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**Environment and Sustainable
Development Program**

The Community Acceptance of Vertical Farming Using Hydroponic System in the Kingdom of Bahrain

Thesis Submitted in Partial Fulfilment of the Requirement for the Master Degree
in Environmental Science and Sustainability Development

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☐ Without making any changes to the thesis.

☒ After making the modifications attached with this decision.

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Abstract

Environmental deterioration, food security, and population expansion are the most critical challenges faced by humanity. One potential remedy for these pressing challenges is vertical farming (VF). In particular, VF is a type of indoor urban farming in which crops are grown in vertically stacked layers, on sloping surfaces, or in high-rise structures. Food security is a major priority for Bahraini officials. According to the 4th Derasat Forum, natural agronomical limitations, such as desert climate, groundwater shortages, and the utilization of agricultural land for urban development, result in low agricultural production. However, this study aimed to understand the key factors influencing community acceptance (CA) of VF using hydroponic systems (HS) in the Kingdom of Bahrain. A cross-sectional exploratory study was carried out during the period from September to October 2023. The survey was conducted online using Google Forms and was distributed through social media platforms. A total of 404 individuals responded to the survey, while 11 participated in the interviews. All interviews were conducted via online video calls on platforms like Microsoft Teams or Zoom from September to November 2023. Descriptive statistics were used to analyze the research data using IBM SPSS (version 25), and Cronbach's Alpha was used to assess the internal consistency and reliability of the survey for the five dimensions (44 items). The responses were summarized numerically using central tendency and statistical dispersion measures. Additionally, the frequency and percentage of the data were presented in graphical form to display, analyze, clarify, and interpret the results visually. In addition, descriptive statistics were conducted using IBM SPSS AMOS (Version 29). Structural Equation Modeling (SEM) was utilized to test the effects of benefits, concerns, beliefs, and location on CA for VF among the population of The Kingdom of Bahrain, to explore the effects of demographic variables on the CA. While benefits had a standardized weight of ($B=.12$ with $p<.001$), general beliefs have a statistically significant effect positive effect ($B=.088$, $p<.001$). Although benefits, concerns and general beliefs had statistically significant effects on CA, concern dimension had the strongest effects on CA ($B=.558$, $p<0.001$). The locations domain ($B=.402$, $p<.001$). The results showed that super and hypermarkets are the most accepted locations to establish VF in the Kingdom of Bahrain. Regarding the sociodemographic characteristics, there were no statistically significant effects for the demographic variables on the CA. Finally, this study highlights the role of VF in supporting Bahrain Vision 2030 and contributing to several UN SDGs, including Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation, and Infrastructure), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production), Goal 13 (Climate Action), Goal 15 (Life on Land), and Goal 17 (Partnerships for the Goals). These insights emphasize the potential of vertical farming to support Bahrain's food production goals and contribute to the Sustainable Development Goals (SDGs) if key community concerns are addressed. However, policymakers and stakeholders must address the concerns raised by the public to ensure the successful integration of VF technologies in Bahrain's urban planning strategies.

Dedication

To my mother who always encourages me, thank you for your constant care and great support, you have given me the moral support that gave me strength.

To my dear sister Nada, I thank you for all the support you have given me throughout my life.

To my family, all members of them.

To my second country, the Kingdom of Bahrain, and its citizens, thank you for your kindness and warm hospitality.

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List of Abbreviations

Not in My Backyard	NIMBY
Gulf Cooperation Council	GCC
Community Acceptance	CA
Vertical Farming	VF
Hydroponic System	HS
Sustainable Development Goals	SDGs
Greenhouse Gas	GHG
Carbon Dioxide.	CO ₂
Oxygen	O ₂
Heating, Ventilation, and Air Conditioning	HVAC
Social Adaptation Theory	SAT
Structural Equation Modeling	SEM
Standard Error	S.E.
Critical Ratio	C.R.
Probability Value	p-value

Standard Deviation

SD

Value Belief Norm

VBN

Chapter One

Introduction to the Study

- 1.1 Introduction
- 1.2 Research Problem
- 1.3 Research Questions
- 1.4 Research Aims and Objectives
- 1.5 Research Significance
- 1.6 Research Setting

Chapter One

Introduction to the Study

1.1 Introduction

Increasing population growth, food insecurity, and environmental degradation are among the most pressing challenges facing humanity today (Al Kodmany & Kheir, 2018). In response to these urgent challenges, vertical farming (VF) has been proposed as a sustainable and innovative agricultural solution. VF is a type of indoor urban farming in which crops are cultivated in high-rise buildings, on sloping surfaces, or in layers piled vertically (Pascual et al., 2018a). Moreover, VF has been designed for sustainable crop production. It operates under carefully selected and well-monitored conditions, which ensures optimum crop production year-round in a relatively small area (Pascual et al., 2018a; Ares et al., 2021a). Because it is implemented in controlled environments, plants are protected from pests and diseases, reducing the need for chemical pesticides and fungicides (Butturini & Marcelis, 2020).

VF incorporates various soil-less growing systems, most notably hydroponics, where plants grow in nutrient-rich water solutions (Resh, 2016; Pascual et al., 2018a). Other VF methods include aeroponics where roots are suspended in air and misted with nutrients and aquaponics, which integrates hydroponics with aquaculture in a symbiotic system (Beacham et al., 2019; Benke & Tomkins, 2017). While hydroponic systems (HS) is the most widely adopted system due to its scalability and ease of control, each VF method has unique advantages and challenges depending on the context (Pascual et al., 2018a).

However, VF still faces critical challenges in its development: profitability, environmental sustainability, and system standardization (De Oliveira et al., 2021). Additionally, many people are still unfamiliar with VF and its methods, which could hinder its global acceptance despite its promise (Sengodan, 2022; Kalantari et al., 2018).

VF is associated with several environmental benefits, including biodiversity preservation, waste reduction, and more efficient energy use in food production (Thomaier et al., 2015; Kalantari et al., 2018). Moreover, VF can reduce the need for land-intensive agriculture, allowing natural ecosystems to be restored while maintaining high food productivity per square meter (Kalantari et al., 2018).

Understanding community acceptance (CA) is increasingly recognized as a crucial factor in the adoption and success of VF initiatives. It is important to evaluate how the public perceives both the benefits and risks of VF systems (Ares et al., 2021a). Prior research has explored consumer concerns regarding environmental, social, and economic impacts of controlled environment agriculture (Jansen et al., 2016; Specht et al., 2016; Coyle & Ellison, 2017; Jürkenbeck et al., 2019; Specht et al., 2019; Grebitus et al., 2020; Yano et al., 2021; Ren et al., 2016; Sanyé-Mengual et al., 2016; Sanyé-Mengual et al., 2019; Broad, 2020; Milestad et al., 2020).

One major factor influencing CA is the individual's environmental value system. According to Martin & Czellar (2017), lack of environmental concern is among the main barriers to sustainable development. Biospheric values, which reflect one's deep connection to the environment, often predict eco-friendly behavior and support for green innovations like VF. These values are shaped by environmental identity and influence decision-making across many contexts (Martin & Czellar, 2017).

Furthermore, people hold different environmental worldviews such as ecocentric (nature-centered), apathetic (indifferent), and anthropocentric (human-centered) which significantly shape their support or rejection of sustainable technologies like VF (Gifford, 2011; Naess, 1973; Washington et al., 2017).

Another important social factor is place attachment, which refers to the emotional and functional bonds people form with their surroundings (Yuan et al., 2015; Menezes et al., 2017; Rezaee & Kalantari, 2019). CA is not only about acceptance of the technology but also its perceived fit within a specific local context. Planning literature emphasizes the need for emotional and cultural sensitivity when introducing technological innovations (Huijts et al., 2012; Walker et al., 2016; Gross, 2016).

The concept of “Not In My Backyard” (NIMBY) also plays a role, where individuals may support VF in principle but oppose its implementation near their homes due to concerns about aesthetics, noise, or property value (Devine, 2015).

In the case of Bahrain, food security is now a priority area for policymakers, as emphasized in the 4th Derasat Forum (DERASAT, 2021). However, the Kingdom of Bahrain suffers from limited agricultural capacity due to a harsh desert climate, groundwater scarcity, and structural constraints. Local agricultural production in Bahrain has consistently declined, contributing less than 20% to the country's food needs, which has increased reliance on imports (Abdulla, 2019; Hassen & Bilali, 2019). Most crops grown in Bahrain require large amounts of water, posing a threat to water security, and the country indirectly imports water through food imports a concept known as virtual water (Allan, 1998; Hoekstra & Hung, 2002). According to recent data, over 80% of fruits and vegetables consumed in Bahrain are imported annually, and the food import bill exceeded \$1.4 billion in 2018 (FAO, 2021;

Bahrain Food Monitor, 2023). This further complicates sustainability efforts in Bahrain's food system.

Therefore, VF technology is particularly suitable for Bahrain, as it directly addresses key challenges like water scarcity, desertification, and urban food dependency (Pascual et al., 2018a; Al Kodmany & Kheir, 2018). However, it is essential to investigate community acceptance (CA) to assess the social feasibility of VF projects in the country.

1.2 Research Problem

The agricultural sector in Bahrain faces severe environmental and structural challenges, including low rainfall, poor soil quality, high salinity in groundwater, and limited arable land due to the country's small size. These constraints have led many farmers and agricultural professionals to abandon the sector. While traditional agriculture struggles under these conditions, modern technologies such as VF using HS offer a promising solution for Bahrain's agricultural challenges. The success of VF using HS may depend on how well it is accepted by the local community. Although limited research has examined CA of VF in the context of Bahrain, global studies such as those by Specht et al. (2016) and Ares et al. (2021a) have shown that public perception and awareness play a critical role in the adoption of innovative agricultural technologies. However, no empirical evidence currently exists to confirm whether CA is a significant barrier in Bahrain. This research aims to fill this gap by investigating the level of awareness, perceptions, and potential concerns among Bahraini residents regarding VF using HS.

1.3 Research Questions

The research question for the current study is:

- 1) What are the factors that impact community acceptance (CA) of vertical farming (VF) using the hydroponic system in the Kingdom of Bahrain?

1.4 Research Aims and Objectives

The research aim of the current study was to identify the fundamental factors that impact Community Acceptance (CA) of Vertical Farming (VF) using Hydroponic Systems in the Kingdom of Bahrain.

The objectives of the study were to:

- 1) Evaluate the impact of environmental, economic, and social benefits and concerns on the CA of VF as a tool for sustainable urban food production in the Kingdom of Bahrain.
- 2) Identify the effect of the general belief on the CA of VF.
- 3) Identify the most accepted location to establish a vertical farm in the Kingdom of Bahrain.
- 4) Identify the sociodemographic characteristics that affect the CA of VF.

1.5 Research Significance

Ensuring the success of the agricultural sector is important in many countries. However, limited natural resources, low rainfall, and poor soil quality discourage sustainable food production in many regions that focus on water and area. In

response, developed countries have successfully implemented advanced agricultural technologies to enhance food security. One such technology, widely recognized for its efficiency in food production, is VF using HS.

VF is widely accepted as a primary source of food produced in many developed countries. VF using HS can address many challenges. However, this widespread popularity is counterbalanced by the lack of relevant research.

The identified gap in the literature served as a key motivation for this study. To the best of our knowledge, no prior research has specifically addressed the contextual acceptability community acceptance of vertical farming using the hydroponic system in the Kingdom of Bahrain.

