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Urban reflections through home gardening; Does Gender Matter?

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A B S T R A C T

In the current global pandemic, actions are taken to prevent Covid-19 spread, residents are embracing small-scale gardening activities in their homes; especially in low to middle income communities, 3rd world countries as in Africa, depending on individual activities. Despite that, there is a lack provided by literature review about home gardening, the paper then shifts to the exploration of the gender influence on home gardening, poses questions; how do gender roles influence home gardening habits, and how would such activities potentially benefit the gardeners, and are the benefits equally distributed or are they potentially skewed to one gender over the other? Using an imperical quantitative approach through a survey, the results imply hypotheses and test them using WarpPLS, to verify their validity.

This paper highlight effects on the connection between gender, gardening activities, and their potential benefits. The findings can help urban authorities to create a fair and inclusive environment.

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1. Introduction

Small and medium-sized cities in low and middle-income nations in Asia and Africa are expected to account for the majority of future urbanisation growth [1]: Although such fast-growing environments offer huge opportunities, there are also a gap related to the challenges risks linked with such growth; In light of the growing health, social and environmental issues in urban areas have led urban policymakers to shift towards urban farming to solve these issues. Urban farming refers to the growing, processing, and distribution of food through plant cultivation and seldom involves raising livestock in and around cities [2].

The main objective of this paper is to look into the different advantages of home gardening to urban farmers, whether they be in the form of personal (health and financial), social or environmental, additionally it aims to explore the differences between the genders, such as who enjoys more benefits when it comes to participating in the activity, this is done using an imperical quantitative approach through conducting an online survey [3,4].

This research can be divided into two parts, the first is primarily made up of literature review that sheds light on what previous studies have previously stated regarding urban gardening activities as well as valuable insight that sheds light on the topic. The second, pertains to the imperical section of the research regarding the research and how it had been conducted, namely using a quantitative method of an online questionnaire survey to collect data from urban households which are involved in home gardening in both Egypt and Malaysia, followed by an indepth study utilizing WarpPLS 7.0, a partial least square structural equation modelling (PLS-SEM) software was used to analyze the data and verify hypothesized results and test their validity.

Green technology promotes environmentally friendly growth, new environmentally friendly sectors, and the creation of jobs and technological advancements in order to ensure long-term sustainability [5]. Therefore it’s important to understand how to achieve green growth, it essentially requires an increase in investments and technologies that lay the groundwork for sustainable development and open new economic avenues for growth. There must be an increase in investments and innovations in sustainable development, as well as new economic prospects, in order to achieve green growth. Green technologies that are both
environmentally friendly and economically beneficial contribute significantly to a society that is both environmentally sound and prosperous [6].

Urban farming involves gardening activities that can easily be applied within cities and urban communities and activities have a positive effect on the economy and ecological system and benefit the urban social life [7]. In a trial to overcome the challenges linked to the rapid urban growth. Crop production is both emblematic and practical in sustainable cities; thus, to boost crop productivity in cities, we must first understand private crop growing attitudes and practises. [8].

Especially in the era of a global pandemic, implementing social distancing, self-isolation, and movement control orders to restrain the transmission of Covid-19, small-scale gardening activities within residential units have become increasingly popular activity among the urban population [9,10] An increase in food demand, food supply chain disruption with more people out of jobs during the pandemic further highlight the significance of home gardening [11]. Home gardening describes a mixed crop of food plants. Such as vegetables and fruits, and medicinal plants that are grown around the residential unit [12]. This type of gardening activity can be either in the form of indoor farming for example, inside the balcony of a residential unit or inside the unit itself, backyard, rooftop or farming located at the outdoor or rooftop space of a residential unit providing different types of crops utilized for different diverse functions such as, food production, lawns and green areas [9,13,14]. Plants are grown either in vegetable beds, containers, or in flower boxes utilising the available housing space [10].

Based on the authors’ findings, it can infer that plant types have an association with both personal and societal benefits, which we will explore more in the Measurement model evaluation section. Gardening sources were also related to personal, social, and environmental advantages. Both genders’ perspectives on home gardening have a major impact on the relationship between gardening sources and social benefits, which relates to the primary research purpose.

2. Literature review

2.1. Home gardening definitions:

According to [12], Home gardens are defined as a single or multi-story zone for various sorts of crops, as well as livestock and animals alongside these crops surrounding the property. Home gardens are described as a single or multi-story zone that contains a wide assortment of crops, as well as cattle and other animals that live alongside the crop varieties, and from the environmental and ecological rewards, home gardens are a place for the management of various food crops and in addition to the environmental and ecological benefits, home gardens provide a space for managing a wide range of food crops. [15].

