COMMUNITY ACCEPTANCE OF VERTICAL FARMING IN URBAN HIGH-DENSITY AREAS OF KUALA LUMPUR, MALAYSIA

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By

FATEMEH KALANTARI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Doctor of Philosophy

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DEDICATION

To those who have lighted a candle in my life in the darkness!

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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October 2019

Chairman : Osman Mohd Tahir, PhD
Faculty : Design and Architecture

Three significant challenges humanity faces today include the ever-expanding population, food security, and environmental degradation. It is, therefore, becoming increasingly necessary to study how to plant and grow crops via controlled environment agriculture inside multi-storied buildings in urban areas. This practice is termed Vertical Farming (VF). VF offers an innovative solution to the three challenges described above by allowing for farming in high-rise buildings in populous cities. Surprisingly, however, no VF structure has been built in Malaysia. Furthermore, there is a lack of existing academic research concerning the community acceptance of VF as new technology. Therefore, this study aims to assess the community acceptance of VF in the urban, high-density areas of Kuala Lumpur (KL). Eight factors of community acceptance were derived from the literature review, and the research model was designed along with the hypotheses and methodology to investigate these factors. The results obtained and presented in this research were based on interviews with experts as well as a questionnaire survey. The data collected from the 403 participants were used to form the survey. SPSS20 was used to analyze the data in Windows. Based on the findings, Concern, Location, Demographic characteristics, Value and Belief, Trust, Fairness, and Knowledge are factors that impact the Community Acceptance of VF in urban high-density areas in KL. Descriptive statistics indicate that more than 70% of the participants do not have any experience or knowledge of VF. However, 61.7% of participants would be open to VF development in urban high-density areas in KL. In general, participants agreed with the benefit factor followed by Location, Concern, and Value and Belief. In other words, residents in KL showed a low level of NIMBY syndrome. Age was the only significant factor with regard to the level of community acceptance. Overall, participants perceived the community as a more honest developer, but they believed the government as a suitable developer. Also, they often got very pessimistic toward private developers. There were significant positive correlations among factors, with the only negative correlation being concern and location. Furthermore, significant

positive correlations were found between factors and community acceptance. Only the correlation between concern and community acceptance was negative. The regression test presented the highest effect on community acceptance belongs to the Location, benefit & Concern factors, respectively. The findings of this study could positively contribute to knowledge generation, stakeholder network establishment, new project implementation, and improvement of the general perception of VF innovation. Additionally, the proposed theoretical framework offers a notable increase in the ability to predict intentions and subsequent behaviors of the community acceptance of VF.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENERIMAAN KOMUNITI TERHADAP PERTANIAN MENEGAK DI KAWASAN KEPADATAN TINGGI BANDAR KUALA LUMPUR, MALAYSIA

