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Impact of urban farming technology on urban community in Malaysia

(Impak teknologi pertanian bandar kepada komuniti bandar di Malaysia)

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Keywords**:** urban farming, urban community, household spending, impact

Abstract

Urban farming roles and functions have evolved due to the revolution in health and nutrition intake by humans. Urban farming has been used as one of the food sources to beautify houses and at the same time to suit the needs of changing lifestyles. Factors such as urbanisation, urban poverty and limited agricultural land have become pushed factors for urban farming. Around 76% of the Malaysian population are estimated to live in urban areas. Among them are people in the Bottom 40 category, with a household income of less than RM4,360 per month. It is estimated that between 50% and 70% of their income is spent on food, which has led them to be categorised as 'urban poor'. Urban farming is seen as an ideal approach to overcome this scenario. Therefore, this study was aimed at identifying the effectiveness of urban farming in reducing the cost of household expenses. A combination of qualitative and quantitative approaches were carried out through the use of a questionnaire, focus group discussion (FGD) and face-to-face interviews. Four urban farming technologies, aquaponics, fertigation, hydroponics and vertical farming have been commonly used by the urban farming community. Out of these four, aquaponics has been the most popular because it is the most efficient of all the technologies. This study revealed that urban farming had benefited the urban community as well as create awareness through the supply of nutritious vegetables to households, improve the appearance of the housing compounds and reduced household expenses. There was a significant reduction of RM66 per month on average which signified a positive impact on reducing household expenses. Meanwhile, the factor analysis showed that respondents had focused on the advantages of the implementation of the urban agricultural approach.

Introduction

The process of urbanisation has led to the migration of the population and concentrated in urban areas. In general, the population of the cities in the world have increased by 500,000 with an average annual increase of 2.4% (2000 – 2018). It is estimated that around 1.7 billion people chose to live in urban areas, which is equal to one million people in every city around the world. The population of the cities is expected to grow until 2030 (United Nations 2018).

According to the Department of Statistics, (Anon. 2019), the population of

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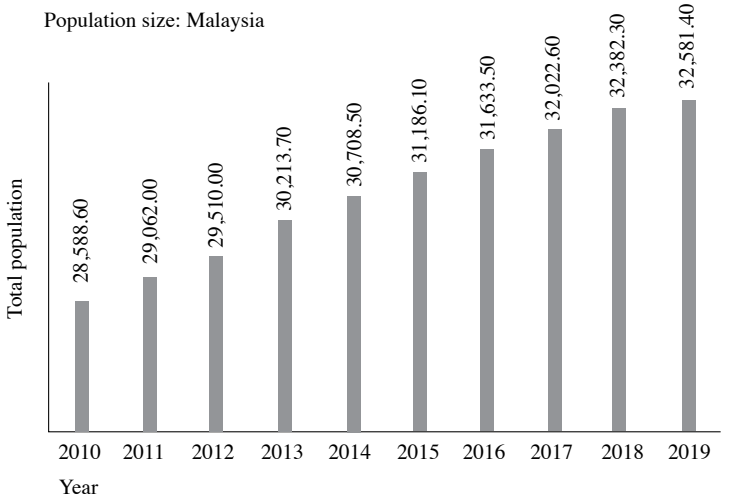
Malaysia increased from 32.4 million in 2018 to 32.6 million in 2019 (*Figure 1*). From the total population, 16.8 million (51.5%) were men and 15.8 million were women. The total working group in Malaysia was 14.9 million in 2019. The majority (70%) of the people are between 15 and 64 years old, followed by children aged 0 to 14 years old (23.3%) and 65 years and above (6.7%). Overall, the number of senior citizens aged 60 and above is 10.6% (Anon. 2019). Most of the senior citizens were retired but still active in social activities.

In general, about 19 cities and town areas in Malaysia are classified as urban with more than 100,000 people (World Bank 2015). Majority of the people in the urban areas live in housing estates that consists of landed properties and high-rise condominiums. It is estimated that around 76% of the total population live in urban areas (World Bank 2020). Most populations are concentrated in coastal zones on the West Coast of Peninsular Malaysia where mega cities are located, such as Kuala Lumpur, Shah Alam, Putrajaya, Johor Bharu, Ipoh and Penang Island (Chee et al. 2017). The populations of Kuala Lumpur (1,453,975), Shah Alam (481,654), Putrajaya (92,600), Johor Baharu (802,489), Georgetown (222,200), Ipoh (673,318) and Seremban (474,691) were according to the World Population Review (2019).