From [16] point of view the main concept of home gardening is to plant a small portion of the house balcony or at the backyard space of the house with different food crops for the purpose of meeting the family and household needs and reduction of the overall cost. According to the FAO, Home gardening is the combination of the social (people with each other), economic (income from farming), and environmental (Pollution reduction) [17], all in one farming system. Where this farming space can be used for several functions, not only farming, as it’s a place for living, recycling of household wastes, and food production.

Urban farming is considered a way to achieve sustainability in cities through its different disciplines as it integrates the three principles of sustainability together [18].

2.2. The main characteristics of home gardening:

Three attributes define home gardening:

- **Location**: Home gardens are installed alongside dwelling units and may take the shape of a rooftop or green wall, or they may be contained within the balcony.
- **Diversity**: As with the rest of the house, gardens contain a wide range of plants, depending on the demand and environment of the planted area.
- **Size**: A minimal amount of area is required to plant food crops, depending on the irrigation method and soil type that is utilised to grow them [19].

2.3. Types of plants grown in home gardening in relation to functions of home gardening

The purpose of home gardening differs depending on whether it is for self-consumption or market production. As a result, the type of plants cultivated is impacted by whether they are for domestic use on a regular basis or have a significant economic value. As a result, home gardening plants might be categorised as medicinal, decorative, or miscellaneous [20].

Another aspect that influences plant selection is gender; some functional types of gardens have been demonstrated to be gendered. As it is determined by men’s and women’s societal obligations. Women are much more accountable for concerns related to the food supply, whereas males are accountable for matters dealing with the protection and healthcare. As a result, women own the majority of plants used within everyday food production, whereas males own the majority of plants used for more specialized purposes such as medicinal, decorative, and commercial value [20].

2.4. Different resources for home gardening

Prior to establishing gardening supplies, many procedures must be completed: selecting the placement and kind of soil, whether or not this is away from traffic, inspecting the soil, and installing raised beds.

- **Type of resources include**: compost, mulch and hygiene [19].
  - Composting could be a viable source of organic waste for recycling because it improves soil quality and minimises waste as a recycling method. Composting also saves money on fertiliser and is seen as a sustainable method of recycling organic waste [19].
  - Mulching is an option for reducing waste in landfills since it controls soil temperature and may be decomposed to create nutrients. Mulching can also contribute to irrigation water conservation by lowering the quantity of water consumed for cleaning and fertilising [19].

2.5. Benefits of home gardening

Urban agriculture has been associated with a variety of possible environmental, social, economic, political, psychological, and curative advantages. As a result, the motivations for urban household food production are fairly diverse. For example, many gardeners, even those with precarious food security, appear to appreciate the crop they cultivate the same or more for its social worth as for its nutritional benefit for themselves and their family. Home gardens are viewed as a sort of integrated local food system that exists between residential units [8]. Benefits are most likely the consequence of four fundamental changes brought to neighbourhoods by urban farms: the development of public projects that encourage involvement, the physical rehabilitation of deteriorated...
areas, the production of local food, and the establishment of new businesses [21].

Home gardening has different benefits on different levels, on the social level: people get more engaged to each other, on the economic level: it offers a source of food which is feasible for everyone, some dwellers make it as a business for them and start to sell these crop or exchange their products with other products they need which are called economic exchange [22]. Farming in households' results in the increase of urban food cultivation, which makes higher yields of land rather than making the backyard of green area, it also provides an affordable food source with direct access to it without being affected by exteriors factors as pesticides and others. [18]. It also reduces the cost of the transportation of the products from the agricultural lands to the local markets and creates more job opportunities in the cities in the agriculture sector rather than it was only in the rural areas [23].

On the ecological level it provides different habitats for biodiversity [24]. It also provides air filtration through regulates the air temperature, resulting in the reduction of urban heat island effect and helps in the filtration of air, creates a better microclimate and less carbon in the air [25]. Additionally, it is used for solid waste management and recycling where solid wastes are composted and used as a fertiliser for the crops [14]. The same goes to water recycling as the filtered water could be used for irrigation of food crops and during rain, it's used for rain water management and acting as basins for capturing rain.[26], it also contributes to the local biodiversity as it promotes green areas in the existing built environment with more ecological and environmental services [14].

Moreover, home gardens have a social value as it makes people interact with nature, adding psychological benefit to the economic benefit to the dwellers. Additionally, it makes the access for fresh food and livestock easier, it also improves the public health of the society as it enhances the microenvironment around the family, households may also use plants for a medical issue as using medicinal herbs, source of vitamins and an opportunity for physical activity. Most urban farming studies centred on community gardening ranges from the concept of community gardening [27]–[29], and environmental or safe community gardening practices [19,30], and the positive influence of community gardening on health [31], social capital [32], community-building [33], environmental behaviour [34] and food security [35].