The results of this study will provide valuable insights for decision-makers in the Kingdom of Bahrain across the economic, environmental, tourism, and social sectors by helping them understand and identify the key factors influencing the community acceptance of vertical farming. This, in turn, can help restore confidence in the agricultural sector, enhance food security, support sustainable development goals, and create job opportunities in various educational and technical fields for both citizens and residents of Bahrain.

1.6 Research Setting

To answer the research question, the study was conducted in the Kingdom of Bahrain, which is one of the Arab countries located in the Arabian Gulf, specifically Western Asia Fig. 1. It is situated 30 kilometres west of the Arabian Peninsula. The latitude and longitude coordinates of the islands of Bahrain range between 25-45 degrees and 25-26 degrees north, respectively. Bahrain consists of 33 islands (Al

Jazi, 2020). According to the Kingdom of Bahrain's National Portal (2023), the total population of Bahrain was 1,577,059.



Fig. 1: Map of the Kingdom of Bahrain (Al-Jazi, 2020).

The significant location of The Kingdom of Bahrain leads to easy access to trade routes between East Asia and Europe. Its advantageous location in the Arabian Gulf makes the Kingdom of Bahrain being a hub for rivalries in both politics and local/global trade. The Capital, Northern, Southern, and Muharraq Governorates make up the Kingdom of Bahrain Fig. 2. (Al-Jazi, 2020).

The northern and western coastal regions of Bahrain are known for their fertile soil and have historically been the primary areas for agriculture, particularly date palm cultivation. However, these areas face increasing pressure due to urban expansion and the depopulation of rural communities (Shun Culture, 2024).

Agricultural land in Bahrain constitutes approximately 10.25% of the total land area, with arable land accounting for about 2.7% (World Bank, 2025; The Global Economy, 2025). Historically, the cultivated area has declined from around 6,000 hectares before independence to approximately 1,500 hectares, a reduction attributed to rapid urbanization, limited land availability (Knoema, 2024). The majority of agricultural plots are small, ranging from a few square meters to 4 hectares(Knoema, 2024).

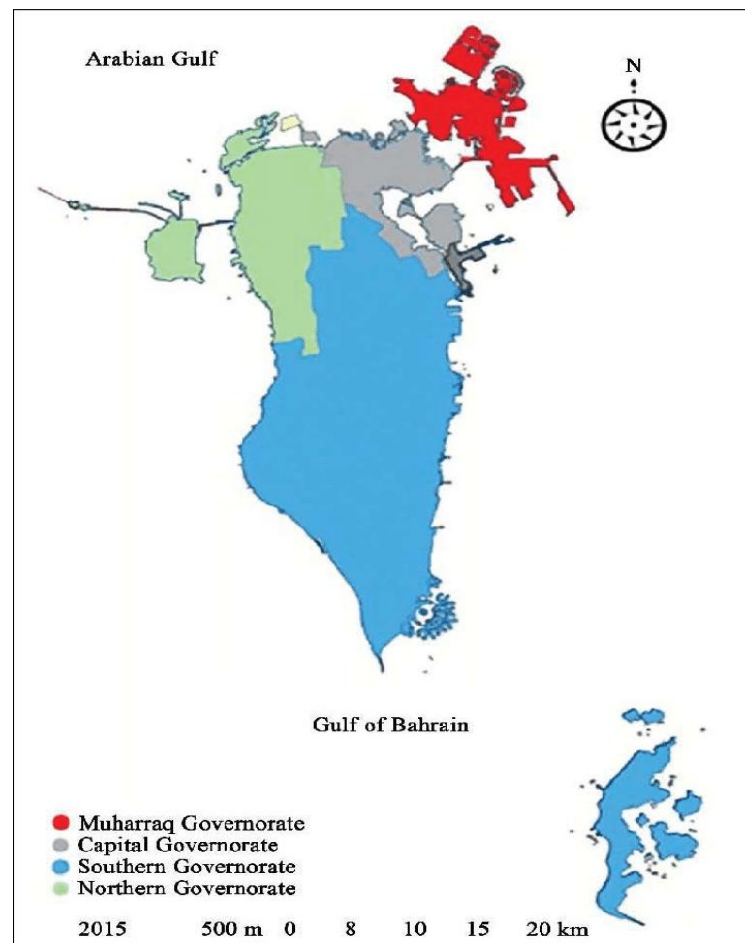


Fig. 2: Governorates of the Kingdom of Bahrain (Abbas, 2022)

1.7 Research Terminologies

Vertical Farming (VF):

Definition: Vertical farming is an innovative method of growing crops in vertically stacked layers within controlled indoor environments, such as high-rise buildings or repurposed urban spaces. It incorporates soilless techniques including hydroponics, where plants grow in nutrient-rich water; aeroponics, where roots are suspended in air and misted with nutrients; and aquaponics, which combines plant cultivation with aquaculture in a mutually beneficial system (Benke & Tomkins, 2017; Beacham et al., 2019; Pascual et al., 2018 b; Resh, 2016).

Hydroponic System (HS):

Definition: A hydroponic is a system that grows plants without the need for soil, by using mineral nutrient solutions in an aqueous solvent directly feeding plants through their roots (Resh & H.M,2016).

Community Acceptance (CA):

Definition: The Community Acceptance Definition is the degree to which a new technology, concept, or practice is accepted and supported in the community. Perceived benefits, cultural values, and social norms often influence it (Gifford, 2014).

Food Security (FS):

Definition: Food security is the condition that all people, at all times, have access to enough, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO,2019).

Sustainable Development Goals (SDGs)

Definition: The Sustainable Development Goals (SDGs) are a set of objectives and goals designed to create a more prosperous and better future for all people from the implementation of the 17 goals of the SDGs. The SDGs address the problems the world is now confronting, including inequality, starvation, global warming, environmental degradation, peace, and equity (United Nations, 2015).

Survey

Definition: A survey is a research tool used to collect data from a specific population or group of individuals. It consists of a series of structured questions designed to measure attitudes, behaviors, opinions, or characteristics. Surveys are

commonly used in social and behavioral sciences to gather quantitative data for statistical analysis (Creswell & Creswell, 2018).

Likert Scale

Definition: The Likert Scale is a psychometric scale commonly used in questionnaires to measure respondents' attitudes or opinions on a symmetric agree–disagree scale for a series of statements. It usually ranges from 1 (strongly disagree) to 5 or 7 (strongly agree), allowing researchers to quantify subjective data (Joshi et al., 2015)

Interviews

Definition: Interviews are a qualitative research method used to collect in-depth insights into participants' thoughts, experiences, and perceptions. They can be structured, semi-structured, or unstructured, and are often used to explore complex attitudes and social dynamics that cannot be captured through surveys alone (Longhurst, 2010).

Chapter Two

Theoretical Framework and Literature Review

- 2.1 Literature Review
- 2.2 Theoretical Framework
- 2.3 Research Hypotheses

Chapter Two

Theoretical Framework and Literature Review

2.1 Literature Review

2.1.1 Factors Influencing Community Acceptance

The factors influencing CA have not been thoroughly studied, and it can be challenging to identify differences between pertinent causes in various political and cultural contexts. Numerous studies show several factors that impact CA (Hanger et al. 2016). Consequently, it is important to consider CA from many perspectives and provide a comprehensive picture of the acceptance regions. It provides a means of assessing acceptability that remains applicable across different levels of development (Busse & Siebert, 2018). All factors mentioned in previous literature have been from diverse fields, and objects were reviewed to comprehend the factors involved in CA that affect VF. Fig.3. presents all the CA factors corresponding to our current research.

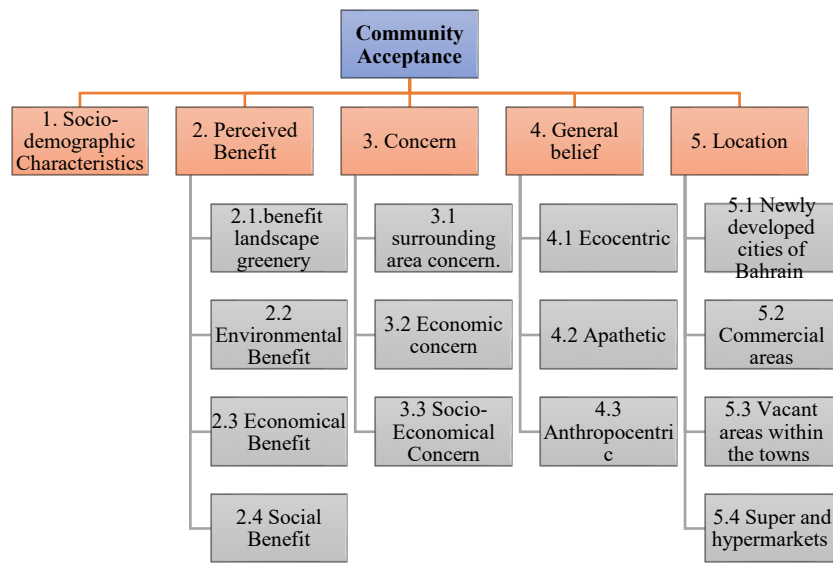


Fig. 3: The CA framework of VF in The Kingdom of Bahrain

2.1.2 Demographic Characteristics Dimension

Socio-demographic characteristics have a particular influence on socioeconomic aspects such as living conditions, family income, home size, age, gender, education, social status, and personal experience (Brunsting et al., 2015; Jaeger et al., 2015; Mouta et al., 2016). Moreover, various research has revealed the influence of socio-demographic characteristics including gender, age, education, and salary on people's perceptions of agriculture (Kalantari & Akhyani, 2021). Accordingly, it is important to avoid the mistaken assumption that experiences or practices from one country can be directly transferred to another. As noted by Brunsting et al. (2015) and Jaeger et al. (2015), what is practiced in one setting may not be achieved in the contexts of other settings (Brunsting et al., 2015; Jaeger et al., 2015).

2.1.3 The Benefit Dimension

Perceived benefits from the community are considered key factors affecting the level of acceptance of VF (Khorsand et al., 2015; Schumann, 2015; Yazdanpanah et al., 2015; Bearth & Siegrist, 2016; Wang & Li, 2016). In particular, perceptions and social acceptance during the early stages of new agricultural technologies are crucial preconditions for their successful proliferation. For instance, governing authorities may fail to implement innovations if they believe these innovations either lack societal benefits or pose significant hazards (Specht et al., 2016). Moreover, participants' overall perceptions whether positive or moderate also depend on perceived local benefits, even though global perceptions strongly indicate local acceptance (Khorsand et al., 2015; Schmidt & Donsbach, 2016).

The major perceived benefits of acceptance can be categorized into three components: environmental, economic, and social (Specht et al., 2016). These

categories were also adopted by Kalantari and Akhyani (2021), who added a fourth component landscape greenery which combines social, economic, and environmental advantages. For example, transforming underutilized urban spaces into vibrant green areas enhances relaxation, happiness, and social benefits (Despommier, 2011). Additionally, VF can host community events that foster social interaction and cohesion (Santo et al., 2016). The aesthetic appeal of VF contributes to urban visual and cultural enhancement by creating architecturally distinctive landmarks that support tourism by attracting visitors and residents alike (Thomaier et al., 2015). Thus, VF integrates green spaces into cities, offering social advantages that extend beyond agricultural production (Despommier, 2011).

Agriculture contributes approximately 24% of global greenhouse gas (GHG) emissions (Waheed et al., 2018). Shifting from outdoor to indoor farming may have significant ecological impacts. Urban green spaces help mitigate the urban heat island effect and improve air quality through oxygen (O₂) and carbon dioxide (CO₂) exchange between indoor farms and their surroundings (Waheed et al., 2018; Elghonaimy & Albadal, 2021). Moreover, reducing or eliminating the use of fossil fuel-powered farm equipment in outdoor farming, such as tractors, through VF deployment could substantially lower GHG emissions (Birkby, 2016). Since VF crops are typically transported short distances from production to market, they further reduce emissions compared to traditional farming, where produce often travels hundreds or thousands of miles (Birkby, 2016).