Statistics showed that about 56% of the population in the urban areas was comprised of the Bottom 40 (B40) income group. Some households living in this location were earning less than RM2,537 a month (Denison 2016). This group spent between 50 and 70% of their income to buy food that caused them to face the 'urban poor' phenomena (Von Braun 2008). To overcome this situation, the government of Malaysia has introduced various strategies and incentives. One of the initiatives was through the concept of urban farming. According to the State of Households II 2014 report, which was published by the Khazanah Research Institute (KRI), 94.6% of all households in urban areas spent their income mostly on food than on any other items. This was supported by data from the Malaysian Adult Nutrition Survey 2014 which pointed out that the consumption of vegetables by adults from urban areas was greater than their counterparts from rural areas (Nur Shahida et al. 2015).

Urban farming is an agricultural practice that applies environmentally friendly technologies and systems to



Source: Anon. (2019)

Figure 1. Population Statistics Malaysia (2010 – 2019)

crops and livestock (Rafiqah and Aziz 2015). Urban farming is integrated into the urban ecosystem for providing food to the surrounding population. Indirectly, transportation and energy costs can be reduced as food sources are located nearby. Mlozi Malongo (1996) defined urban farming as "an initiative to address the economic crisis that contributes to household income, food resource availability, employment and market opportunities for the related agricultural sector in the urban economy". By implementing urban farming, human capital and resources such as energy can be optimised through reduced food transportation cost because they were within the same area. All in all, urban farming can be seen as an integrated approach which is not the only source of fresh food but also as a mechanism of social integration, economic development and environmental sustainability (McEldowney 2017).

The agriculture sector has been recognised as the third engine of economic growth, besides the manufacturing and service sectors. Thus, the government has established many initiatives and introduced many policies that could enhance this sector. For example, under the National Agriculture Policy (NAP) (2011 – 2020), crop production activities have been given special attention to ensure food security, as well as enhance the economic development. The NAP promotes and supports urban agriculture in Malaysia indirectly. The policy emphasised on the use of more modern and dynamic technologies which are flexible and suitable to be used in limited spaces such as urban and peri-urban areas. This initiative aims to increase the production of vegetables and fruits for local community, as well as to reduce the household expenses through self-gardening (NAP 2011). The concept of urban farming is very relevant to city communities who are living in high-rise buildings. Currently, many condominium-style homes and apartments are built with no space for planting. Growing vegetables in the yard have long been practiced but only for personal use.

The concept of urban farming is not new to many cities in the world. Many cities have their own concept of urban farming. The cities create a better linkage between urban farming and food systems. Some examples of urban farming in the cities are Aero farm (Newark, USA), Agricool (Paris, France), BIGH Farms (Brussels, Belgium), Bites (Phoenix, USA), Bowery Farming (New York Metro area, USA), Fresh Direct, (Abuja, Nigeria), GrowUp Urban Farm (London, United Kingdom), Liv UP (Sao Paulo (Brazil), Pasona Urban Ranch (Tokyo, Japan), RotterZwam (Rotterdam, The Netherlands) and Sustenir Agriculture (Singapore). The concept of the food systems in the cities have proven that urban farming could overcome the urban poor issues, as well as increase the food in the crop production systems. However, the application of urban farming is relatively new in Malaysia (Noriah et al. 2017). People in the high-rice condominiums, for example, plant food crops for self-consumption or potted plants for landscape.

In response to these scenarios, this study was conducted to evaluate the effectiveness of urban farming community programmes, as well as to see the factors that encourage the participation of city communities in this programme. The data were collected through a set of structured questionnaires using the targeted sampling method. Process measurement was carried out using three approaches: face-to-face interviews, focus group discussions and visits to urban farming sites in collaboration with the Putrajaya Corporation and the Kuala Lumpur City Hall (DBKL) under the urban farming programme.