Home gardening has a positive effect on the mental health of people; it helps people to be more connected to nature and more engaged with each other [36,37]. Home gardening received less attention among researchers [38]–[40]. Many urban farms are not strictly food security and market-oriented, but instead employ agricultural production to fulfil social objectives, walking the line between business and community development [11,21]. Scholars envisaged the potential leisure, health, economic and environmental benefits of home gardening during pandemic and self-isolation [11,41]. But there is a lack of empirical evidence for this assertion.

2.6. Urban gardening and gender:

While both men and women contribute significantly to home gardening, and this is universally recognised by both genders, some research suggest that women are more involved in home gardening and contribute more to small-scale farming [42]. According to [43] analysis, women are the main managers of home; Women gardeners enjoy environmental and economic benefits than men [14].

Additionally, the literature finds variation in gardening activity between men and women worldwide. Aging Mahi women prioritised gardening as a regular pastime, whereas Maori males of the same age group did not [44]. Not only are the plants grown by urban gardeners are highly variegated [8,11], women grow more varieties of plants than men [45], and women tend to grow food plants, and men grew medicinal plants [20,46]. A study on activities during pandemic reported an increase in gardening activities among adult women compared to men [47]. But not much is known whether gardening provides similar benefits to both men and women [48].

3. Research methodology

A questionnaire survey with five latent variables of 24 items was used to collect the data. All variables are reflective. The two exogenous variables – type of plants and green gardening sources represent home gardening practices with four items each, were measured using a five-point Likert scale, from 1 = strongly disagree to 5 = strongly agree. Table 1 presents the measurement items in the questionnaire and their sources.

The survey did not hesitate to discuss the impact of Covid-19 on home gardening practices, as well as the benefits and drawbacks it
imposed on the activities; it also examined the potential issues and benefits (environmental, social, and personal) that home gardening had on the participants. Lastly, the poll enquired about the candidates’ ability to sustain home gardening as a sustained activity and the feasibility of pursuing it as a genuine part-time activity rather than a pastime that fluctuates. The following table further elaborates on the imposed questionnaire, its questions and answers, along with the sources from which the participants were inspired to pose those questions.

The survey implies the following two hypothesis: that the vegetation type grown, and the supply of gardening are indeed the primary drivers of the personal, environmental, and societal advantages that impact the residential gardeners.

Hypothesis 1 (H1): Type of plants significantly influence personal, environmental and social benefits of home gardeners.

Hypothesis 2 (H2): Gardening sources significantly influence personal, environmental and social benefits of home gardeners.

Additionally, this paper bridge this knowledge gap by investigating whether home gardening provides personal (health and financial), social and environmental benefits to gardeners and whether the benefits of home gardening are the same between female and male home gardeners.

For women, the main benefits were social as communicating with the surrounding neighbours and sharing seeds with them. It also improves the social inclusion between the societies by providing more recreational spaces that would help people to communicate together.

The findings implied further two hypotheses:

Hypothesis 3 (H3): The relationship between type of plants and personal, environmental and social benefits of home gardening differ between female and male home gardeners.

Hypothesis 4 (H4): The relationship between gardening sources and personal, environmental and social benefits of home gardening differs between female and male home gardeners.

4. Measurement model evaluation

The five latent variables (type of plants, gardening sources, personal benefits, environmental benefits and social benefits) were tested for reliability and validity. Cronbach’s alpha, composite reliability (CR) and Dijkstra-Henseler Rho_A were used to check the reliability of the variables. The thresholds for Cronbach’s alpha and Dijkstra-Henseler Rho_A are 0.5 and CR is between 0.70 and 0.90 [56]. Table 1 shows that Cronbach’s alpha, CR and Dijkstra-Henseler Rho_A were within the required limit, confirming the internal consistency of the variables. Indicators’ reliability was examined, and the results showed that the factor loadings surpassed 0.50 with p value ≤ 0.05. These results satisfied the reliability requirements of the latent variables.

Next, Heterotrait-monotrait ratio (HTMT) and full collinearity VIFs were performed to check for the validity of the reflective variables. The values of HTMT should be lower than 0.90 [57] criterion and the full collinearity VIFs must be lower than 3.3 [51]. Table 2 presents that the HTMT for each latent variable fulfilled criterion and the full collinearity VIFs were lower than 3.3, confirming the discriminant validity of the reflective variables.

4.1. Structural model evaluation

The structural model assessment involved testing for lateral collinearity, the significance and relevance of the structural model relationship and the coefficients of determination (R²) and predic-
specific relevance ($Q^2$) as per [58]. Specifically, lateral collinearity was assessed using average block variance inflation factor (AVIF) and average full collinearity VIF (AFVIF) values, which were 1.344 and 1.856, respectively; both values met the cut-off point of 3.3, suggesting strong predictive power of the endogenous variables. The hypothesis was accepted if $P < 0.05$, in a one-tailed $P$ value hypothesis test and the $T$ ratio was over 1.645 [49]. The Table 3 presents the results of the direct effects analysis Table 4.