Oleh

FATEMEH KALANTARI

Oktober 2019

Pengerusi : Osman Mohd Tahir, PhD
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Tiga cabaran utama yang dihadapi oleh manusia pada masa kini adakah kadar penduduk yang semakin meningkat, keselamatan makanan, dan kemusnahan terhadap alam sekitar. Oleh itu, adalah menjadi satu keperluan kepada kajian terhadap kaedah penanaman dan pertumbuhan tanaman melalui pertanian persekitaran terkawal di dalam bangunan bertingkat di kawasan bandar. Amalan ini dikenali sebagai Pertanian Menegak (*Vertical Farming* (VF)). VF merupakan penyelesaian yang inovatif bagi menangani tiga cabaran utama yang telah disebutkan di atas dengan menawarkan pertanian di bangunan tinggi di dalam kawasan bandar yang pesat. Namun begitu, struktur pembinaan VF tidak terdapat di Malaysia. Tambahan pula, terdapat kekurangan penyelidikan akademik berhubung penerimaan masyarakat terhadap VF sebagai satu teknologi baru. Sehubungan dengan itu, kajian ini bertujuan untuk menilai penerimaan masyarakat terhadap VF di kawasan bandar, kawasan berkepadatan tinggi di Kuala Lumpur (KL). Terdapat lapan faktor penerimaan masyarakat telah diperolehi daripada sumber hasil kajian literatur, dan model penyelidikan yang telah dibina bersama dengan hipotesis dan metodologi untuk menyiasat faktor-faktor tersebut. Keputusan yang diperolehi dan disampaikan di dalam kajian ini adalah berdasarkan kepada temubual bersama pakar dan kajian soal selidik (borang survei). Data yang dikumpul dari 403 orang responden telah digunakan untuk membentuk kajian tersebut. SPSS20 telah digunakan untuk menganalisis data. Berdasarkan kepada hasil kajian, faktor Keprihatinan, Lokasi, Ciri-ciri Demografi, Nilai dan Kepercayaan, Amanah, Keadilan serta Pengetahuan adalah penyumbang utama kepada penerimaan masyarakat terhadap VF di kawasan bandar berkepadatan tinggi di KL. Statistik deskriptif menunjukkan bahawa lebih daripada 70% responden tidak mempunyai pengalaman atau pengetahuan mengenai VF. Bagaimanapun, 61.7% responden menerima pembangunan VF di kawasan berkepadatan tinggi di KL. Secara umumnya, responden bersetuju dengan faktor manfaat yang diperoleh dan diikuti oleh Lokasi, Keprihatinan serta Nilai dan

Kepercayaan. Dengan kata lain, penduduk KL menunjukkan sindrom NIMBY pada kadar yang rendah. Umur menjadi faktor penting yang berkaitan dengan tahap penerimaan masyarakat. Secara keseluruhan, responden melihat masyarakat sebagai pemaju yang lebih dipercayai, namun mereka yakin kerajaan merupakan pemaju yang sesuai. Selain itu, mereka sering menjadi mudah hilang kepercayaan terhadap pemaju swasta. Kesemua faktor-faktor telah menunjukkan korelasi positif yang signifikan, hanya korelasi di antara kebimbangan dan lokasi adalah korelasi negatif. Selain itu, korelasi positif yang signifikan didapati di antara faktor dan penerimaan masyarakat. Hanya korelasi di antara kebimbangan dan penerimaan masyarakat adalah korelasi negatif. Ujian regresi menunjukkan kesan tertinggi ke atas penerimaan masyarakat yang faktornya masing-masing adalah Lokasi, Faedah dan Keprihatinan. Hasil kajian ini secara positifnya dapat menyumbang kepada generasi yang berpengetahuan, rangkaian pihak yang berkepentingan, pelaksanaan projek baru, dan peningkatan persepsi umum mengenai inovasi VF. Sebagai tambahan, cadangan rangka kerja teori yang akan ditawarkan ini dapat memberi peningkatan ketara dalam keupayaan untuk memenuhi kehendak dan penerimaan masyarakat terhadap VF.

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Fatemeh Kalantari
January 2019

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

CA	Community Acceptance
DJT	Distributive Justice Theory
EFA	Exploratory Factor Analysis
KL	Kuala Lumpur
NIMBY	Theory of Backyard Motives
PA	Public Acceptance
TDI	Theory of Diffusion of Innovation
TPB	Theory of Planned Behaviour
UA	Urban Agriculture
UHDA	Urban High-density Areas
VF	Vertical Farming

CHAPTER 1

INTRODUCTION

1.1 Introduction

The first chapter presents the background and nature of this study. Essentially, it is about the importance of Vertical Farming (VF) and its role in enhancing the related community acceptance and improving the implementation of VF in the urban high-density areas of Kuala Lumpur. The present chapter casts light on the background and perspective of the research, and then it summarizes its research questions, objectives, research design, and the significance of the research.