Materials and methodology

This study was carried out to understand the phenomena and the effectiveness of the application of urban farming technologies on urban communities in the Klang Valley, Malaysia. The data were collected using the

combination of qualitative and quantitative methodologies. The qualitative research methodology aimed to provide futher information and justification.

The list of respondents were from government agencies including the Putrajaya Corporation, the DBKL and the Persatuan Lestari Alam. A total of 88 respondents who were involved in activities related to urban farming programmes around their homes, and nearby residential areas participated in this study. Besides, the respondents were willing and generously shared their time and thoughts to provide inputs for the study by participating in the focus group discussions. Currently, 16 urban farming community groups are established in the Klang Valley, Malaysia. The group consists of a head and residential members who jointly mobilised the urban farming programmes. The community areas are in Ampang, Bandar Tun Razak, Keramat, Putrajaya, Pandan Jaya, Pandan Perdana, Cheras, Setapak, Bangsar, Kepong and Kajang. In general, several related agencies, such as the Putrajaya Corporation (an agency under the Ministry of Federal Territories), the DBKL and the Department of Agriculture (DOA) Malaysia are responsible for monitoring the progress of this urban farming communities.

Descriptive analysis was used to describe the percentages for demographic profiles such as physical, intellectual, ethnic, implemented urban farming technologies, urban farming technologies, usage level, perceptions, problems as well as respondents' tendency towards urban farming practices. This was followed by Paired t-test analysis to determine whether there were any significant differences between sample means of household expenses before, and after they practice urban farming. Information required in the sample was measured twice (before and after), and both data measurements were used to make comparisons. Finally, factor analysis was carried out to identify the factors that encouraged them to implement urban farming near their homes.

Results and discussions

In order to determine the impact of urban farming technologies, some focus group discussions (FGD) were held involving urban community members from Ampang, Bandar Tun Razak, Keramat, Putrajaya, Pandan Jaya, Pandan Perdana, Cheras, Setapak, Bangsar, Kepong and Kajang. A total of 88 participants were involved in the FGD.

Socio demographic information

A descriptive analysis was used to identify the socio-demographic characteristics of the urban farming communities. This helped us to understand the social structure and social relations of the respondents in this study. In general, the urban farming activity was carried out on a part-time basis. The urban farming community programme was started in 2003. During the past 15 years, the participation of the city communities had shown an increasing trend. It had increased significantly in 2014 when the government intensified the programme with new incentives that included financial aids and subsidies. In fact, the highest participation was recorded in 2017 when the government held special campaigns and initiatives that led to the awareness of the city communities.

Most of the participants were men (60.2%) while the balance 39.8% were women (*Figure 3*). The majority of the participants (39%) were housewives or pensioners. Around 27% of the participants were working in the government sector, while some were involved in entrepreneur/ business (20%) and private sectors (13%). The activities were carried out in the morning and whenever free.

Most of the urban farming participants were Muslims with an average monthly income of at least RM2,833 which was in the Bottom 40 category (low-income households) (*Figure 4*). Their involvement was driven by their own interest in gardening and intention of producing their own food. The majority (29%) of the active