5. Research results

Most of the respondents were women 131 (74%) compared to men (46 or 26%). Majority of the respondents were full-time workers (95 or 53.7%), followed by students (29 or 16.4%), self-employed (21 or 11.9%), retiree and part-time workers (7 or 4%) respectively. The respondents lived in apartment (64 or 36.2%), detached house (53 or 30%), terrace or link house (30 or 17%), semi-detached house (19 or 10.7%) and cluster house (11 or 6%). Most of them were owners (139 or 78.5%) and only 38 (21.5%) were tenants. Sixty-two (35%) of the respondents have been involved in gardening from 1 to 5 years, 30 (17%) less than a year, 26 (14.6%) have been gardening since the start of COVID-19 and from 11 to 20 years respectively and the remaining have been involved in gardening for over 20 years. The home gardens are located in the backyard (58), balcony (50) front yard (36) and side yard (21) with 64 respondents have over one garden location.

5.1. Hypothesis testing for objective 1

To achieve Objective 1, direct effect analysis using WarpPLS 7.0 was performed on type of plants and gardening sources and personal, environmental and social benefits relationships. The hypothesis was accepted if $P < 0.05$, in a one-tailed $P$ value hypothesis test and the $T$ ratio was over 1.645 [49]. The Table 3 presents the results of the direct effects analysis Table 4.

Five paths were significant: TP->PB path was positive ($β = 0.229$) and significant ($P < 0.001$ and $T$ ratio $≥ 1.64$), TP->SB path was positive ($β = 0.234$) and significant ($P < 0.001$ and $T$ ratio $≥ 1.64$), TP->EB path was positive ($β = 0.267$) and significant ($P < 0.001$ and $T$ ratio $≥ 1.64$), GS->PB path was positive ($β = 0.465$) and significant ($P < 0.001$ and $T$ ratio $≥ 1.64$), GS->SB path was positive ($β = 0.267$) and significant ($P < 0.001$ and $T$ ratio $≥ 1.64$). The highest effects were obtained from GS->EB where $f^2 = 0.434$, thereby signifying a large effect (Cohen 1988)). By contrast, the TP-> EB path was not significant with $P = 0.119$, and $T$ ratio was 1.615, which is below the 1.64 threshold. Therefore, H1A, H1C, H2A, H2B and H2C were supported.

5.2. Moderation analysis for objective 2

This study used full latent growth approach to calculate moderating effects as recommended by [52]. Without the presence of gender as a moderator, the explained variance ($R^2$) is 0.377, 0.481 and 0.178, and the Stone–Geisser $Q^2$ are 0.376, 0.479 and 0.031 respectively for personal, environmental and social benefits. With the presence of gender as a moderator, the explained variance ($R^2$) is 0.382, 0.483 and 0.022, and the Stone–Geisser $Q^2$ are 0.381, 0.481 and 0.206 respectively for personal, environmental and social benefits. Therefore, there is a marked increase in R2

| Construct | Cronbach’s alpha | CR | Dijkstra-Henseler Rho_A | Factor loading | P value |
|-----------|------------------|----|-------------------------|----------------|---------|
| Type of plants (TP) | 0.645 | 0.790 | 0.699 | (0.660) | < 0.001 |
| TP1 | | | | (0.678) | < 0.001 |
| TP2 | | | | (0.709) | < 0.001 |
| TP3 | | | | (0.712) | < 0.001 |
| TP4 | | | | (0.612) | < 0.001 |
| Gardening sources | 0.589 | 0.765 | 0.595 | | |
| GS1 | | | | (0.590) | < 0.001 |
| GS2 | | | | (0.629) | < 0.001 |
| GS3 | | | | (0.763) | < 0.001 |
| GS4 | | | | (0.689) | < 0.001 |
| Personal benefits (PB) | 0.862 | 0.892 | 0.890 | (0.744) | < 0.001 |
| PB1 | | | | (0.750) | < 0.001 |
| PB2 | | | | (0.728) | < 0.001 |
| PB3 | | | | (0.685) | < 0.001 |
| PB4 | | | | (0.637) | < 0.001 |
| PB5 | | | | (0.760) | < 0.001 |
| PB6 | | | | (0.685) | < 0.001 |
| PB7 | | | | (0.691) | < 0.001 |
| PB8 | | | | (0.891) | < 0.001 |
| Environmental benefits (EB) | 0.866 | 0.904 | 0.874 | | |
| EB1 | | | | (0.860) | < 0.001 |
| EB2 | | | | (0.843) | < 0.001 |
| EB3 | | | | (0.831) | < 0.001 |
| EB4 | | | | (0.709) | < 0.001 |
| EB5 | | | | (0.788) | < 0.001 |
| Social benefits (SB) | 0.818 | 0.892 | 0.833 | (0.818) | < 0.001 |
| SB1 | | | | (0.889) | < 0.001 |
| SB2 | | | | (0.862) | < 0.001 |
for social benefit by 13% (from 0.178 to 0.201) and an increase in the predictive relevance of the model by 13.8% (from 0.181 to 0.206) when gender is introduced, suggesting the presence of a moderating effect. Moderating effect is confirmed if \( p < 0.05 \) and the T-ratio value meets the cut-off point of ± 1.645 [49,61].