1.2 Background of the Study

The world is faced with three major problems, most significantly the ever-growing population, food security, and environmental devastation (Indraprahasta, 2013; Pinstrup-Andersen, 2018). The global population is predicted to be nine billion in 2050 (Despommier, 2010; Perez, 2014; Voss, 2013). Urbanization and the quick rise of the population worldwide would change the city's form and landscape and eventually change the urban areas into the concrete jungles (Safikhani et al., 2014). This issue requests a redefinition of human's formal awareness of living and working in high-rise buildings in urban areas (Pinstrup-Andersen, 2018). Approximately 80 percent of these people live in city areas (Despommier, 2010). On the other hand, feeding such a population requires more farming endeavors and more land to plant agricultural products. However, the amount of productive land on earth is restricted. Even if all the land available in the world were used, still we would need more land. Moreover, about 80% of appropriate land for cultivating edible materials is used all over the globe (Feldmann & Hamm, 2015). The existing agricultural food print on the Earth is the size of the whole of South America. Then, we would need a land around the size of Brazil to feed these 9 billion people. Unfortunately, this arable land does not exist at all (Despommier, 2010, 2011; Voss, 2013). Livestock farming uses one-third of the free land worldwide (Despommier, 2010; Perez, 2014). Suparwoko & Taufani (2017) also explained that soil erosion due to drought and flood has already expressively reduced places where we can cultivate our foods. Agrochemicals, especially fertilizers, are used in every major farming organization without thinking about the location of the farm. The use of herbicides and pesticides has become normal in many places, especially in farms. The food that we eat travels for a long distance to access urban dwellers every day from the farm to our plate (Perez, 2014; Islam & Siwar, 2012). This unsustainable problem is mentioned as 'food miles,' and this issue is increasing massive amounts of greenhouse gases and other pollutants such as carbon dioxide and creating the agribusiness division of a major contributor to global warming (Al-Kodmany, 2018; Lu & Grundy, 2017).

Then one technique of this issue can develop urban agricultural (UA) attempts as an instrument to access sustainable development, food security, and control (Nadal, Alamús, et al., 2017). On the other hand, growing yields in a city like UA still have certain main problems related to heavy metals and dirty soils. Animal husbandry also causes so many problems, such as infection and noise pollution. Another key problem with any open-air farming process is concerned with seasons, whether located in the city or around it. Plant diseases and insect pests permeate farming lands and residential areas. They also transfer food production to the proximity of places where people live (Despommier, 2011). Therefore, UA, on its own, is not capable of removing our issues of existing food strategy. Still, it may critically balance other plans, which include environmental and socio-economic matters with the current food structure (Walters & Stoelzle Midden, 2018). Then another farming method needs to be substituted. From this perspective, we should come up with a volume of new agricultural knowledge with some positive effect on our nature, and that reduces the negative environmental effects of agricultural land, especially concerning soil degradation, biodiversity, protection of new dwindling water stores and greenhouse gas emissions.

The time is for studying how to grow our food by controlled environment agriculture in areas within cities. It is a time to research and implementation about VF, in which our food would be grown safety inside a tall or multi-storied building within a controlled environment. The food would be existing to city inhabitants. Therefore, there would be no need to send the food from the farm to our plate. The agricultural footprint can be seriously decreased by a VF concept that can be applied to every urban center regardless of location (Despommier, 2010). VF is a new idea in the world for producing food inside cities. Yet, there are some VF projects in several regions of the world, such as Japan, Korea, Singapore, and Europe. However, it is a new technology and not still known by many people and countries in the world. Yet, it is necessary to acknowledge that many VFs are not on their own sustainable, and investigation of their real effects lies at a novice level. When developing a successful plan of innovation such as a VF, making decisions, and enacting them, it is necessary to take into account the reception of novelties, assessments, or projects (Busse & Siebert, 2018). In the initial creative stage, how the public receives VF is a pre-requisite for the achievement of its spread. Innovative kinds of farming attempts will enter cities, and making food will occur no more ‘‘somewhere in the countryside’’. It would mean that novel sets of factors will face the inclusion of farming products in a city context. These role-players might include stakeholders, real-estate owners, city designers, architects and landscape planners, or city’s political leaders and dwellers who are significantly involved in the city. Perceiving and accepting VF can be considered as relevant to the satisfying presentation and use of VF in the social and spatial context of cities. ‘Acceptance’ in this environment represents the procedure or true nature of viewing something as sufficient, credible, or appropriate (Specht et al., 2016).