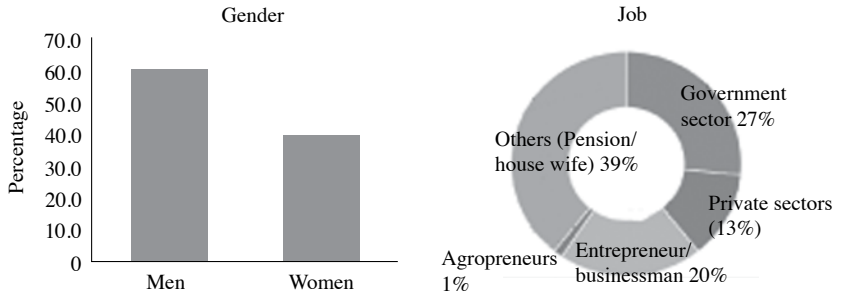


Figure 3. Gender and occupation of the urban farming community members

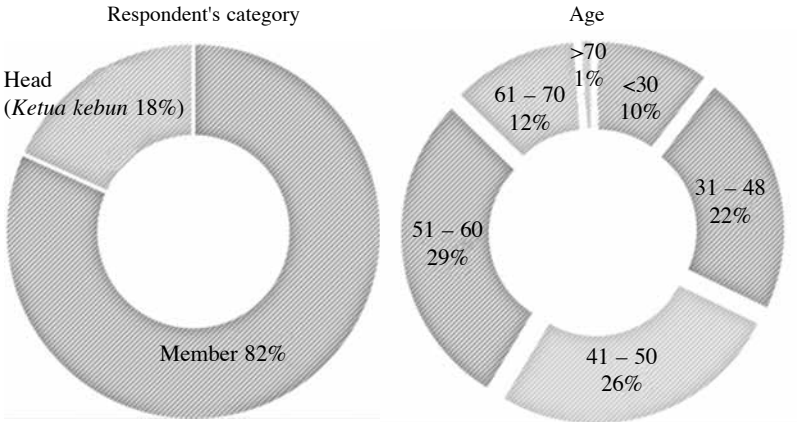


Figure 4. Respondent's category and age of the urban farming community members

participants were between 51 and 60 years followed by the age group 41 – 50 years (26%) and youths around 31 – 40 years. Only a small group of young people under the age of 30 were involved.

The government of Malaysia revitalised the urban farming programme in 2014 (*Figure 5*). It gained popularity among the urban communities especially in the low-cost housing areas. The programme was initiated and monitored by the DBKL and the Putrajaya Corporation, in collaboration with the DOA. The programme involved residents in urban and suburban areas with the cooperation and involvement of various relevant Departments and Agencies at the State and Federal levels. In total, there were 289 residential community locations registered with the DOA throughout Malaysia. There were four categories under the DOA registered urban farming programmes, namely, residential individuals, residential communities, schools, and institutions including public and private. The total number of these categories covered 1,738 locations across Malaysia. (Noriah et al. 2017). As of 2016, the total number of participants reached 38,506.

The DOA is the leading government agency responsible for monitoring the movement and collection of data and information on urban agriculture activities in Malaysia. The role of the DOA is more intensive on the technical aspects of agriculture, such as determining the appropriate soil pH, planting methods and training for the participants. Meanwhile, the Federal Agricultural Marketing Authority (FAMA) plays a role in recommending the high-demand crops in the market and also markets the agricultural produce. The programme was specially designed

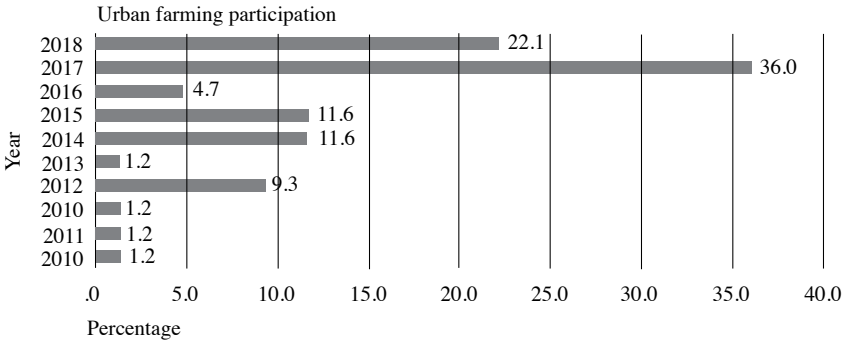


Figure 5. Percentage by first time year of participation in the urban farming community programmes

to benefit the community as well as to provide encouraging returns. The urban farming programme is also supported by the environment-friendly Non-Government Organisations (NGO), such as the Persatuan Lestari Alam, an entity registered with the Malaysian Registration Department, and the Kuala Lumpur Local Agenda Partners 21 (LA21). The NGOs are actively dealing with social and environmental issues.

In average, every urban farming community operates 0.25 acres of land for cultivating vegetables. Most of the community participants preferred to cultivate Brazilian spinach, chillies and salads. These were followed by herbs, okra, eggplant and mustard green. Through the urban farming programme, the government hoped to help urban dwellers, especially the urban poor to reduce their kitchen expenses by producing some of the vegetables they needed.