Table 3

| HTMT ratios | TP | GS | PB | EB | Full collinearity VIFs |
|-------------|----|----|----|----|------------------------|
| TP          |    |    |    |    | 1.433 |
| GS          | 0.783 |    |    |    | 2.089 |
| PB          | 0.625 | 0.793 |    |    | 2.657 |
| EB          | 0.562 | 0.959 | 0.861 |    | 3.062 |
| SB          | 0.478 | 0.541 | 0.620 | 0.612 | 1.554 |

Table 4

| Hypothesis | Std. Beta | Standard Error | P value | T ratio | \( f^2 \) | Decision |
|------------|-----------|----------------|---------|---------|--------|----------|
| H1A: TP->PB | 0.229 | 0.072 | <0.001 | 3.196 | 0.107 | Support |
| H1B: TP->EB | 0.119 | 0.073 | 0.054 | 1.615 | 0.050 | Not supported |
| H1C: TP->SB | 0.234 | 0.072 | <0.001 | 3.270 | 0.080 | Support |
| H2A: GS->PB | 0.465 | 0.068 | <0.001 | 6.798 | 0.268 | Support |
| H2B: GS->EB | 0.632 | 0.066 | <0.001 | 9.574 | 0.434 | Support |
| H2C: GS->SB | 0.267 | 0.071 | <0.001 | 3.746 | 0.100 | Support |

Note: \( p\)-value \( \leq 0.05 \), T ratio \( \geq 1.645 \) for the one-tailed test with a confidence level of 0.95.

Table 5

| Number | Hypothesis | Standard Beta | Standard Error | P value | T ratio | \( f^2 \) | Decision |
|--------|------------|---------------|----------------|---------|---------|--------|----------|
| H3     | G**:TP->PB | 0.010 | 0.075 | 0.447 | 0.314 | Not supported |
| H3B    | G**:TP->EB | -0.042 | 0.075 | 0.286 | 0.568 | Not supported |
| H3C    | G**:TP->SB | -0.008 | 0.075 | 0.458 | 0.106 | Not supported |
| H4     | G**:GS->PB | -0.028 | 0.075 | 0.353 | 0.378 | Not supported |
| H4B    | G**:GS->EB | 0.015 | 0.075 | 0.421 | 0.199 | Not supported |
| H4C    | G**:GS->SB | 0.145 | 0.073 | 0.024 | 1.992 | Support |

Fig. 1 shows that only one path; G**:GS->SB that was positive (\( p = 0.145 \)) and significant (\( p \leq 0.05 \) and T-ratio \( \geq 21.645 \)). The result confirmed the presence of moderating effect of path G**:GS->SB supporting H4C. Kenny’s (2018) effect size indicator was used to evaluate the strength of the moderating effect, whereby the \( f^2 \) value of 0.005 is small, 0.01 is medium and 0.025 is large. The effect size of the moderating effect was calculated using the following formula:

\[
f^2 = \frac{(R^2 \text{ included moderator} - R^2 \text{ excluded moderator})}{(1 - R^2 \text{ included moderator})}.
\]

The result showed that the effect size of moderation G**:GS->SB, where \( f^2 = 0.03 \), is large.

These an interaction graph was used to better explain the results.

Fig. 1 presents the relationship between gender on green gardening source and social benefit relationship (G**:GS->SB). Fig. 1 demonstrates that male and female home gardeners exert distinct moderating effects on the relationship between gardening source and social benefits. Female home gardeners with a greener gardening source attained a greater social benefit than males.

These results show that type of plants have a positive and significant relationship with personal and social benefits with the greatest effect come from personal benefit, gardening sources have positive and significant relationships with all the three benefits, with the greatest benefit is from environmental benefit, and female gardeners got stronger relationships between green gardening source and social benefits than male gardeners.

6. Research discussion

This research aims to start an open research discussion which aims to take into account the gender perspective on urban garden-
ing, that would encompass diverse regions with more variables to be taken into consideration.