A study covering 1990 to 2014 highlights the positive impact of decreasing CO₂ emissions by shifting outdoor farming to indoor farming combined with renewable energy implementation (Waheed et al., 2018). However, VF generally requires more energy than conventional farming, which benefits from natural sunlight and typically consumes less energy. The high energy demand of VF often lessens its

environmental friendliness (Stanghellini & Katzin, 2024). Therefore, the overall environmental benefit of VF depends greatly on the energy source and amount needed to maintain controlled growing conditions, despite obvious advantages in water efficiency and pesticide reduction (Stanghellini & Katzin, 2024). Additionally, consumers tend to prefer natural, safe, and pesticide-free locally grown food over conventional alternatives (Feldmann & Hamm, 2015; Jürkenbeck et al., 2019).

Literature indicates that participants highly value the benefits of VF due to its energy efficiency, smaller land use, year-round crop production, and reduced fuel consumption compared to conventional farming (Kalantari et al., 2017; Jürkenbeck et al., 2019). VF technology is particularly suitable for regions suffering from water scarcity, land degradation, desertification, soil pollution, and harsh climates (Pascual et al., 2018a; Al-Kodmany & Kheir, 2018). Bringing agriculture indoors through VF reduces the surface land required for farming, enhances urban food production, and allows previously cultivated land to revert to its natural state. Moreover, VF increases crop yields per acre and diversifies food products (Kalantari et al., 2018). Economically, urban VF creates more jobs, produces high-value food, enables continuous harvesting, and improves food security (Thomaier et al., 2015; Kalantari et al., 2018; Elghonaimy & Albadal, 2021). However, VF products can be more expensive due to energy, technology, infrastructure, operational costs, market positioning, consumer perception, and supply chain factors (Stein, 2021; Stanghellini & Katzin, 2024).

Furthermore, food prices are directly linked to oil prices, rising as oil becomes scarcer (Kalantari et al., 2018). The adoption of renewable energy may offset some costs and eventually make VF more economical, potentially reducing product prices (Waheed et al., 2018).

Hydroponic systems, a key technology in VF, do not require soil or sunlight, which may impact plant nutritional value (Treftz et al., 2016). However, findings about nutritional differences between hydroponically and soil-grown produce remain mixed. Some studies indicate higher nutrient quality in conventionally grown plants, others favor hydroponic produce, and some find no significant difference (Treftz et al., 2016). VF is designed for sustainable crop production under carefully monitored conditions, ensuring optimal year-round yields in limited space (Pascual et al., 2018a; Ares et al., 2021b). Indoor farming also protects plants from pests and diseases, reducing the need for fungicides and pesticides (Butturini & Marcelis, 2020).

Socially, VF projects contribute to community well-being by enhancing emotional, mental, and spiritual health, fostering social interaction, and providing educational opportunities in agriculture (Kalantari & Akhyani, 2021). VF drives innovation by integrating engineering and advanced technologies, merging disciplines such as agriculture, engineering, environmental science, and computer technology (Kozai, 2018). It demands specialized skills related to hydroponics, aeroponics, and aquaponics (Despommier, 2011). Consequently, VF is anticipated to significantly support sustainable urban food production (Despommier, 2011).

2.1.4 Concern Dimension

Compared to experts, laypeople often focus more on potential disasters and health risks associated with novel agricultural technologies, such as VF (Ren et al., 2016). Risk perception plays a critical role in shaping public acceptance, frequently acting as a strong predictor of how VF is received by communities (Schumann, 2015; Yazdanpanah et al., 2015; Bearth & Siegrist, 2016; Specht et al., 2016; Wang & Li,

2016). Therefore, understanding consumer perceptions of VF including both its perceived benefits and risks is essential (Ares et al., 2021).

Perceived risks associated with VF can be categorized into environmental, social, and economic dimensions. Environmentally, the high energy consumption of VF facilities, particularly due to mechanical systems like heating, ventilation, and lighting, raises concerns about sustainability and carbon footprint, especially if renewable energy sources are not used (Ren et al., 2016; Martin et al., 2019). Socially, the influx of farmworkers from diverse cultural backgrounds can create integration challenges and increase demand for local services such as healthcare and education, potentially leading to social tensions within communities (Holmes, 2013; Portes & Rumbaut, 2001; Massey et al., 2002).

Economically, VF requires significant upfront investment and ongoing operational costs, including infrastructure, technology, and energy expenses (Despommier, 2010; Stein, 2021). Moreover, land and building costs in urban areas tend to be high, further increasing financial risk (Sanyé-Mengual et al., 2016). While automation reduces labor requirements a potential economic benefit it may also lead to job losses in traditional farming sectors, contributing to local economic disruption (Benke & Tomkins, 2017; Despommier, 2011). This economic tension is compounded by the competitive pressure VF places on local farmers, who may struggle to maintain market share against technologically advanced but costly urban farms (Banerjee & Adenaeuer, 2014; Kozai et al., 2019; Kalantari et al., 2017).

Consumer skepticism toward VF products, often driven by concerns over new technologies and food safety, also represents a risk to widespread acceptance (Deliza & Ares, 2018; Siegrist & Hartmann, 2020). Additionally, mechanical systems integral to VF such as Heating, Ventilation, and Air Conditioning (HVAC) units

generate noise and vibrations that could affect urban residents' comfort and wellbeing, especially if mitigation measures are not implemented (Ruan & Yin, 2021; Martin et al., 2019).

Waste management presents another challenge, as VF generates both organic and non-organic waste streams, such as packaging materials, growth substrates, and water treatment by products; necessitating sustainable practices to minimize environmental impacts (Sanyé-Mengual et al., 2015; Gómez et al., 2019; Tong et al., 2020).

Financial viability remains a significant hurdle; studies show that indoor VF operations often struggle to be profitable due to high energy and labor costs, resulting in premium pricing that limits market access compared to conventional farming products (De Oliveira et al., 2020; Horomia et al., 2021; Stein, 2021). However, ongoing investments from venture capitalists signal confidence in the long-term potential of VF despite short term financial challenges (Stein, 2021).

In summary, while VF offers promising ecological and social benefits, its success depends on effectively managing perceived and actual risks across environmental, social, and economic domains. Projects solely driven by commercial interests without addressing these multidimensional challenges tend to face lower acceptance from communities (Specht et al., 2016).

2.1.5 General Belief Dimension

One of the biggest challenges to the sustainable development of our world, according to the United Nations Millennium Declaration, is a lack of regard for nature (Märting & Czellar, 2017). This worry is a reflection of a lack of desire to act

and learn how to act in a way that is environmentally friendly. Therefore, although current research indicates that having biospheric values may encourage eco friendly behavior, the development of a biospheric value orientation may be significantly influenced by an individual's environmental identity. Specifically, these values and beliefs can influence personal choices in a range of situations and fields (Märtn & Czellar, 2017). Moreover, based on the social adaptation theory (SAT), which is widely represented in sociological and scientific literature, our overall values facilitate our adaptation to the environment. Essentially, this reflects a mindset in which personal values develop into overarching principles or fundamental life goals (Terziev & Stoyanov, 2016). These values function as guiding principles in our lives and play a crucial role in shaping our perceptions and behaviors toward environmental attitudes (Hemström et al., 2014). Similarly, value orientations and basic beliefs pertain to our values in specific aspects. Consequently, values and beliefs represent key underlying factors influencing assessments of social acceptability (Hemström et al., 2014). There are many types of adaptation, such as socioeconomic and organizational, among others (Terziev & Stoyanov, 2016). As a result, people judge phenomena based on their benefits to ecosystems or the biosphere (Märtn & Czellar, 2017). To further elaborate, three primary views can be used to understand how members of a community generally behave about environmental issues: Ecocentric, apathetic, and anthropocentric. People's interactions with their surroundings and their support for environmentally friendly activities, like VF, are shaped by these viewpoints (Gifford, 2011; Naess, 1973; Washington et al., 2017).

According to Value Belief Norms (VBN) theorists, egoistic, altruistic, and biospheric values are particularly relevant to human behaviour in stopping environmental damage (Rhead et al., 2015).

In contrast, the concept of the Ecocentric approach argues the individual's behaviour and nature for its own sake and thinks that all living things have the right to exist whether biological or physical elements regardless of how useful they are to us (Gray et al., 2018). This viewpoint promotes the preservation of natural ecosystems and highlights the interdependence of natural ecosystems. So, human needs, like those of other species, are subordinate to the requirements of the Earth as the sum of its ecosystems; therefore, when human desires conflict with the ecosystems, the former should, realistically and morally speaking, yield to the other ecosystems (Gray et al., 2018). This approach claims that current business education paradigms often disregard the interconnectedness between humans and nature, which is essential for achieving sustainable development (Gray et al., 2018). On the other hand, ecocentrics will support VF if it's a component of a larger plan to slow down environmental deterioration and encourage sustainable living. They might play a significant role in promoting knowledge of the ecological advantages of VF, including its ability to minimize pesticide use, water use, and land use (Banerjee & Adenaeuer, 2014).

Contrariwise, apathetic individuals indicate a widespread lack of interest in environmental matters. Several things may contribute to their lack of concern, such as ignorance, a sense of helplessness, or a preference for short term social and economic problems over long term environmental sustainability (Cathomas et al., 2015; Tan et al., 2019; Gifford, 2011). Therefore, targeted outreach and education programs may be necessary to convince apathetic individuals of the immediate advantages of VF. Gaining their support might be facilitated by showcasing concrete, immediate advantages for VF (Gifford, 2011).

According to Tan et al. (2019), anthropocentrism is a philosophical and ethical perspective that places the exclusive intrinsic worth on humans' relative to all other

living things (Tan et al., 2019). Thus, if VF is in line with people's objectives of enhancing economic success and human well being, anthropocentrism behaviour will promote it (Despommier, 2011). When VF is offered as a solution to human-centric issues, anthropocentrists are likely to be in favour of it. Their backing, though, might be subject to how VF projects are viewed in terms of their practicality and economic sustainability (Norton, 1984).

2.1.6 Location Dimension

CA plays a crucial role in the acceptance or rejection of innovations, both in general and particularly with regard to their specific location, because there are relationships between people and the place, which is known as the emotional and practical relationship. This relationship leads to feelings, knowledge, beliefs, behaviours, and actions known as place attachment (Yuan et al., 2015; Menezes et al., 2017; Rezaee & Kalantari, 2019). The literature on societal planning emphasizes cooperation and empowerment; however, more recent studies have highlighted the emotional and cultural significance of place as an important factor influencing public acceptability (Li et al., 2016). While 'Place attachment' focuses on individual feelings, experiences, and geographical factors (Rezaee & Kalantari, 2019). A study found that negative/opposition to selecting the location is raised along with a decrease in the distance of a residence to the place of projects (Sun et al., 2016). The locals' reactions to proposed development sites, such as waste facilities and renewable energy projects, are frequently indicative of the Not in My Backyard (NIMBY) phenomenon (Devine, 2015).

The term NIMBY (Not In My Backyard) refers to local citizens' objections to specific developments in their neighbourhood. These people frequently voice concerns about potential harm to their quality of life, the neighbourhood

environment, and their property values (Devine, 2015). The social and economic factors have been highlighted in many studies in NIMBY. Since the communities may have more resources to mobilize against undesirable developments, thereby shifting the burden to less privileged areas. Also raises ethical concerns about environmental justice (Schively Slotterback, 2017).