Moreover, during the past decade, the term ‘acceptance’ has been increasingly used both in research and everyday contexts for innovation or technology in numerous disciplines. Acceptance of new technology or new ideas is interchangeably referred

to as social acceptance, public acceptance, and local opposition, along with three dimensions (Community, Market, and Socio-political acceptance). It means for the success of a new project, for example, VF, people living in the city should accept VF as a new project, and their level of acceptance determines VF success in projects as an innovation.

1.3 Statement of Problem

By the year 2020, 70 percent of the Malaysian population will be living in cities. Nowadays, 68.2 percent of Malaysian people live in cities (City Hall of Kuala Lumpur, 2008). Urban residents in Malaysia have the problem of rising living costs, especially caused by a higher price of food provision, processing, and supply. An objective of the National Agro-Food Policy (NAFP) is to assure sufficient provision of healthy and secure food for the whole population in Malaysia (Rezai et al., 2016).

Moreover, according to the KL Structure Plan (2020), the population of KL is going to rise from 1.4 million to 2.2 million (Rezai et al., 2016). Besides, KL is regarded among the most crowded cities (population of 6891 persons per km^2). The Central Business District (CBD) of the city ringed by sky-scrapers (Aflaki et al., 2017; Benis et al., 2017; Maruthaveeran & van den Bosh, 2015). Based on the KL Structure Plan (2020), the shortage of land is the main issue in the City Centre of KL. According to that, the residential area covers 22.66%, and open space covers just 6.52% of the land use in KL (Figure 1.1).

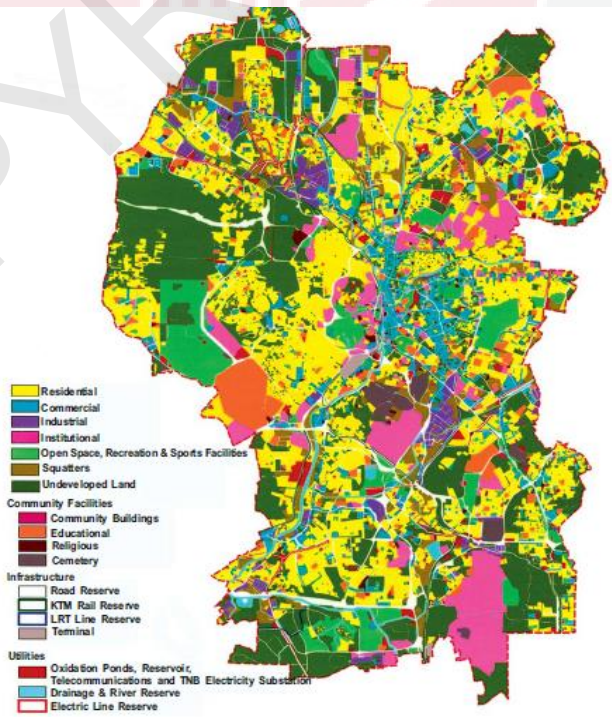

Figure 1.1 : Land use of Kuala Lumpur in the year 2000
(Source: City Hall of Kuala Lumpur, 2008)

Because of the fast growth of KL city which resulted in the disappearance of green lands, farming, and ex-mining areas were modified into residential, business and amusement areas and the local weather of the city zones altered the change of temperature, rain, climate-air pollution concerns (Hanisah et al., 2012).