Integrating agriculture into urban planning and development is essential for sustainable development in various aspects of urban life and needs including food supply, environmental greening, water and urban waste-management, education and recreation. For the most part, Municipal Councils throughout the Klang Valley are responsible for organising and identifying as well as distributing the provisions under 'Community Grants' to the communities who were actively involved in urban farming activities. The one-offs allocation ranges from RM1,000 to RM10,000 under the concept of community involvement. Agricultural inputs were also provided such as seeds, planting materials, equipment and also advisory services for the cultivation and selection of vegetables. Around 88% of the community groups received a total of RM10,000 grant from the government. Only 12% were sponsored by non-government organisations as well as by private individuals.

Most of the respondents in this study knew about the urban farming community programme through their resident's community (54.5%), friends (31.8%), the Internet (25%), government agencies (20%) and reading materials (12.5%) (*Figure 6*).

Application of urban farming technologies

Traditionally, communities in the city used many approaches in planting the food crops or flowers in their home, such as in the pot. Urban farming may also include breeding and keeping of livestock, bees, aquaculture (fish farming), aquaponics (fish farming integrated with vegetables), and non-food products such as planting flowers and producing seeds.

Four common urban farming technologies were mainly used by city communities in Malaysia including aquaponics, aeroponics, hydroponics and vertical farming. Aquaponics technique combines the conventional aquaculture (raising aquatic animals such as fish, crayfish in tanks) with hydroponics

(cultivating plants in water) in a symbiotic environment. Hydroponics and fertigation have almost the same technique to ensure that the nutrients or fertilizers can be supplied directly to the roots of the plants and prevent root diseases. Hydroponics is one of the most popular techniques for quick and simple farming. The vertical farming technique refers to crops that are grown vertically. With this technique, more crops can be produced on a limited land space. This means more food can be produced by using less land (Molden 2007).

This study revealed that aquaponics was the most widely used method within the community and was seen as the most efficient approach (45.5%). This approach saved money and energy because no fertilizers and pesticides were required. Instead, the fish waste was used as fertilizer. Thus, it is a simple but effective method and low in maintenance. This was followed by hydroponics (25.0%), fertigation (23.9%) and vertical farming (21.6%) which were also implemented in their community gardens (*Figure 7*). To strengthen the study, cross tab analysis was also conducted. It was found that the majority (70%) of the participants who practiced aquaponics in the community were from private clusters. This was followed by hydroponics which was also widely used by private clusters. Meanwhile the cluster of pensioners and housewives practiced aquaponics (54.8%),