NIMBY attitudes are often driven by protecting one's own and one's community's interests, which occasionally conflict with more general societal objectives, is the main motivation behind NIMBY sentiments (Van der Horst & Vermeulen, 2015). In this context, the NIMBY scenarios depend on tension between local resistance and global environmental goals which can delay or even prevent the implementation of projects that address important environmental problems such as climate change (Schively Slotterback, 2017; Van der Horst & Vermeulen, 2015).

In the context of Bahrain, while limited literature directly addresses NIMBY, the country's high urban density, scarce land availability, and strong community ties suggest that local resistance to certain urban developments is plausible, particularly when projects are perceived to disrupt neighborhood aesthetics, property values, or social cohesion (Aljenaid & Kadhem, 2019).

To address NIMBY opposition, community engagement is essential in particular early in the planning process to reduce resistance and understanding the community concerns and foster more equitable development outcomes thus leading to more sustainable and accepted projects (O'Hare, 2017).

2.1.7 Executive Summary

According to Kalantari & Akhyani, several factors affect the CA, making it crucial for the community. The demographic characteristics perceived, and benefits

are key factors impacting the level of acceptance by any community. In the early innovation phase, the perceptions and social acceptance of new agricultural technologies are significant preconditions for success or failure. The major perceived benefits of acceptance are based on three benefits: Environmental, economic, and social.

The second factor, perceived concern, is regarded as a key predictor of acceptance, and regarding perceived risks of VF and related controlled environment agriculture technologies already exist.

The third factor, general belief is classified as important for understanding the perceptions and behaviour towards environmental attitudes. Furthermore, value orientations and basic beliefs pertain to our values in specific aspects; consequently, values and beliefs are major covert factors in social acceptability evaluations. According to VBN theorists, egoistic, altruistic, and biospheric values are particularly relevant to human behaviour in stopping environmental damage. Anthropocentrism is defined as a philosophical perspective and ethical belief that assigns intrinsic value solely to humans in comparison to all other beings. However, ecocentrism was identified by ecologists to denote a nature-centered system of values, as opposed to a human-centered (anthropocentric) one.

Finally, the location and demographic characteristics play key roles in accepting or rejecting innovations in general, and specifically concerning the location because there are relationships between people and the place. Additionally, demographic characteristics have a special impact on people's perceptions.

2.2 Theoretical Framework

The aforementioned studies shaped the current study and developed its theoretical framework. More specifically, various factors can influence the degree of acceptance, potentially affecting different groups and stakeholders in different ways. In this context, we focus on selected studies that provide detailed discussions of CA factors, particularly drawing on the work of Kalantari and Akhyani (2021). To the best of our knowledge, there is currently no comprehensive framework addressing the acceptance of VF. The current study aimed to understand the community's acceptance of VF using the hydroponic system in the Kingdom of Bahrain and understand the impact of the five dimensions on their acceptance of VF (Fig. 3).

The theoretical underpinning of this study is also informed by established behavioral and innovation adoption theories. The Technology Acceptance Model (TAM) emphasizes perceived usefulness and ease of use as key predictors of technology acceptance (Davis, 1989). Similarly, the Theory of Planned Behavior (TPB) suggests that attitudes, subjective norms, and perceived behavioral control influence an individual's behavioral intentions (Ajzen, 1991). The Diffusion of Innovation Theory (Rogers, 2003) further contributes by highlighting how innovations are adopted through social systems over time, based on perceived attributes such as relative advantage, compatibility, and observability. Additionally, the VBN Theory explains environmentally significant behavior based on personal values, ecological worldviews, and a sense of moral obligation to act (Stern et al., 1999). Although not all of these theories are directly applied in full, elements from each particularly VBN inform the conceptual framing of CA in this study.

2.3 Research Hypotheses

The current study aimed at exploring "The CA of VF using the hydroponic system in the Kingdom of Bahrain "from the public, perspective and hence there were no hypotheses to be tested.

Chapter Three

Research Methodology

3.1 Research Methodology

3.2 Research Sample Size

3.3 Methods of Data Collection and Sample Criteria

3.4 Research Tools

3.5 Data Collection and Procedures

3.5.1 Management of Questionnaire Distribution and
Interview

3.5.2 Qualitative Interview Analysis

3.5.3 Ethical Considerations

3.6 Statistical Approaches

3.6.1 Reliability Analysis

3.6.2 Descriptive Statistics

3.6.3 Structural Equation Modelling

Chapter Three

Research and Methodology

3.1 Research Methodology

The current Quantitative and Qualitative study aimed to identify the fundamental factors that impact CA of VF using Hydroponic Systems in the Kingdom of Bahrain. A representative sample was utilized to collect data using Likert scale survey and structured interviews. The data was analyzed using structural equation modeling and multivariate analysis between the independent and dependent variables (Hair et al., 2019). The sample targeted citizens and residents of Bahrain aged 18 years or older, who could provide insightful perspectives on how beliefs, concerns, perceived benefits, and geographic location affect the dependent variable, which is the community acceptance of VF.

A cross-sectional, non-experimental design was adopted, as the objective is to examine associations rather than causation. Cross-sectional studies collect data at a single point in time, allowing the identification of patterns and relationships without manipulating variables (Setia, 2016). Multivariate analysis, specifically structural equation modeling (SEM), was used to examine relationships among multiple variables. The analysis was conducted using IBM SPSS AMOS (Version 29) to assess the effects of independent variables on dependent variables.

A quantitative correlational study examines relationships between groups or variables, while qualitative methods provide deeper contextual insights through narrative data. For this reason, this thesis will employ a mixed-methods design, integrating quantitative correlation analysis with qualitative thematic analysis to comprehensively address the research questions.

Non-experimental correlation analysis will identify the linear direction and magnitude of relationships between variables, supplemented by qualitative data to explore underlying patterns and meanings. Experimental and quasi-experimental designs, which focus on causal relationships, are not applicable to this study, as the primary aim is to examine associations rather than causation (Shadish, 2002). By combining quantitative and qualitative approaches, this research will leverage the strengths of both methods statistical generalizability from the quantitative phase and rich, nuanced insights from the qualitative phase (Tashakkori et al., 2020).

3.2 Research Sample Size

The sample size was calculated using the Raosoft online software. Based on a calculation with 1,577,059 population (Kingdom of Bahrain, National Portal, 2023). A 5% margin of error, a 95% confidence level, and a 50% response distribution, the target sample size for this research was determined to be 385 participants for the survey.

3.3 Methods of Data Collection and Sample Criteria

In this study, data was collected through surveys and interviews. The sample survey was collected randomly, and the only criterion specified was the age of the

participants. All members of the Bahraini community aged 18 years or older could participate in the survey.

On the other hand, the interviews were conducted in the Kingdom of Bahrain and were limited to representatives of private farms (including owners, managers, and farmers), decision-makers and executives, and academics. The participants for the interviews were selected based on specific criteria, which are outlined below:

The private farm owners were required to have a commercial registration, actively involved in agricultural crop production, and utilized hydroponic systems or other relevant technologies in their farm practice, with three to five years of experience in the Bahraini market. In other interviewees, the participants involved in this held managerial positions by being managers or supervisors. They possessed a minimum of three years of experience in farm management, along with an understanding of both hydroponic and conventional farming systems. However, the farmers involved in this study were registered with the Agency for Agriculture and Marine Resources and held an agricultural card for Bahraini farmers. Those farmers were actively involved in crop production for more than three years and were familiar with hydroponic systems. The academics who participated in the study were faculty members at different universities in the Kingdom of Bahrain. They specialized in agriculture, environmental science, or other relevant fields. Finally, the selected decision-makers and executives were employees in the government sector with more than three years of relevant experience, and their job title was aligned with the objectives of the study.

3.4 Research Tools

In the present study, a self-administered structured questionnaire was adopted from Kalantari & Akhyani (2021) work with minor modifications to suit the Bahraini community. The questionnaire was distributed using Google Forms. The survey questions were presented in both English and Arabic, allowing respondents to choose their preferred language and ensure thorough understanding. The responses were based on the 5-point Likert Scale: 1- Strongly agree, 2-Agree, 3- Neither agree nor disagree, 4-Disagree, 5- Strongly Disagree (Appendix 3).

To ensure clarity for participants, the survey began with an introductory statement that provided an explanation and clarification of general concepts, including the definition, advantages, and disadvantages of VF (Appendix 1). Following the introductory, the survey consisted of five dimensions, primarily comprised of multiple-choice questions with close-ended answers (Appendix 2). The first dimension gathered participants socio-demographic characteristics; including age, gender, education level, family income, and governorate. The second dimension focused on the perceived benefits of VF and included fourteen questions in four components: landscape greenery, environmental, economical, and social benefits. The third dimension covered the concern of implementation of VF, with ten questions related to surrounding areas, economic and socio-economic concerns. The fourth dimension consisted of eleven questions that explored general beliefs regarding ecocentric, apathetic, and anthropocentric attitudes. The fifth and final dimension covered potential sites for the construction of VF, including newly developed cities in Bahrain, commercial areas, vacant spaces within cities, and locations such as Super and Hypermarket.

On the other hand, the interviews were conducted using open-ended questions related to the same dimensions discussed above, including perceived benefits, concerns, general beliefs, and potential sites for VF.

3.5 Data Collection and Procedures

3.5.1 Management of Questionnaire Distribution and Interview

The survey was randomly distributed via social media platforms, such as WhatsApp and Twitter, from September to October 2023, resulting in 404 responses.

The interviews responses were collected from eleven participants, who were selected from various fields, including:

Two university professors specialized in botany, an agricultural engineer, an environmental engineer, a manager from the Ministry of Municipalities Affairs and Agriculture, an advisor and a manager from the Ministry of Education, two private farm owners, one private farm manager and two farmers. When needed, necessary permissions were obtained to conduct the interviews. All interviews were conducted via online video calls on platforms such as Microsoft Teams or Zoom, from September to November 2023. Each typically lasted between 30 and 60 minutes.

3.5.2 Thematic Analysis of Qualitative Interviews Based on Beliefs, Concerns, Benefits, and Location Dimensions

The qualitative data were collected through structured interviews and manually transcribed by the researcher to ensure both accuracy and deeper engagement with the content. A thematic analysis was conducted following open coding procedures, where similar responses were identified and grouped together. These codes were

then categorized under four main dimensions of the study: Benefit (environmental, economic, social, and landscape greenery), Concern (surrounding area, economic, and socio-economic), General Belief (ecocentric, anthropocentric, and apathetic), and Location. Recurring themes were noted, and the frequency of similar responses was analyzed to highlight common patterns. Selected quotes from participants were also used to support and validate the identified themes, enhancing the credibility and depth of the qualitative findings.

3.5.3 Ethical Considerations

The survey was prepared based on the work of Kalantari & Akhyani (2021) and was approved by the Deanship of Graduate Studies at the University of Bahrain. The survey did not include sensitive personal information, such as names or phone numbers. In addition, all responses were kept strictly confidential.

3.6 Statistical Approaches

3.6.1 Reliability Analysis

The reliability test was conducted to ensure data stability before proceeding with further analysis. Cronbach's Alpha was calculated using IBM SPSS (version 25) to assess the internal consistency of the instrument. This widely applied statistical measure evaluates how closely related a set of items are as a group, with coefficient values ranging from 0 to 1. Higher values indicate greater reliability (Tavakol & Dennick, 2011). In social science research, values of 0.70 or higher are generally considered acceptable, values above 0.80 indicate good reliability, and values above 0.90 indicate excellent reliability. In this study, Cronbach's Alpha was used to assess the internal consistency and reliability of the five dimensions of the survey, comprising a total of 44 items (Table 1).