Furthermore, based on the study, it has been highlighted that women seem to reap more benefits of home gardening than their male counterparts on numerous fronts, this could be an approach to overcome the gender gap, a front which has been a priority research topic across the world.

Additionally, the studies showed that to get the optimum benefits from home gardening, urban farming policy should be geared towards the type of plants and gardening sources utilized for the activity. Additionally, social benefits of female gardeners can be improved by ensuring a green source of home gardening.

7. Conclusion

As was expected home gardeners, both men and women, approach the relation between gardening activities and their possible benefits from different perspectives and in different ways. It is possible to use the insights to enable urban authorities determine the proper policy for home gardening in order to tackle urban health and economic challenges, as well as establishing a fair and inclusive environment for both sexes to benefit from urban farming.

The data shows that plant types have a positive and substantial link with personal and social advantages which was touched upon in the literature review section 2.3 and was proven to be true based on the testing of the validity of hypothesis 3, which could be seen in the previously mentioned tables, with personal gains having the most influence. Gardening sources have a decent link with all three benefits, with environmental benefits having the most value. Most importantly to the research objective, namely the gender reflections on home gardening having distinct moderating effects on the relationship between gardening source and societal benefits. For instance female home gardeners with a greener gardening source benefitted more socially than males. The gender point of view on urban agriculture assists us in making the most of urban farming techniques, understanding how women and men’s behaviours toward urban farming methods change the universal urban agriculture paradigm, and challenging designers and urban planners to advantage both genders and promote fairness and inclusion through implementation and practice.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Okeke FO, Eziyi IO, Udeh CA, Ezema EC. City as habitat; Assembling the fragile city. Civ Eng J 2020;6(6):1143–54. doi: https://doi.org/10.22997/cq.2020.03108736.

[2] M. Goldstein, J. Bellis, S. Morse, A. Myers, and E. Ura, “Urban agriculture—a sixteen city survey of urban agriculture,” Environ. Law Clin., vol. 1, no. 1, 2011, Accessed: Mar. 12, 2022. [Online]. Available: https://www.researchgate.net/publication/237237115_The_impact_of_urban_agriculture_on_the_household_and_local_economies.

[3] El Khateeb El Khateeb, S. Samah, Shawket Shawket, IM, Indy. A new perception; generating well-being urban public spaces after the era of pandemics. Developments in the Built Environment 2022. doi: https://doi.org/10.1080/09538794.2022.2093873.

[4] Shawket Shawket, IM, Indy. Feminist Non-functional Empowerment in Urban Spaces: An Empirical Study on New-Cairo, Egypt. Advances in Science. Technology and Innovation 2022.

[5] Chisetti C, Quaratto F. Green Technologies and Environmental Productivity: A Cross-sectoral Analysis of Direct and Indirect Effects in Italian Regions. Ecol Econ Feb. 2017;132:1–13. doi: https://doi.org/10.1016/j.ecolecon.2016.10.007.

[6] Guo M, Nowakowska-Grunt J, Gorbanov Y, Egorova M. Green technology and sustainable development: Assessment and green growth frameworks. Sustain. 2020;12(16). doi: https://doi.org/10.3390/s12164991.

[7] Mougeot L. Urban agriculture: Definition, presence, potentials and risks. Grow Cities, Grow Food Urban Agric Policy Agenda 2000.

[8] J. B. Kirkpatrick and A. Davison, “Home-grown: Gardens, practices and motivations in urban domestic vegetable production,” Landsc. Urban Plan., vol. 170, no. December, 2016. pp. 24–33, 2016, doi: 10.1016/j.landurbplan.2017.09.023.

[9] Montefiore M. ‘Interrogating the ‘productive’ home gardener in a time of pandemic lockdown in the Philippines’. Food Folks. Foodways 2020;216:25–20. https://doi.org/10.1007/s10021-013-9694-8.

[10] Wilkins JL Challenges and Opportunities Created by the COVID-19 Pandemic. J Nutr Educ Behav Jul. 2020;52(7):669. doi: https://doi.org/10.1016/j.jneb.2020.05.005.

[11] R. Lal, “Home gardening and urban agriculture for advancing food and nutritional security in response to the COVID-19 pandemic,” Food Security, vol. 12, no. 4. Springer, pp. 871–876, Aug. 01, 2020, doi: 10.1007/s12571-020-01058-3.

[12] Kumar BM, Nair PKR. The enigma of tropical homegardens. Agrofor Syst 2004;61–62(1–3):135–52. doi: https://doi.org/10.1300/J033v04n01_0173.