Although urban farming has been a significant affair in recent years in Malaysia, a limited number of state organizations participated in the program. Agriculture in Malaysian cities is thus restricted due to a shortage of integrated development views. One goal of the National Agro-Food Policy (NAFP) is to make sure of the sufficient provision of safe and secure food for the whole population in Malaysia. Several state organizations have started to push urban residents to initiate food supply tasks such as the department of agriculture (DOA) and Universiti Putra Malaysia (UPM) (Rezai et al., 2016). It emphasizes the essentiality of the Malaysian urban policy-makers to pay more attention to the city. Considerable interest in farming inside the cities is shown by policymakers, state organizations, and scholars due to its effect on food security and poverty elimination in Malaysia. To this aim, VF is seen as a way of addressing the livelihood strategies of urban families.

As the structure plan of KL shows in 2020, the prospects and goal of KL as a globally recognized metropolis are to make KL as a city with a significant global and sub-global voice for the benefit of all residents, workers, tourists, and investors (City Hall of Kuala Lumpur, 2008). Thus, in 2008, the Physical Planning Department of Kuala Lumpur City Hall has begun Draft Kuala Lumpur City Plan 2020 (DKLCP 2020) with specific goals and policies to attain economic, social and environmental development simultaneously. A key goal is the development of urban green spaces has become a significant part of its urban city planning (Maruthaveeran & van den Bosh, 2015). To the best of my knowledge, the policy of KL has mentioned many plans and strategies for food security problems in KL (Aflaki et al., 2017; Benis et al., 2017; Maruthaveeran & van den Bosh, 2015; Rezai et al., 2016). Unfortunately, there is a lack of a strategic plan specific about the implementation of VF in KL. There is just some article in newspapers and journals and conceptual designs in private firms. Unfortunately, no project has been established as a VF in Malaysia until now.

Particularly, the growth of VF and related research has just newly emerged. The related volume of research on VF has mainly emphasized the recognition of its overall possible effects along with all aspects of sustainable city development in the light of the literature reviews and investigation of existing actual instances (Despommier, 2011; Specht, Siebert, et al., 2016; Thomaier et al., 2015). The presence of these discourses showed to be important because of the very limited amount of academic engagement with VF to this point has been largely technical, with little attention to theoretical concerns. Moreover, it was hypothesized that several characteristics concerning VF could cause the refusal of projects within a creative procedure. In the majority of cases, it is not first evident if society may accept the project or not. This society includes local actors or other stakeholders. It

would point to the emergence of creative goods, strategies, and procedures of VF potentially as a specific threat to those who want to extend, invest, or implement it.

To sum up, the creation of VF is broadly speaking at an initial level of investigation and development. A series of open questions exist that include uncertainties about the economic potential in technological questions and those on social acceptance, which makes the subject a truly fruitful topic for investigation via acceptance. As a result, acceptance has newly turned into a key topic in investigating the agricultural method of farming and sustainability science (Busse & Siebert, 2018). For instance, according to Specht et al. (2015), authorities knew about the lack of acceptance as the main demerits of indoor farms.

According to the present researcher, most Community Acceptance (CA) studies focused on different topics such as wind energy (Guo et al., 2015; Hall et al., 2013; He et al., 2013; Khorsand et al., 2015; Liu et al., 2016; Songsore & Buzzelli, 2014; Walter, 2014; Yuan et a., 2015), renewable energy (Lim & Lam, 2014; Liu et al., 2013; Yazdanpanah et al., 2015), nuclear energy (Hong et al., 2013; Visschers & Siegrist, 2013; Wang & Li, 2016), carbon capture and storage (Batel et al.; Wennersten et al., 2015), forestry (Hemström et al., 2014; Maruthaveeran & van den Bosh, 2015; Olsen et al., 2012; Perini & Magliocco, 2014; Williams, 2014) and solar energy (Hanger et al., 2016) followed by some investigations on influencing factors or determinants of CA. To sum up, the innovation of VF has never been explored with an emphasis on the creative process itself from a sociological outlook (Specht et al., 2015; Specht et al., 2016). VF extensive perception and CA are the key preconditions for its achievement within a creative procedure. Recognizing and getting aware of the recognized acceptance criteria is needed for actors, implementers, investigators, and policymakers who desire to look into, introduce or develop VF projects (Specht, Siebert, et al. 2016).