Cronbach's Alpha Value	Internal consistency
0.0 - 0.20	Less Reliable
>0.20 – 0.40	Somewhat Reliable
>0.40 – 0.60	Reliable enough
>0.60 – 0.80	Reliable
>0.80 – 1.00	Very Reliable

Table (1): Interpretation of Cronbach's Alpha values (Tavakol & Dennick, 2011).

3.6 Statistical Approaches

3.6.1 Reliability Analysis

The reliability test ensured data stability before proceeding, Cronbach's Alpha. Cronbach's Alpha was calculated using IBM SPSS (version 25). Therefore, Cronbach's Alpha was used to assess the internal consistency and reliability of the survey for the five dimensions (44 items).

3.6.2 Descriptive Statistics

Descriptive statistics were used to analyze the research data using IBM SPSS (version 25). Frequencies and percentages were used to describe the distribution of categorical variables for the five dimensions (Appendix 3). In addition, means and standard deviations were calculated to summarize the central tendency and

dispersion of the continuous variables. Moreover, correlation coefficients were computed to examine the relationships among the study variables (Appendix 4).

3.6.3 Structural Equation Modeling

Descriptive statistics were conducted using IBM SPSS AMOS (Version 29). Structural Equation Modeling (SEM) was utilized to test the effects of benefits, concerns, general beliefs, and location on CA for VF among the population of The Kingdom of Bahrain. To explore the effects of demographic variables on the CA, independent sample t-test, one way analysis of variance were utilized. The goodness of fit of the SEM was evaluated based on chi-square test, chi-square to degree of freedom ratio, Root Mean Square of Approximation (RMSEA), Goodness of fit index (GF), and Root mean Square Residuals (RMR) (Gana & Broc, 2019; Keith, 2019). Also, to test the effects of the independent variables on the dependent variable, critical values were calculated by dividing the unstandardized parameters by the standard error of the estimates. A significance level of 0.05 was adopted to determine whether there is a statistically significant difference (Schermelleh-Engel et al., 2003).

Chapter Four

Results, Discussion, Conclusion and Recommendations

4.1 Results

4.2 Discussion

4.3 Conclusion

4.4 Recommendations

Chapter Four

Results, Discussion, Conclusion and Recommendations

This chapter covers the results obtained from the current study, followed by discussion, conclusion and recommendations, respectively.

4.1 Results

4.1.1 Cronbach's Alpha Test

The reliability of the instrument was assessed using Cronbach's Alpha test to detect the internal consistency of the items of the survey. The test was performed for the entire survey, including: the socio-demographic characteristics, benefits, concerns, general beliefs, and locations. Table (2) presents the test results, which show that the coefficient (α) for the 44 items in the current study was 0.845, indicating a high level of internal consistency and reliability.

Variable	Coefficient Value	N of Items
The Questionnaire items (Socio Demographic Characteristics, Benefit, Concern, General Belief, and Location)	0.845	44

Table (2): Cronbach's Alpha test results for the current study

4.1.2 Frequencies and Percentage of the Socio-Demographic Characteristics Variables

Table (3) presents the frequencies and percentages of the socio-demographic characteristics for the 404 participants who completed the study survey.

Personal Data	Frequency	%
Governorate		
Southern	48	11.9%
Northern	140	34.7%
The capital	66	16.3%
Mahraq	150	37.1%
Age in years		
18-27	52	12.9%
28-37	141	34.9%
38-47	114	28.2%
48-56	74	18.3%
> 56	23	5.7%
Gender		
Male	227	56.2%
Female	177	43.8%
Educational level		
Lower Than High School Certificate	21	5.2%
High School Certificate	71	17.6%
Bachelor Degree	199	49.3%
Master Degree	80	19.8%
PhD Degree	33	8.2%
Monthly income		
400-600 BHD	42	10.4%
601-800 BHD	87	21.5%
801-1000 BHD	131	32.4%
1001-1200 BHD	58	14.4%
> 1200 BHD	86	21.3%

Table (3): Frequency and percentage of socio-demographic characteristics of the study sample (n=404)

The participants engaged in this study were from the four governorates of the Kingdom of Bahrain. Among which, 48 individuals (11.9%) were from the Southern governorate, 140 individuals (34.7%) were from the Northern governorate, 66 individuals (16.3%) were from the capital governorate and 150 individuals (37.1%) were from Maharaq governorate. Their age ranged from 18 to 60 years old, with a mean of 40.6 ± 12.8 years. The majority of the participants were males, with frequency of 227 that represents 56.2% of the total participants, while females frequency was 177 representing 43.8% of the studied sample.

Regarding the educational level of the participants, the results indicated that the least number of participants (21 participants, representing 5.2%) did not hold secondary school level of education; whereas participants held secondary school level of education only represented 17.6% of the total studied sample (71 participants). However, the highest percentage of the participants held bachelor's degree (199 individuals, representing 49.3%), followed by participants with master degree (80 participants, representing 19.8%) and PhD degree (33 participants, representing 8.2%), respectively.

In terms of monthly income, 42 participants (10.4%) reported earning between 400-600 BHD, while 87 participants (21.5%) earning between 601-800 BHD. A total of 131 participants (31.4%) had incomes that ranged between 801-1000 BHD, while 58 participants (14.4%) earning between 1001-1200 BHD. Finally, 86 participants (21.3%) had a monthly income that exceeds 1,200 BHD.

4.1.3 Frequencies and Percentage of Benefit Dimension

The results concerning the benefits dimension are presented in Table (4).

*Codes	Sentences	Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Frequency %
B1	Requiring less emission fuel to transport the food because the food is produced in the city.	Environmental benefit	159 39.4%	112 27.7%	72 17.8%	50 12.4%	11 2.7%	Frequency %
B14	Helping to repair more of the urban ecosystem by using less land.	Environmental benefit	198 49.0%	122 30.2%	44 10.9%	29 7.2%	11 2.7%	Frequency %
B11	Accessing healthy and fresh food.	Environmental benefit	189 46.8%	102 25.2%	54 13.4%	36 8.9%	23 5.7%	Frequency %
B12	Increasing social interaction between communities.	Social benefit	168 41.6%	115 28.5%	70 17.3	29 7.2%	22 5.4%	Frequency %
B13	Providing new educational fields for producing food and relevant technologies.	Social benefit	188 46.5%	120 29.7%	58 14.4%	25 6.2%	13 3.2%	Frequency %
B2	Providing well emotional, mental, and spiritual health and social well-being of the community	Social benefit	181 44.8%	102 25.2%	70 17.3%	35 8.7%	16 4%	Frequency %
B3	Reducing the urban heat.	Landscape greenery	135 33.4%	103 25.5%	60 14.9%	53 13.1%	53 13.1%	Frequency %
B8	Increasing the air quality by its greenery.	Landscape greenery	146 36.1%	97 24%	60 14.9%	58 14.4%	43 10.6%	Frequency %
B6	Island by its greenery providing sites for rest, joy, and amusement for community and landscape view.	Landscape greenery	199 49.3%	105 26%	52 12.9%	32 7.9%	16 4%	Frequency %
B4	Offer more job opportunities for the community.	Economic benefit	172 42.6%	97 24%	81 20%	36 8.9%	18 4.5%	Frequency %
B5	Decreasing the price of food within cities.	Economic benefit	150 37.1%	97 24%	70 17.3	58 14.4%	29 7.2%	Frequency %
B7	Promoting the economic opportunity for land shortage.	Economic benefit	206 51%	98 24.3%	48 11.9%	33 8.2%	19 4.7%	Frequency %
B9	Producing more valuable food and selling in markets.	Economic benefit	171 42.3%	112 27.7%	64 15.8%	39 9.7%	18 4.5%	Frequency %
B10	Minimising the energy cost.	Economic benefit	163 40.3%	113 28%	64 15.8%	44 10.9%	20 5%	Frequency %

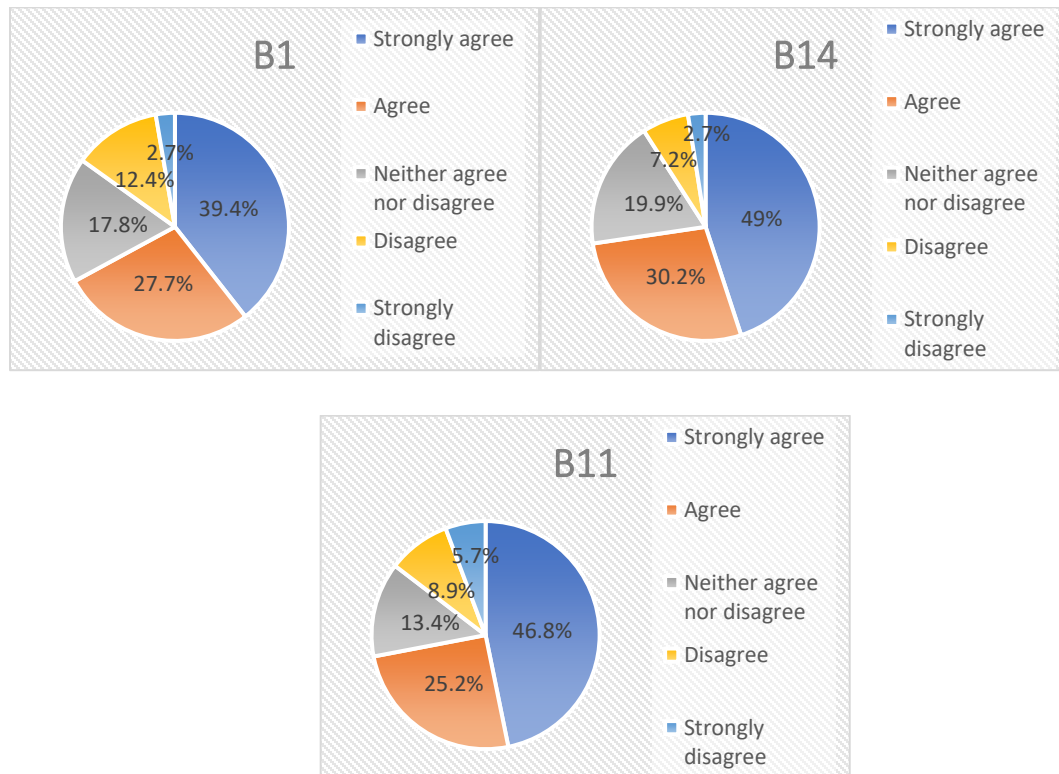
Table (4): The frequency and percentage for the benefit dimension of 14 items (n=404).

** Questions codes in the survey, refer to appendix2*

4.1.3.1 Environmental benefit

The results concerning the environmental benefit component are shown in Table (4) and Fig. 4. The results indicate that the majority of the participants strongly agreed that: VF requires less fuel emissions to transport food in the city (159 participants, representing 39.4%) (B1); VF is repairing more of the urban ecosystem by utilizing less land (189 participants, representing 46.8%) (B14); and VF facilitate accessing healthy and fresh food (198 individuals; representing 49%) (B11).