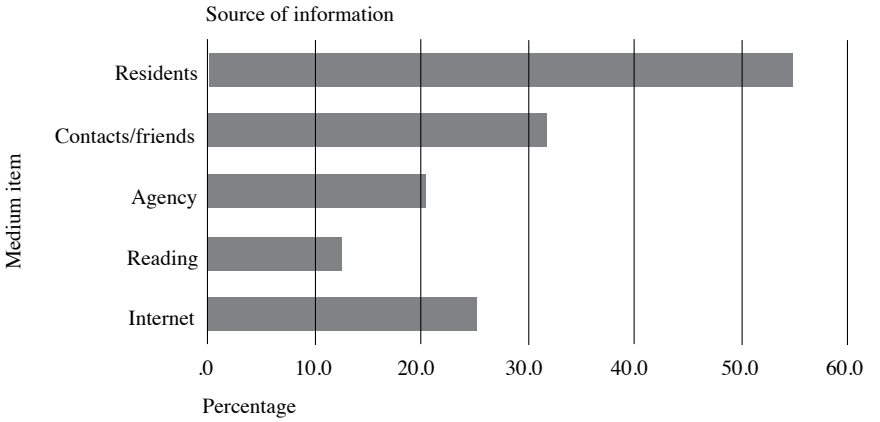


Figure 6. Information sources among urban farming communities

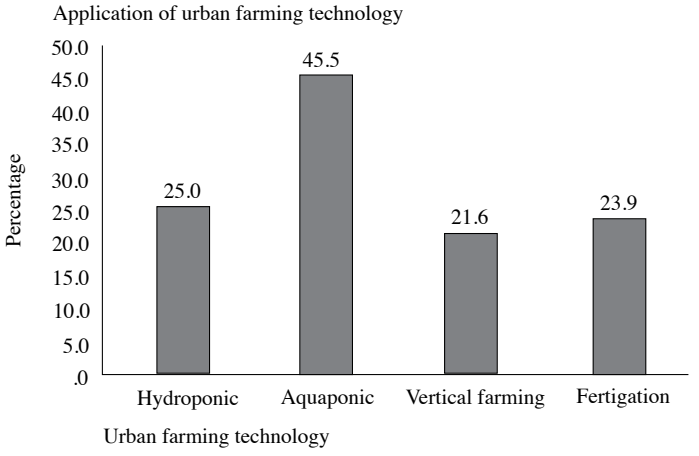


Figure 7. Application of urban farming technology by city communities

hydroponics (25.8%) and fertigation (38.7%) near their residential areas.

Impact of urban farming technology to the community

Urban farming technologies have been used in many cities in the world. For example, the city of Singapore has transformed many of its buildings into vertical farming and beautifying the building with new landscapes. Starting from 2008, green building has been mandatory in Singapore urban planning. Generally, urban farming can benefit the city communities through the following approaches:

i. Reduce the cost of household expenditure

Income level is a major factor in determining expenditure of individuals and households in meeting their basic needs. The low-income people relied on urban gardening due to lack of access to foods (McClintock et al. 2016). The goal of urban farming practices is to promote people living in high-rise buildings to plant food crops for their everyday use. Cost of local foods may be lower because of savings made from the reduced amount of storage, transport, middlemen, processing and packaging. The urban farming community programme was targeting public participation and food supply for low-income people as well as contributing to the reduction of household spending (Poulsen 2017)

Previous studies showed that urban framing demonstrates the potential to offer many advantages, including sustainable practices with holistic social benefits, economic and environmental issues to the public. It advocates, the main objective in this study. The analysis of the impact of urban farming technology to the community has been mostly concentrated on reducing household expenses involving vegetables or fruits.

This study revealed that the average expense of the participants before the urban farming community programme was recorded to reach RM145 per month. Analysis proved that there was a significant reduction of RM66 per month or RM792.80 per year on average which signified a positive impact of reducing household expenses of five people, especially for the urban poor who are the target users (*Table 1*). Thus, this study demonstrated that the urban farming community programme can reduce the cost of household expenditure (vegetables or fruits) by at least 45.56%.

In addition, almost all participants (70.5% agreed and 27.3% strongly agreed) agreed that urban farming practices could save their cost of daily kitchen expenses, especially for the purchase of fresh vegetables (*Figure 8*). This finding supported the paired t-test analysis, which proved that there was a positive impact of reducing household expenses among the urban farming communities.

Table 1. Paired t-test analysis

Paired samples test									
		Paired differences							
					95% Confidence Interval of the difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig. (2-tailed)
Pair 1	Estimated expenses for vegetables/ fruits (after-before)	–66.07143	141.32369	16.89141	–99.76887	–32.37398	–3.912	69	.000

ii. Improve landscape

Producing food in the city can improve the environment. As mentioned by Russo et al. (2017), an edible green infrastructure (EGI) approach can offer improved resilience and quality of life in the city. Different structures and components of urban farming technologies contribute to an edible green infrastructure with the main aim of contributing to urban food supply (World Watch Institute 2011). The most important factor is that urban farming community creates spaces where local residents can enjoy the natural green space.

Perception and sensation are unique sources for understanding and visualizing things (Demuth 2013). From the survey, respondents believed that urban farming could optimise the land use of vacant building areas and improve the landscape (55.6%) as well as promote organic farming (58%). The concept of urban farming was also seen as contributing to a healthier lifestyle (45.5%).

iii. Food supply

Many studies shed light on the role of urban agriculture in providing food to the population. Urbanisation progressively forms the challenge to food security, which is not a single global issue but instead, an outcome of the limitless food supply chains that mostly take food from rural areas. Hence, urban agriculture approach has the potential to increase access to healthy and nutritious food (Blaine et al. 2010). Furthermore, it encourages urban communities to grow and produce their food to meet their daily needs. The study found that almost all participants agreed that urban farming can contribute to the food supply for the whole household (*Figure 9*).