1.4 Research Questions

In line with the stated problem in this study, the main research question was developed to ensure the exploration process: How is community acceptance of Vertical Farming assessed in urban high-density areas of Kuala Lumpur?

Sub Research Question 1: What are the factors of community acceptance of Vertical Farming in urban high-density areas of Kuala Lumpur?

Sub Research Question 2: What is the influence of the community acceptance factors on Vertical Farming in urban high-density areas of Kuala Lumpur?

Sub Research Question 3: What is the difference among these factors of community acceptance of Vertical Farming in urban high-density areas of Kuala Lumpur in terms of the level of agreement?

Sub Research Question 4: What are the relationship among these factors of community acceptance of Vertical Farming in urban high-density areas of Kuala Lumpur?

1.5 Research Objectives

The present research hopes to assess the community acceptance of Vertical Farming in urban highly populated areas of Kuala Lumpur.

Objective 1: To identify the factors of community acceptance of Vertical Farming in urban high-density areas of Kuala Lumpur.

Objective 2: To investigate the impact of community acceptance factors on Vertical Farming in urban high-density areas of Kuala Lumpur.

Objective 3: To assess the difference among community acceptance factors of Vertical Farming in urban high-density areas of Kuala Lumpur in terms of the level of agreement.

Objective 4: To determine the relationship among community acceptance factors of Vertical Farming in urban high-density areas of Kuala Lumpur.

1.6 The scope of the Study

This research covers only research on the CA of VF in urban high-density areas of KL. Other dimensions of Public acceptance (PA) as a market and socio-political acceptance are not considered in this study. The reason is that all efforts to make sense of such a descriptive study of CA is faced with the threat of ambiguity or overgeneralization if it is not somehow emphasized. Moreover, according to van Rijnsoever et al. (2015), the effect of socio-political acceptance and its interrelationship with other aspects of acceptance depend on the expected demand of the market (Market acceptance). In addition, market acceptance takes the role of consumers as those adopting technology (community acceptance). That is because products or services that manage to find a decent market demand are most probably maintained to spread through society (van Rijnsoever et al., 2015).

Consequently, due to understanding the socio-political reception, Market acceptance should be examined subsequently due to the understanding of the Market acceptance, initially, CA should be examined (Figure 1.2). To summarise, CA is the first and important element to examine any acceptance research study. So, this study focused on Community Acceptance as the foremost dimension of PA study.

Figure 1.2 : Conceptual Relationship between Dimensions of Acceptance Study

The reason why Kuala Lumpur was selected as the target setting is to the best knowledge of mine, the fact that city residents accepted VF-related issues in high-density urban areas that have not been studied so far. Furthermore, VF is developed in city-centers faced with the limitation of land and growing population. According to the global standard, KL is a high-density city around the world (Aflaki et al., 2017). This study investigates only the urban high-density areas of KL due to the growing population issue and limitation of land in these areas.

1.7 The significance of the Study

In urban areas, the space-related and social distance between urban residents and agriculture is increasing, and the majority of people have less experience or knowledge of cultivation (Specht et al., 2015). If seen from an environmental/psychological point of view, technological advancement is not viewed as detached from people. Instead, it is viewed as a socio-technical systemic approach in which technological progress and people are affecting mutually and making progress collaboratively. CA will be a primary factor in predicting the promises of a project. Seeking for CA in the operation of a project helps people to become part of the food center. In turn, this involvement will contribute to the program and motivates CA of this novel agricultural movement in cities. Such acceptance will be a catalyst to create a new life and bring back order and discipline to cities with the help of food systems (Feldmann & Hamm, 2015). How VF is perceived can be enhanced provided that projects make sensible use of its positive capabilities. Moreover, CA proved more effective when VF projects used a careful design method, went for an otherwise unutilized (rooftop) space or unoccupied building, and when they were financially independent (Specht, Siebert, et al., 2016). Benis & Ferrão (2017), recognized that cities must develop food for themselves as their collaborative role would affect the change. More participation by the public means a deeper sense of possession. Consequently, they will work collaboratively to observe farm success. In turn, this helps the program get expanded and attract public interest in this new agriculture movement in cities. If the community accepts the idea of VF in centers of urban areas, one expected long-standing advantage would repair many of the Earth's ecosystem problems. Then no harvests would fail by severe weather phenomena such as droughts, floods, and storms. Thus, VF creates a sustainable city environment which encourages the public to live in a safe and healthy environment, cleaner air, safe tap water, safe usage of public liquid waste, new work opportunities, and less abandoned lots and constructions. If these objectives are combined, the approach helps to global food safety, and we can make sure that international sustainability criteria of environmental compatibility and public acceptability are met (Suparwoko & Taufani, 2017). VF initiative shows great potential for the emergence of innovation. These investigations shed light on actual