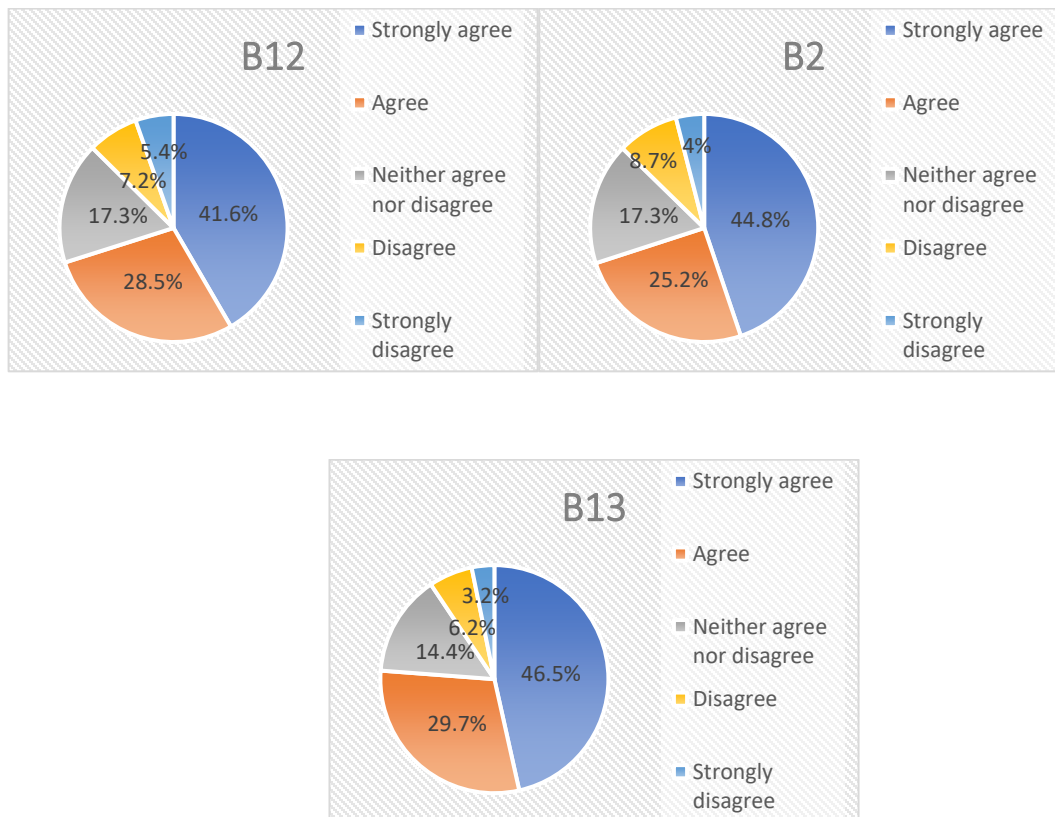
Fig. 4: Percentage of environmental benefit component



4.1.3.2 Social benefit

As presented in Table (4) and Fig. 5, the majority of the participants strongly agreed with the components of the social benefits. A total of 168 participants (representing 41.6%) strongly agreed on the importance of VF in increasing social interaction between communities (B12). Additionally, 188 participants (representing 46.5%) strongly agreed that VF provides new educational fields for producing food and relevant technologies (B13). Furthermore, 181 participants (representing 44.8%) strongly agreed that the social benefit of VF contributes to emotional, mental, and spiritual health (B2).

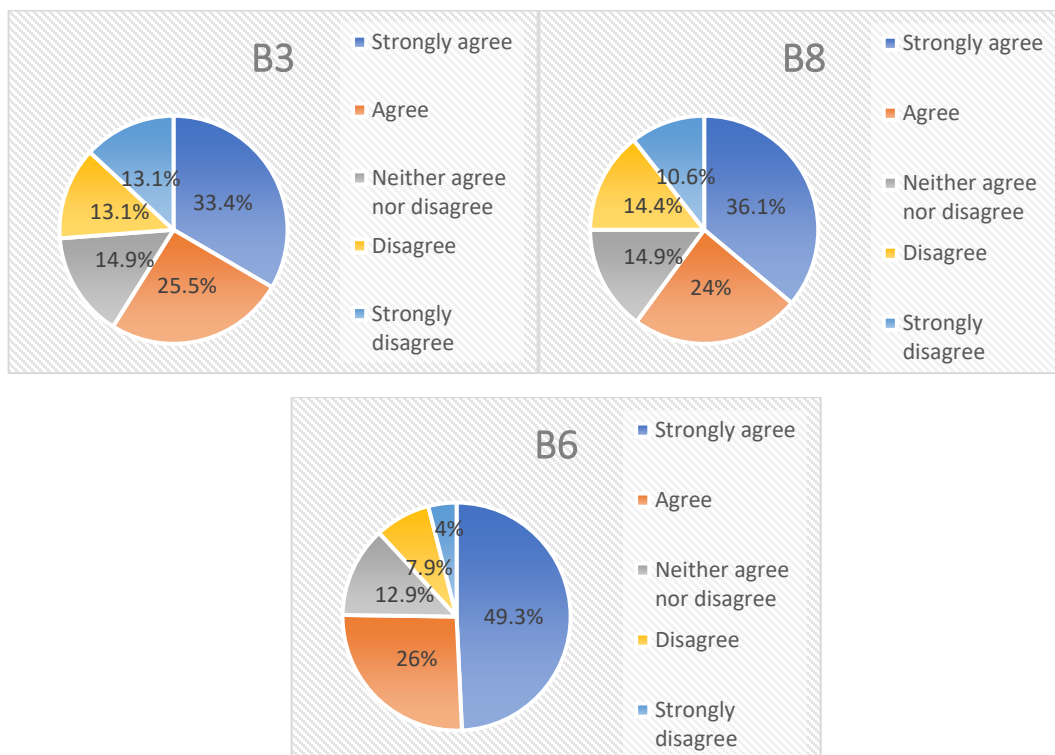
Fig. 5: Percentage of social benefit component



4.1.3.3 Landscape greenery

The majority of the participants strongly agreed with the three questions concerning landscape greenery. As presented in Table (4) and Fig. 6, 135 participants (representing 33.4%) strongly agreed that VF contributes in reducing urban heat (B3); on the other hand, 146 participants (representing 36.1%) strongly agreed that VF increases air quality by its greenery. (B8). Whereas 199 participants (representing 49.3%) strongly agreed that VF by its greenery providing sites for rest, joy, and amusement for community and landscape (B6).

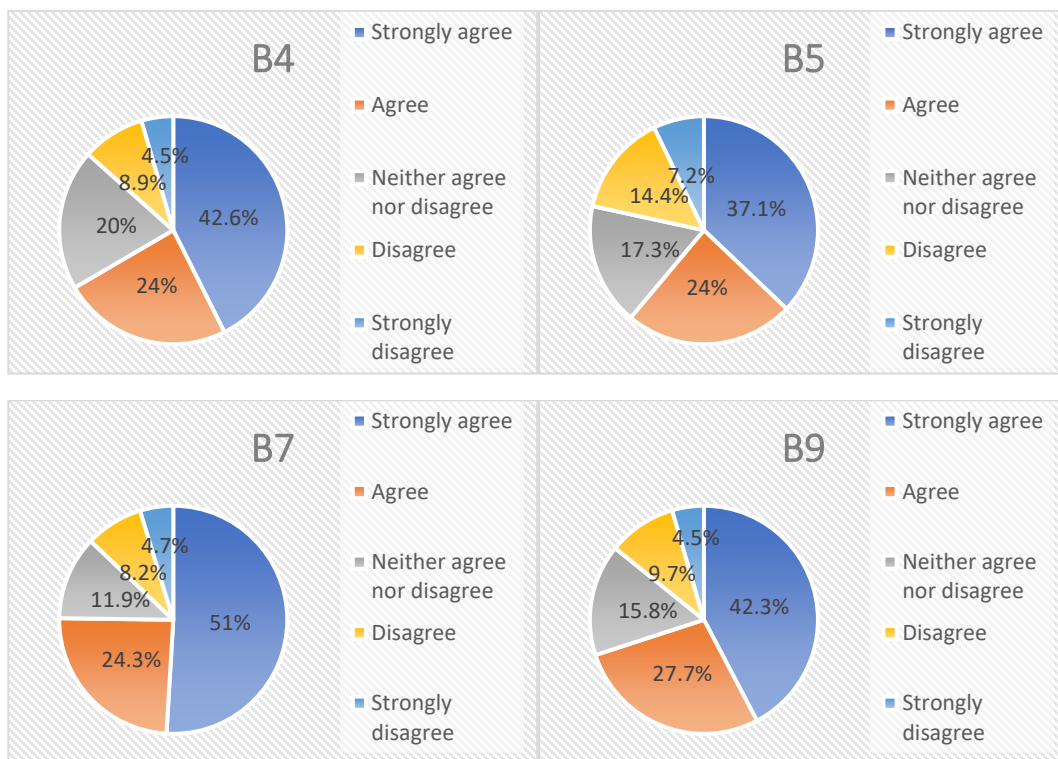
Fig. 6: Percentage of landscape greenery component

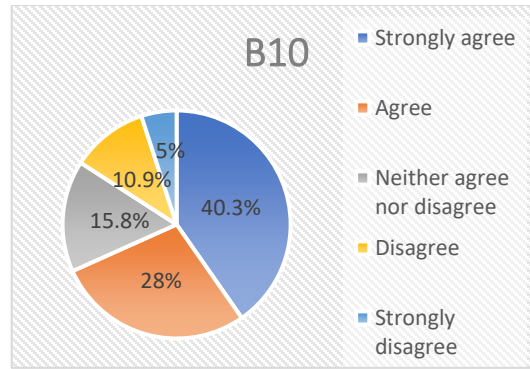


4.1.3.4 Economical benefit

The results of the economic benefits of VF are shown in Table (4) and Fig. 7. The majority of the participants strongly agreed with all of the questions provided to investigate their prospectives regarding the economical benefits of VF. Among the total number of the participants, 174 respondents (42.6%) strongly agreed that VF establishes more job opportunities for the community (B4). While 150 participants (37.1%) strongly agreed on its contribution in decreasing the price of food within cities (B5). Nearly half of the respondents, 207 individuals (51%), strongly agreed that VF promotes the economic opportunity for land shortage (B7) and 171 participants (42.3%). Furthermore, 163 participants (40.3%) strongly agreed that VF minimizes the energy cost (B10).

Fig. 7: Percentage of economic benefit component





4.1.4 Frequencies and Percentage of Concern Dimension

The results of the concern dimension are summarized and presented in Table (5).

