating this factor through a nation-wide strategy can assist in the better allocation of crops on the different spatial typology scales. Despite the research effort to develop extensive insights on UA initiatives in Jordan, not all of these initiatives were possible to document and analyze, mainly due to their fragmented nature and lack of communication and media coverage. The study, however, was aimed to represent a starting point for researchers who are interested in UA to build on the finding on this research through further research and recommendations that would eventually result in a more integrated body of knowledge in relation to such a national comprehensive strategy.

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Article history: Received:09.10.2022 Revised: 02.11.2022 Accepted: 20.12.2022 Available online: 30.12.2022