[13] van Heezik Y, Freeman C, Porter S, Dickinson KJM. Garden Size, Householder Knowledge, and Socio-Economic Status Influence Plant and Bird Diversity at the Scale of Individual Gardens. Ecosystems Dec. 2013;16(8):1442–54. doi: https://doi.org/10.1007/s10021-013-9708-0.

[14] Zasada I, Weltlin M, Zoll F, Rasmussen SL. Home gardening practice in Pune (India), the role of communities, urban environment and the contribution to urban sustainability. Urban Ecosyst 2020;23(2):403–17. doi: https://doi.org/10.1007/s10458-020-09826-1.

[15] Salick J, Brown WL, Posey D. Home Gardens and Agrobiodesity. Econ. Bot. 2006;60(3):304. https://doi.org/10.1007/s11353-006-0034-0.

[16] Odebose S. Assessment of home gardening as a potential source of household income in Adinyele local government of Oyo state. Niger J Hort Sci Sep. 2006;11(1):47–55. doi: https://doi.org/10.4314/nhs.v11i1.1308.

[17] Makinde OO. The Effects of Physical and Social Characteristics on Residents’ Perception on Neighbourhood Quality in the Urban Environment. J Human, Earth, Futur Sep. 2020;1(3):122–45. doi: https://doi.org/10.2970/JHEF.2020.010357.

[18] Krishnan S, Nandwani D, Smith G, Kankarta V. “Sustainable Urban Agriculture. A Growing Solution to Urban Food Deserts” 2016:325–40.

[19] Poulsen MN, Neff RA, Winch PJ. The multifunctionality of urban farming: perceived benefits for neighbourhood improvement. Local Environment 2017;22(11):1411–27. doi: https://doi.org/10.1080/09660422.2017.1357685.

[20] Baur J. Campus community gardens and student health: A case study of a university garden. J. Community Health 2019;44(4):741–6. doi: https://doi.org/10.1007/s10909-018-0821-5.

[21] W. L. Shaw, R. M. Smith, J. W. Johnston, and S. C. Flanagan, “Promoting edible landscapes,” Urban Agriculture in peri-urban agriculture. Food and Agriculture Organization of the United Nations,” 2007.

[22] R. Vacnna and D. G. Deans and D. G. Deans. The effects of Environmental and Social Characteristics on Neighbors' Perceptions of Local Quality in the Urban Environment. J Human, Earth, Futur Sep. 2020;1(3):122–45. doi: https://doi.org/10.2970/JHEF.2020.010357.

[23] Poulsen MN, Neff RA, Winch PJ. The multifunctionality of urban farming: perceived benefits for neighbourhood improvement. Local Environment 2017;22(11):1411–27. doi: https://doi.org/10.1080/09660422.2017.1357685.

[24] Baur J. Campus community gardens and student health: A case study of a university garden. J. Community Health 2019;44(4):741–6. doi: https://doi.org/10.1007/s10909-018-0821-5.

[25] W. L. Shaw, R. M. Smith, J. W. Johnston, and S. C. Flanagan, “Promoting edible landscapes,” Urban Agriculture in peri-urban agriculture. Food and Agriculture Organization of the United Nations,” 2007.

[26] Poulsen MN, Neff RA, Winch PJ. The multifunctionality of urban farming: perceived benefits for neighbourhood improvement. Local Environment 2017;22(11):1411–27. doi: https://doi.org/10.1080/09660422.2017.1357685.

[27] Baur J. Campus community gardens and student health: A case study of a university garden. J. Community Health 2019;44(4):741–6. doi: https://doi.org/10.1007/s10909-018-0821-5.

[28] W. L. Shaw, R. M. Smith, J. W. Johnston, and S. C. Flanagan, “Promoting edible landscapes,” Urban Agriculture in peri-urban agriculture. Food and Agriculture Organization of the United Nations,” 2007.

[29] Poulsen MN, Neff RA, Winch PJ. The multifunctionality of urban farming: perceived benefits for neighbourhood improvement. Local Environment 2017;22(11):1411–27. doi: https://doi.org/10.1080/09660422.2017.1357685.

[30] Baur J. Campus community gardens and student health: A case study of a university garden. J. Community Health 2019;44(4):741–6. doi: https://doi.org/10.1007/s10909-018-0821-5.
[33] Mayrhofer R. Co-creating community gardens on untapped terrain – lessons from a transdisciplinary planning and participation process in the context of municipal housing in Vienna. Local Environ 2018;23(12):1207–24. doi: https://doi.org/10.1080/13549839.2018.1541345.

[34] Whitburn J, Linklater WL, Milfont TL. Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. Environ Behav Aug 2019;51(7):767–810. doi: https://doi.org/10.1177/0014482519827100.

[35] Furness WW, Gallaher CM. Food access, food security and community gardens in Rockford, IL. Local Environ Apr 2018;23(4):414–30. doi: https://doi.org/10.1080/13549839.2018.1426061.