*Codes	Sentences	Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Frequency %
C1	VF may make noise in the surrounding area.	Surrounding area concern	51 12.6%	95 23.5%	141 34.9%	59 14.6%	58 14.4%	Frequency %
C7	Produce waste in the surrounding area.	Surrounding area concern	71 17.6%	94 23.3%	111 27.5%	67 16.6%	61 15.1%	Frequency %
C9	Provide conflict between neighbourhood and Farm Company.	Surrounding area concern	72 17.8%	78 19.3%	116 28.7%	66 16.3%	72 17.8%	Frequency %
C10	VF may produce a bad smell in the surrounding area.	Surrounding area concern	84 20.8%	104 25.7%	101 25%	67 16.6%	48 11.9%	Frequency %
C2	The price of land to develop VF in the urban area is so expensive.	Economic concern	186 46%	99 24.5%	66 16.4%	36 8.9%	17 4.2%	Frequency %

C6	The implementation and maintenance of VF are so expensive.	Economic concern	154 38.1%	112 27.7%	69 17.1%	44 10.9%	25 6.2%	Frequency %
C8	It may have negative economic impacts on local farmers.	Economic concern	86 21.3%	104 25.7%	102 25.2%	56 13.9%	56 13.9%	Frequency %
C3	May decrease property values in the surrounding area.	Socio- economical concern	63 15.6%	85 21%	101 25%	50 12.4%	105 26%	Frequency %
C4	VF is like a laboratory and the products are far from natural.	Socio- economical concern	76 18.8%	88 21.8%	90 22.3%	56 13.9%	94 23.3%	Frequency %
C5	Change the fabric of society by having too many farm workers in the company.	Socio- economical concern	83 20.5%	100 24.8%	94 23.3%	61 15.1%	66 16.3%	Frequency %

Table (5): The frequency and percentage for the concern dimension of 10 items (n=404)

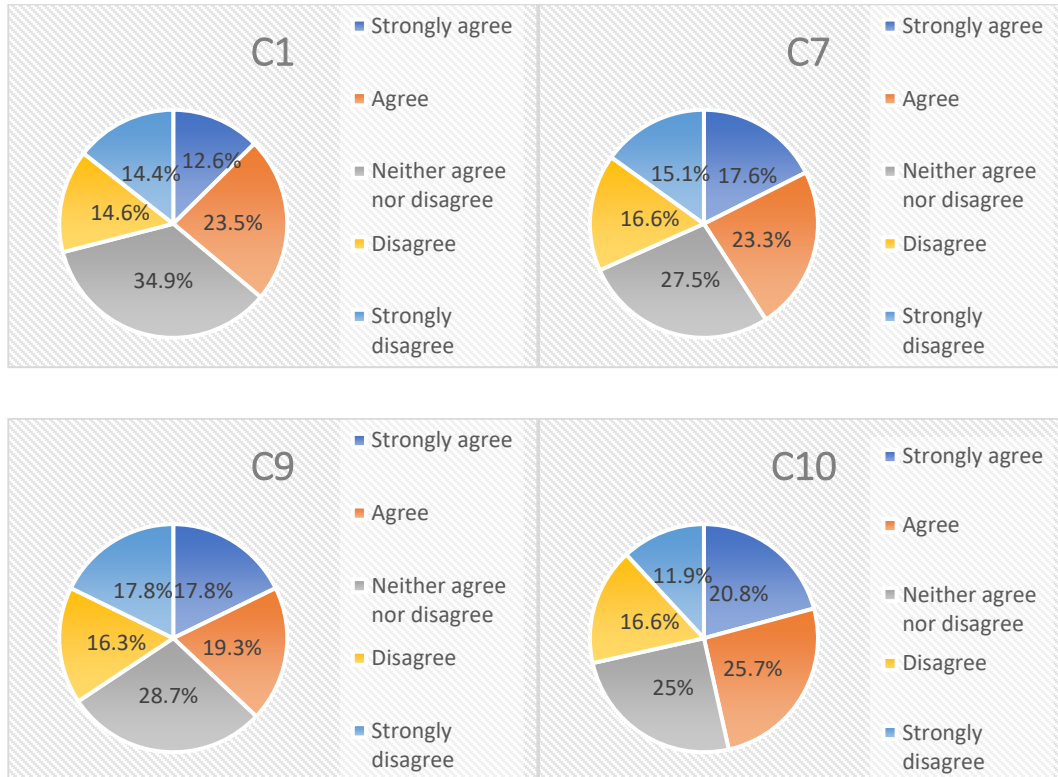
** Questions codes in the survey, refer to appendix2*

4.1.4.1 Surrounding area

The participants perspectives regarding surrounding area are represented graphically in Tabal (5) and Fig. 8. The majority of the participants neither agree nor disagree with all of the questions provided to investigate their prospectives regarding the surrounding area concerns of VF, except for C10. The responses of the participants showed that 141 participants (34.9%) neither agreed nor disagreed that VF may make noise in the surrounding area (C1). Similarly, 111 participants (27.5%), neither agreed nor disagreed that VF can generate waste in the surrounding (C7). While 116 participants (28.7%) neither agreed nor disagreed that VF leads to conflicts between neighborhood and farm companies (C9). 104 participants (25.7%)

agreed that VF may produce bad smell in the surrounding area (C10). However, 101 participants (25%) neither agreed nor disagreed C10).

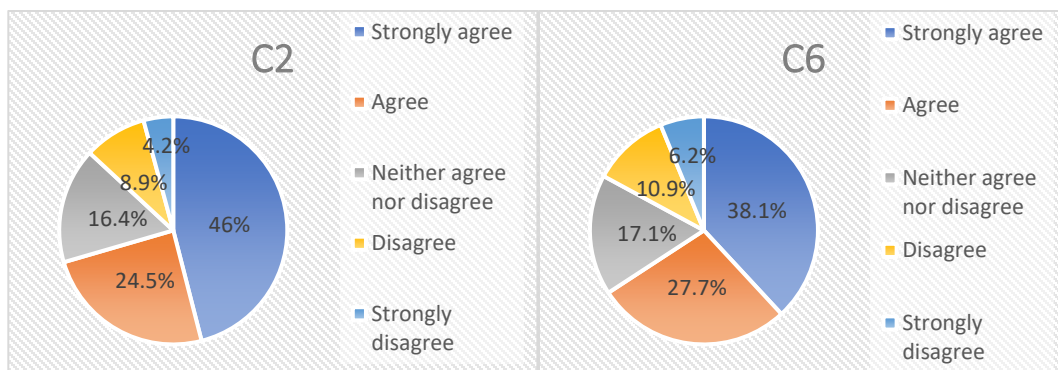
Fig. 8: Percentage of surrounding area component

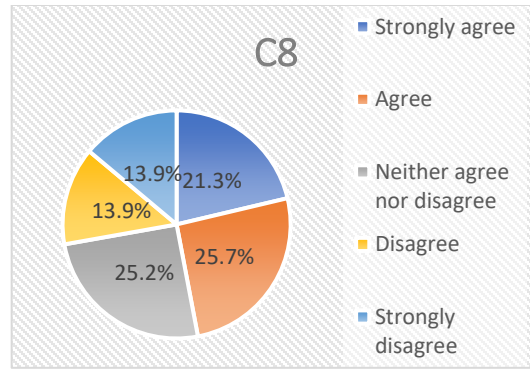


4.1.4.2 Economic concern

The results of the economic concerns related to VF implementation are shown in Tubal (5) and Fig. 9. The majority of the participants strongly agreed with the questions provided to investigate their prospectives regarding the economic concern of VF implementation, except for C8. A total of 186 participants (38.1%) strongly agreed that the price of land to develop VF in the urban area is very expensive (C2). Similarly, 154 participants (38.1%) strongly agreed that implementation and maintenance of VF are very expensive (C6). 104 respondents (25.7%) agreed that VF may have negative economic impacts on local farmers (C8). Meanwhile, 25.2% of the participants (Table 4) neither agreed nor disagreed with (C8). On the other hand, the results of the study showed that the majority of the responses to the concern that VF may have a negative economic impact on local farmers (C8) were equally distributed among agreed (104 participants; representing 25.7%) and neither agreed nor disagreed (102 participants; representing 25.2%).

Fig. 9: Percentage of economic component

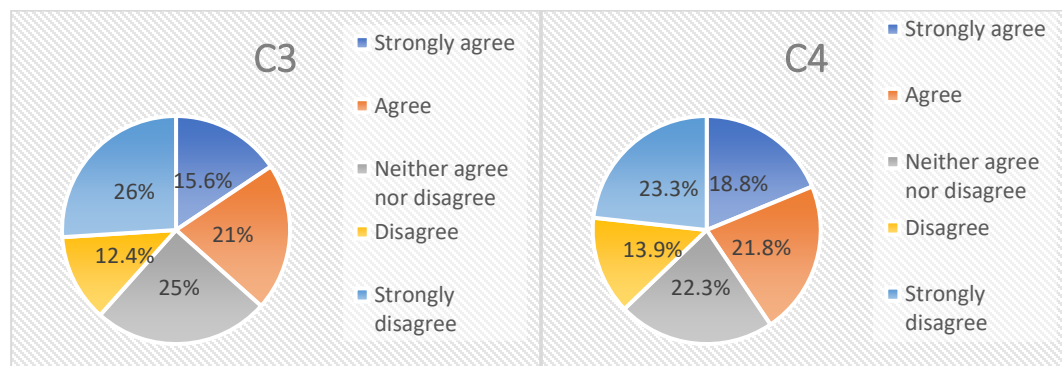


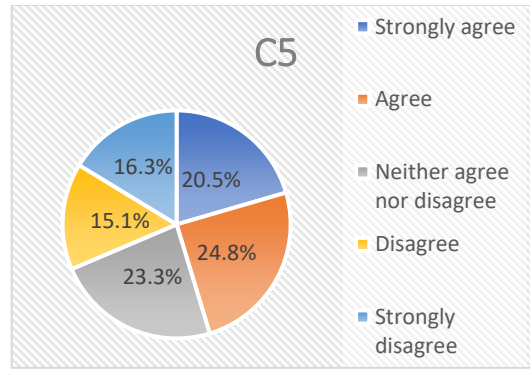


4.1.4.3 Socio- economical

These results in Table (5) and Fig. 10. show that the majority of the participants (105 participants; respondents 26%) strongly disagreed that VF may decrease property values in the surrounding area (C3). Likewise, the majority of the participants (94 participants; 23.3%) strongly disagreed that VF products are far from natural (C4). However, the majority of participants either agreed that there is a concern about changing the fabric of society (C5) (100 respondents; 24.8%) or neither agreed nor disagreed (94 respondents; 23.3%).

Fig. 10: Frequency and Percentage of Socio-Economical Components





4.1.5 General Belief Dimension

The results of the general belief dimension are presented in Table (6).

*Codes	Sentence	Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Frequency %
D1	A key reason to grow vegetables inside urban areas by VF is for people to have fresh and cheap food.	Anthropocentric	179 44.3%	120 29.7%	54 13.4%	36 8.9%	15 3.7%	Frequency %
D2	Rejecting VF does not mean that I don't like the environment.	Anthropocentric	157 38.9%	98 24.3%	56 13.9%	54 13.4%	39 9.7%	Frequency %
D4	Implementation of VF project as land development in Bahrain is a good idea as long as the high quality of life can be preserved.	Anthropocentric	195 48.3%	130 32.2%	47 11.6%	23 5.7%	9 2.2%	Frequency %
D3	Sometimes it makes me sad to see the desert environment being cleared for agriculture or building construction.	Ecocentric	155 38.4%	87 21.5%	50 12.4%	74 18.3%	38 9.4%	Frequency %
D5	One of the most important reasons to develop VF in urban areas is to preserve the urban environment.	Ecocentric	159 39.4	132 32.7%	56 13.9%	25 6.2%	32 7.9%	Frequency %
D8	It makes me sad to see the transformation of the green belt of agricultural lands in Bahrain into urban areas.	Ecocentric	192 47.5%	105 26%	57 14.1%	32 7.9%	18 4.5%	Frequency %

D9	The most important reason for land protection by VF is human survival.	Ecocentric	176 43.6%	114 28.2%	58 14.4%	36 8.9%	20 5%	Frequency %
D11	I believe that VF is important for our environment.	Ecocentric	117 43.8%	114 28.2%	68 16.8%	33 8.2%	12 3%	Frequency %
D6	I am opposed to programs to preserve land, reduce pollution and conserve resources in urban areas.	Apathetic	63 15.6%	79 19.6%	57 14.1%	59 14.6%	146 36.1%	Frequency %
D7	I don't care about environmental issues.	Apathetic	28 6.9%	83 20.5%	62 15.3%	83 20.5%	148 36.6%	Frequency %
D10	I think saving environment is not my duty.	Apathetic	41 10.1%	87 21.5%	49 12.1%	82 20.3%	145 35.9%	Frequency %