practices or ways of removing the existing problems and hope to encourage creativity or repeat projects successfully conducted elsewhere in the world. New ideas are put forth with regard to their use, while questions of the introduction process are dealt with only afterward (Menezes et al., 2017; Specht, Zoll, et al., 2016). Some investigations focus on the social, contextual, and economic possibilities and restrictions of VF. In this case, creative ideas are viewed as complicated representing technological, institutional and social aspects. However, the creative aspect itself is only considered as a side effect (Menezes et al., 2017; Specht, Zoll, et al., 2016). The present research intends to fill the existing gap and create a better awareness of VF. Selective issues have been included in the literature that attests to the probable problems in the innovation procedure. The overall view of VF as not real agriculture can also negatively influence its practical performance and diffusion (Specht, Siebert, et al., 2016). So far, VF innovation has never been examined to emphasize the creative process from a sociological point of view (Specht, Zoll, et al., 2016; Yang & Campbell, 2017).

Agriculture still plays a significant role in Malaysia. Then, city farming in Malaysia is a means of sustainable development capable of providing food or other relevant services inside or in the suburbs of the city (Islam & Siwar, 2012). Although KL is a modern and advanced city, urban growth, especially that of green areas in cities, has turned into a central component of city planning (Aflaki et al., 2017; Hanisah et al., 2012; Maruthaveeran & van den Bosh, 2015). However, VF requires particular care as a technique for either very populated cities with restricted areas for land-based farming or metropolises, not limited to enough farming land to form local food systems (Menezes et al., 2017; Specht, Zoll, et al., 2016). Endmost, it appears that the concept of a vertical farm in a high- density city-center of such urban areas as KL could solve a lot of real issues related to food production and environmental degradation (Benke & Tomkins, 2017; Suparwoko & Taufani, 2017). VF in Malaysia has the benefit of seasonally wet and warm weather. They can easily minimize cooling and heating water, consumption of indoor temperature and artificial light, and also has a plentiful amount of natural resources, including long hours of sunlight and enough water from daily rain to cultivate. VF also has involved it as technical elements within the superior phenomenon of urban or local agriculture with different food production (Pinstrup-Andersen, 2018). Not only do vertical farms act as hospitals for food, but they also serve ecologically to the city, which strongly needs novelties in infrastructures such as the management of waste and hydrological services, water management systems, and so on. Both flexibility and stability are catered for by vertical farms. The 21st-century urbanism has produced certain conditions that challenge our cities. Vertical farms can be one solution (Pinstrup-Andersen, 2018).

Therefore, a conceptual model of VF acceptance is needed that can be used in innovation development (new as perceived by citizens, investors, and policymakers) developed or enacted to foster social and/or environmental circumstances (Huijts et al., 2012). Furthermore, research findings explained here provide evidence for benefits not only to those managing and/or investing in VF large projects but also to

policymakers, advisors, designers, landscape architects, architects, and other stakeholders.

1.8 Definitions of Key Terms

The following section provides a theoretical and operational definition for the terms, which are the focus of this study.