iv. Community engagement

Through the urban farming community programme, people in the community become more socialised and work together for the success of their programme. This situation can create an active relationship by working with community members to identify what is needed and what is desired. This process will include urban residents to meet and communicate among the residents who participate as well as create awareness among the neighbourhood. As stated by Holland (2004), urban farming goes beyond the scope of growing food and has valuable community development potential, serving as an agent of transformation for a community. This programme encourages local residents to work together without involving labour (*Figure 10*).

Encouragement for participation in the urban farming community programme

The reliability test was conducted on the factor items involved resulting in a Cronbach's Alpha value of 0.825. Four factors were obtained with an eigen value of more than 1.0 and a cumulative variance of 67.095% explaining the distribution of the factors. Four components were identified for the issues involved, namely, advantage, agency, infrastructure and technology. These

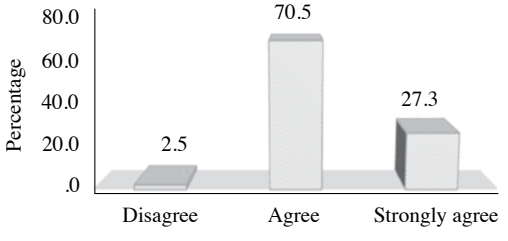


Figure 8. Urban farming community perception on saving daily kitchen expenses

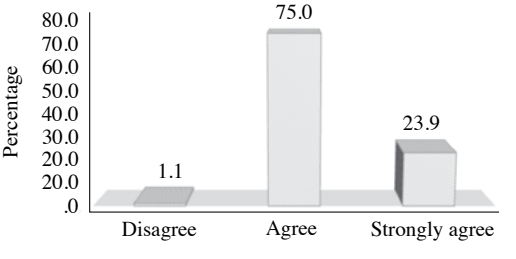


Figure 9. Urban farming community perception on food supply

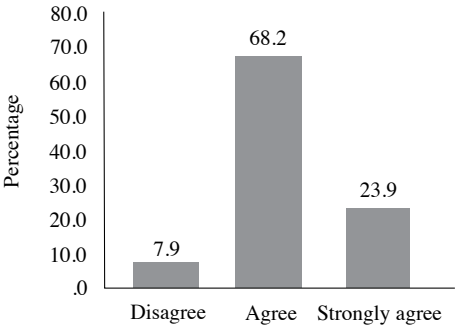


Figure 10. Perception on community engagement

monikers were used based on the statements of the problems in the questionnaire (*Table 2*).

Table 2 indicated the main factor which had been labeled as 'advantage' which comprised four items with eigenvalues (4.422). The item which gave the highest correlation value that had prompted the respondents to carry out the urban community agricultural programmes was the desire to decrease daily cost (0.836). This was followed by the existence of continuous related programmes (0.672), the increase of the quality of fresh products (0.669) and the existence of an association that would look after the welfare of respondents (0.654). The results showed that respondents had focused on the advantages of the implementation of the urban agricultural approach.

The second factor 'agency' also required a high variance ratio with eigenvalues (1.748). The items in this group comprised the encouraging advisory services given by departments and agencies (0.815), the excellent monitoring provided by agencies (0.800) and the reduction of labour (0.742). These items explained the role and contribution of the departments and agencies to ensure the continuity and smoothness of the programmes related to urban agriculture.

The third factor 'infrastructure' dealt with two items with eigenvalues (1.455), namely, areas that were suitable and conform to the criteria of the urban agriculture concept (0.885) and the sufficiency of infrastructure and equipment (0.771). The final factor 'technology' had a comparatively lower variance ratio to the others with eigenvalues (1.097). Among the items involved were a simple technology manual (0.699), demand and an encouraging product market for urban agriculture (0.602), a deep-rooted passion for urban agriculture (0.566) and accessibility to simple technology information on urban agriculture (0.550).