[36] Fulford S, Thompson S. Youth Community Gardening Programming as Community Development: The Youth for EcoAction Program in Winnipeg, Canada. Can. J. nonprofit Soc. Econ. Res. 2013;4(2). doi: https://doi.org/10.22230/ciser.2013v4n2a145.

[37] Cruz-Cárdenas J, Oleas NH. Private Urban Garden Satisfaction and Its Determinants in Quito, Ecuador. SAGE Open 2018;8(1). doi: https://doi.org/10.1177/2158244017756247.

[38] Diduck AP, Raymond CM, Rodela R, Moquin R, Boerchers M. Pathways of learning about biodiversity and sustainability in private urban gardens. J Environ Plan Manag May 2020;63(6):1056–76. doi: https://doi.org/10.1080/09640568.2019.1633288.

[39] Gray L, Guzman P, Glowa KM, Drevno AG. Can home gardens scale up into movements for social change? The role of home gardens in providing food security and community change in San Jose, California. Local Environ Feb 2014;19(2):187–203. doi: https://doi.org/10.1080/13549839.2013.792048.

[40] Sofo A, Sofo A. Converting Home Spaces into Food Gardens at the Time of Covid-19 Quarantine: all the Benefits of Plants in this Difficult and Unprecedented Period. Hum Ecol Apr 2020;48(2):131–9. doi: https://doi.org/10.1007/s10745-020-00147-3.

[41] Mitchell R, Hanstad T. Innovative Approaches to Reducing Rural Landlessness in Andhra Pradesh: A Report on the Experience of the IKP Land Activities. Seattle: WA Rural Dev. Inst; 2008.

[42] Howard PL. “Gender and social dynamics in swidden and homegardens in Latin America” 2006:159–82.

[43] Shawket, IM, Indjy, Elkhateeb El Khateeb, S, Samah. Redefining Urban Municipal Housing in Vienna. Local Environ 2018;23(12):1207–24. doi: https://doi.org/10.1080/13549839.2018.1541345.

[44] Cruz-Cárdenas J, Oleas NH. Private Urban Garden Satisfaction and Its Determinants in Quito, Ecuador. SAGE Open 2018;8(1). doi: https://doi.org/10.1177/2158244017756247.

[45] Fulford S, Thompson S. Youth Community Gardening Programming as Community Development: The Youth for EcoAction Program in Winnipeg, Canada. Can. J. nonprofit Soc. Econ. Res. 2013;4(2). doi: https://doi.org/10.22230/ciser.2013v4n2a145.

[46] Diduck AP, Raymond CM, Rodela R, Moquin R, Boerchers M. Pathways of learning about biodiversity and sustainability in private urban gardens. J Environ Plan Manag May 2020;63(6):1056–76. doi: https://doi.org/10.1080/09640568.2019.1633288.

[47] Gray L, Guzman P, Glowa KM, Drevno AG. Can home gardens scale up into movements for social change? The role of home gardens in providing food security and community change in San Jose, California. Local Environ Feb 2014;19(2):187–203. doi: https://doi.org/10.1080/13549839.2013.792048.

[48] Diduck AP, Raymond CM, Rodela R, Moquin R, Boerchers M. Pathways of learning about biodiversity and sustainability in private urban gardens. J Environ Plan Manag May 2020;63(6):1056–76. doi: https://doi.org/10.1080/09640568.2019.1633288.

[49] Kock N, Hadaya P. Minimum sample size estimation in PLS-SEM: The inverse least squares approach. Int J Appl Nonlinear Sci 2016;2(3):200. doi: https://doi.org/10.1504/IJANS.2016.077025.

[50] Kock N, Caskins L. Simpson's paradox, moderation and the emergence of quadratic relationships in path models: an information systems illustration. Int J Appl Nonlinear Sci 2016;2(3):200. doi: https://doi.org/10.1504/IJANS.2016.077025.

[51] Garcia MT, Ribeiro SM, Germani ACCG, Bógus CM. The impact of urban gardens on adequate and healthy food: A systematic review. Public Health Nutrition 2018;21(2):416–25. doi: https://doi.org/10.1017/S1368946217002944.

Further Reading

[52] Ong M, Baker A, Aguilar A, Stanley M. The meanings attributed to community gardening: A qualitative study. Heal Place Sep 2019;59. doi: https://doi.org/10.1016/j.healthplace.2019.102190.

[53] Garcia MT, Ribeiro SM, Germani ACCG, Bógus CM. The impact of urban gardens on adequate and healthy food: A systematic review. Public Health Nutrition 2018;21(2):416–25. doi: https://doi.org/10.1017/S1368946217002944.

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