1 Food Security

UN Food and Agriculture Organization describes food security as an ideal case in which everyone can always physically, socially and economically access adequate, healthy and nourishing food to satisfy the food requirements and interests to live an active and healthy life (Besthorn, 2013; Hosseini et al., 2017). Similarly, in this research, food security is described as "always having both physical and economic access to adequate food to satisfy dietary needs for a productive and healthy life."

1.8.1 Urban Agriculture (UA)

UA is defined as the industry which produces, processes and sells food and fuel, primarily in response to routine needs for urban users on land or water spread in the urban and peri-urban regions, utilizing many techniques of production, consuming and re-consuming natural supplies and city wastes to supply a variety of products and livestock (Ahlström & Zahra, 2011; Benis & Ferrão, 2017; Cahya, 2016; Pölling et al., 2016). In the current study, UA is farming within cities as a socio-economic movement primarily located on the edge of a city area or in intra-urban open spaces and the suburban areas. It is included in the city's financial and ecological system. UA is defined as the production of harvest and livestock properties within urban areas.

1.8.2 Vertical Farming (VF)

It is the technique of farming that includes high loads of food growth in skyscrapers, which accelerates development and planned production possible through managing nutrient solution of crops and the growth context according to hydroponics and aeroponic modes. Using cutting-edge greenhouse methods, such constructions might be employed as a production system that provides for obtaining healthy crop production via controlling and monitoring growth environment, elements required in growing crops with the help of different sensors (Banerjee & Adenaeuer, 2014; Benke & Tomkins, 2017; Kim et al., 2014; Pinstrup-Andersen, 2018; Thomaier et al., 2015). In this study, VF is a method used in farming that involves high loads of food growth in tall buildings that make rapid production and planned production possible through controlling contextual circumstances and nutrient solutions, via cutting-edge greenhouse methods. Plants, animals, fungi, or similar sorts of life are developed for food. Yet, fuel, fiber, or similar goods or services are provided by

artificially layering them vertically above one another and leave a little urban footprint and less water and energy resources.

1.8.3 Urban High-Density Area (UHDA)

Ellis' research (2004) indicated that residential development in the UK is taken as low density if there are fewer than 20 dwellings in each net hectare. In case this number is 30-40, it is taken as a medium, and when it exceeds 60 dwellings, it is reckoned as densely populated (TCPA, 2003). Low density in the US is characterized as 25-40 dwellings per net hectare. It is taken a medium if this number ranges from 40 to 60. When this number exceeds 110, it is taken as high density. Accordingly, based on the global standard, KL with approximately 60 persons per hectare of urban land-use is one of the high-density cities around the world (Aflaki et al., 2017; Maruthaveeran & van den Bosh, 2015). In this study, the urban high-density areas (UHDA) of KL is selected as a study area.

1.8.4 Community Acceptance (CA)

Community Acceptance points to how residents act either optionally or on obligation as the beneficiaries of technology. Local people, including residents and those employed, can complain about projects even when adequate socio-political or market acceptance has been catered. It is significant when the acceptance of a novel idea influences many actors (Van Rijnsoever et al., 2015). In this study, Community Acceptance means accepting a particular project by the local community in a well-defined location, particularly residents that have a significant influence on the process.

1.9 Organization of Thesis

The present research is divided into six chapters. Each chapter is introduced here:

Chapter one: Here, the background and perspective of the study are presented. Then it summarizes the research questions, objectives, research design, and significance.

Chapter two: This chapter lays out the literature review, where the study draws the theoretical framework in the light of a review of the related literature. It includes an analysis of the concept of VF and its technology, issues, and benefits besides the issue of UHDA around the world. The last part of the chapter focuses on CA in UHDA regarding VF and its related theories.

Chapter three: The present section explains the selected method of the study. The study utilizes a survey questionnaire and face-to-face interviews with experts as general approaches.

Chapter four: This chapter looks into the interview results as well as those of the survey on participants' opinions about the CA of vertical farming in UHDA of KL.

Chapter five: This chapter integrates and concludes all the findings of finalizing in the present study. It includes a conclusion, implications, and suggestions for further studies.

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