Table 2. Factors that encourage participants to involve in the urban farming community programme

Factor	Statement	Loading
Advantage	Reduce daily costs	0.836
	Existence of related continuous programmes	0.672
	Improvement of quality of fresh products	0.669
	Existence of an association to look after welfare of respondents	0.654
Agency	Advisory services from Department/Agency	0.815
	Good monitoring from local Department/Agency	0.800
	Decreasing labour and workers	0.742
Infrastructure	Areas that are suitable and conform to urban agriculture concept	0.885
	Sufficient infrastructure and equipment	0.771
Technology	Simple technology manual	0.699
	Encouraging demand and marketing of urban agricultural products	0.602
	In-depth passion for urban agriculture	
	Accessibility to simple information for urban agriculture	0.566
		0.550
Cumulative variance 67.095%		

Conclusion

These findings provided a good sign on the potential development of the urban farming technologies towards city communities in Malaysia. Urban farming is seen as supporting agriculture in a more economically oriented way. Besides, urban farming brings an affordable approach to minimise spending, especially for the B40 low-income group. In addition, the key factors that encourage respondents to implement urban farming community programmes are the components of benefits, namely, reducing daily costs, improving quality of fresh produce and also continuous programme existence and association.

The application of urban farming technologies provides the opportunity to improve the quality of life, drive the economy of the community and provide a positive impact as well as a good platform for community engagement. Consequently, this finding will be advantageous in addition to promoting a stronger community interdependence to create the sustainable urban farming community.

Looking ahead, this makes urban farming practices highly relevant and realistic to meet the needs of urban residents and should be reinforced in terms of government support and policy interventions to provide an even greater impact in the future. However, the success of establishing the urban farming community programmes is not a short time effort. It demands a comprehensive strategy from the government, the implementing agencies and the community awareness towards further enhancing national food sovereignty, whether in the present or in the future.

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Abstrak

Peranan dan fungsi pertanian bandar telah berkembang selari dengan revolusi amalan pengambilan makanan dan kesihatan manusia. Pendekatan pertanian bandar telah digunakan sebagai salah satu sumber makanan, instrumen untuk memperindah rumah, dan pada waktu yang sama untuk memenuhi perubahan gaya hidup. Faktor-faktor seperti urbanisasi, kemiskinan bandar dan tanah untuk pertanian yang terhad telah menjadi faktor pendorong kepada keperluan pertanian bandar. Sebanyak 76% penduduk Malaysia dianggarkan menetap di kawasan bandar. Antaranya adalah penduduk bandar kategori B40 dengan pendapatan isi rumah kurang dari RM4,360 sebulan. Dianggarkan bahawa antara 50% dan 70% daripada pendapatan mereka dibelanjakan untuk makanan, yang menyebabkan mereka dikategorikan sebagai 'miskin bandar'. Pelaksanaan program pertanian bandar dilihat sebagai pendekatan yang ideal untuk mengatasi situasi ini. Oleh itu, kajian ini bertujuan untuk mengenal pasti keberkesanan pertanian bandar dalam mengurangkan kos perbelanjaan isi rumah. Kombinasi pendekatan kualitatif dan kuantitatif dilakukan melalui penggunaan set soal selidik, perbincangan kumpulan fokus (FGD) dan temu bual bersemuka. Empat jenis sistem penanaman teknologi pertanian bandar yang biasa diamalkan oleh komuniti adalah seperti akuaponik, fertigasi, hidroponik dan vertical farming. Dari keempat-empat teknologi terlibat, akuaponik merupakan yang paling popular kerana dilihat sebagai paling efisien berbanding dengan teknologi lain. Kajian ini memberi pendedahan bahawa pendekatan pertanian bandar memberi banyak manfaat kepada komuniti setempat. Di samping mewujudkan kesedaran terhadap makanan berkhasiat melalui penyediaan sayur-sayuran segar kepada isi rumah, persekitaran perumahan mereka cantik dan menarik serta mengurangkan perbelanjaan isi rumah. Terdapat pengurangan yang signifikan dengan jumlah purata penjimatan perbelanjaan sebanyak RM66 sebulan dalam kalangan komuniti terlibat. Selain itu, analisis faktor menunjukkan bahawa responden telah menumpukan pada kelebihan pelaksanaan pendekatan pertanian bandar.