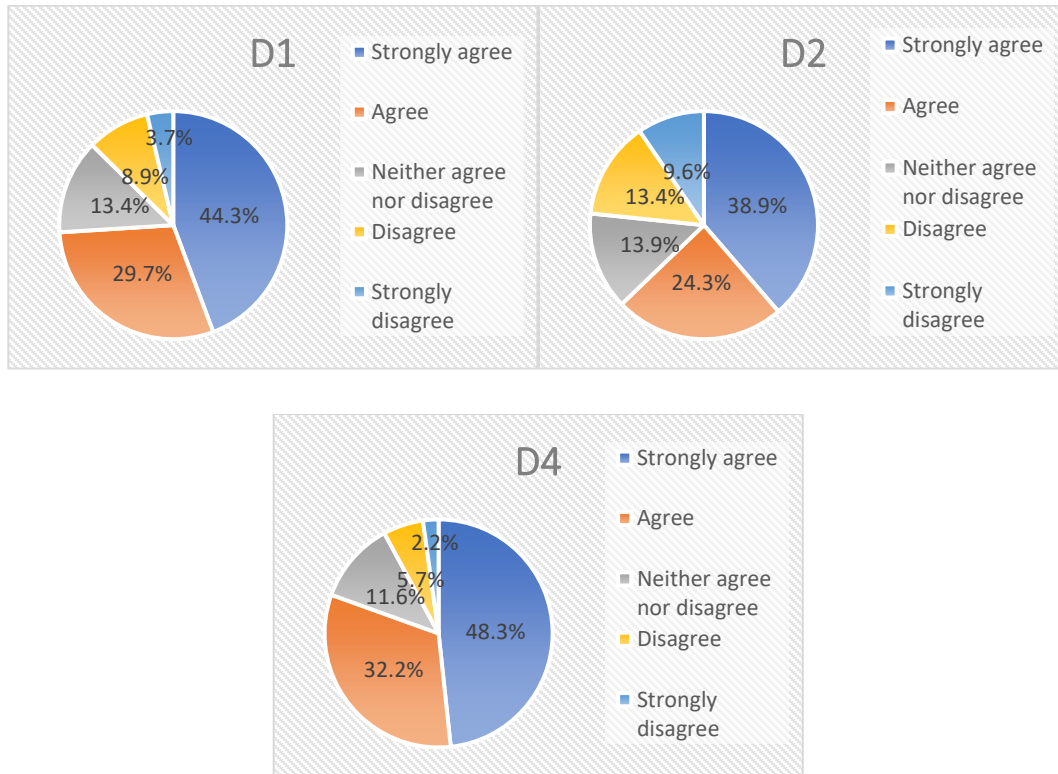
Table (6): The frequency and percentage for the general belief of 11 items (n=404)

**Questions codes in the survey, refer to appendix 2*

4.1.5.1 Anthropocentric

Table (6) and Fig.11 present the responses to the three questions related to the anthropocentric component. The results indicate that the majority of the participants strongly agree with the three questions of the anthropocentric component. A total of 179 participants (44.3%) strongly agreed that a key reason to grow vegetables inside urban areas by VF is for people to have fresh and cheap food (D1). Similarly, 157 participants (38.9%) strongly agreed that rejecting VF does not mean that I don't like the environment (D2). Additionally, 195 participants (48.3%) strongly agreed with implementation of VF project as land development in Bahrain is a good idea as long as the high quality of life can be preserved (D4).

Fig. 11: Percentage of anthropocentric component

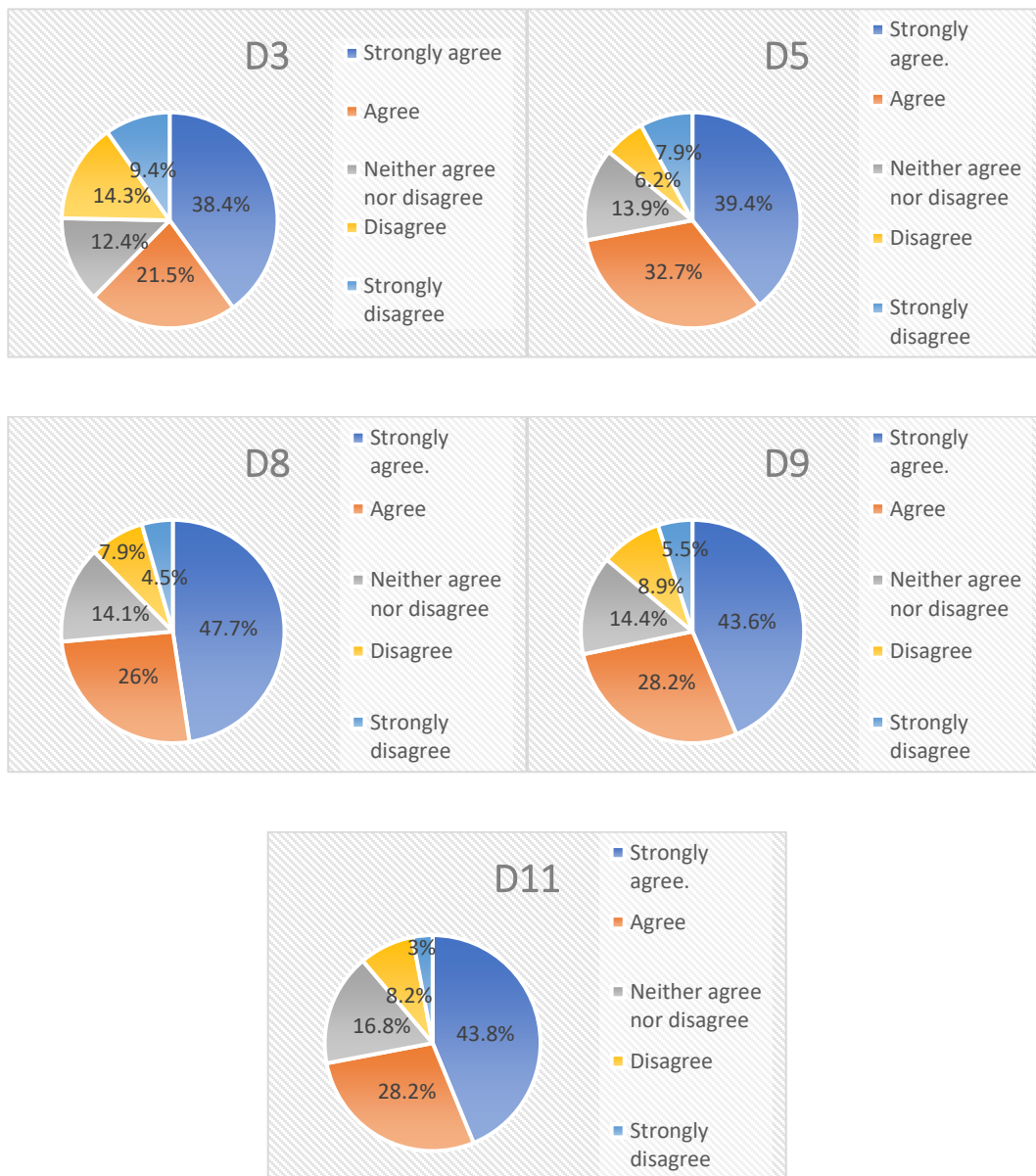


4.1.5.2 Ecocentric

The results of the participants' responses concerning the ecocentric component are presented in Table (6) and Fig. 12. The results indicate that the majority of the participants strongly agree with the questions raised to identify their perspectives toward ecocentric component of general believe dimension. A total of 155 participants (38.4%) strongly agreed that sometimes it makes me sad to see the desert environment being cleared for agriculture or building construction(D3). Whereas 159 participants (39.4%) strongly agree with the statement, one of the most important reasons to develop VF in urban areas is to preserve the urban environment. (D5). Furthermore, 192 participants (47.5%) strongly agreed that they expressed concern about the transformation of the green belt of agricultural lands in Bahrain

into urban areas (D8). Additionally, 176 participants (43.6%) strongly agreed that the most important reason for land protection by VF is human survival. Furthermore, 117 participants (43.8%) strongly agreed that VF is important for our environment (D11).

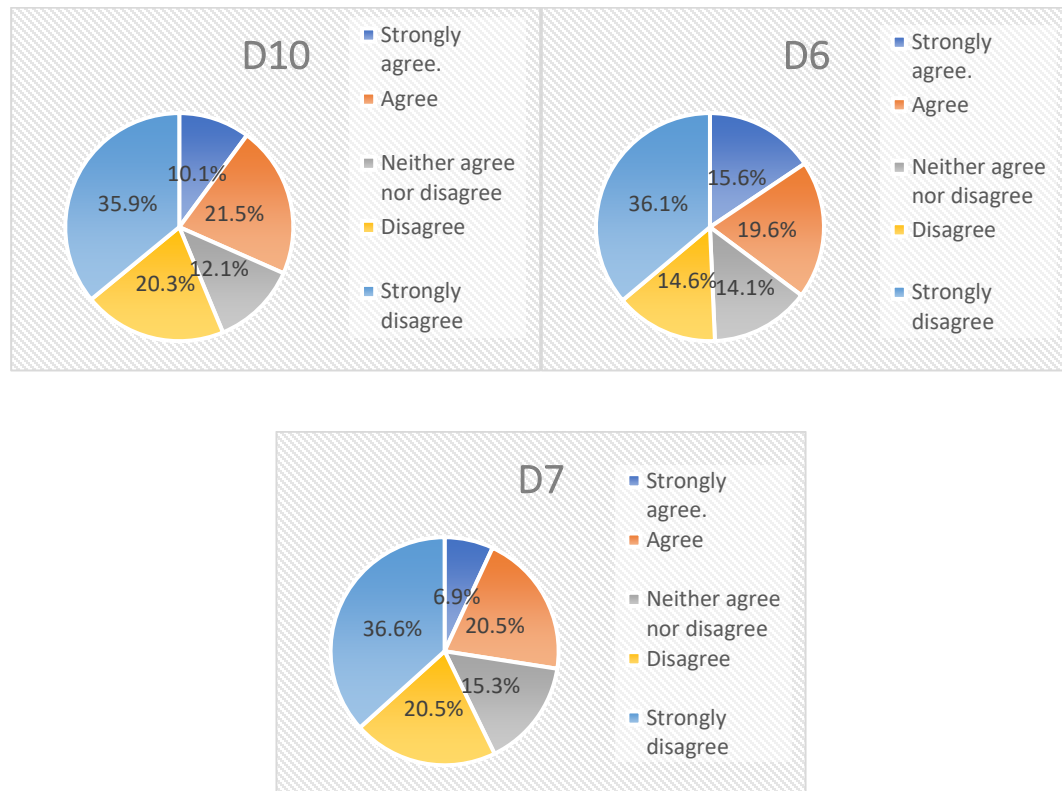
Fig. 12: Percentage of ecocentric component



4.1.5.3 Apathetic

Table (6) and Fig. 13 show that the majority of the participants strongly disagreed with the components of apathetic. Out of the 146 participants (36.1%) strongly disagreed with the statement saying that: I am opposed to programs to preserve land, reduce pollution and conserve resources in urban areas (D6). Also, 148 participants (36.6%) strongly disagreed with the statement saying that: I don't care about environmental issues(D7). In addition, 145 participants (35.9%) strongly disagreed with the final statement saying that: I think the saving environment is not my duty (D10).

Fig. 13: Percentage of apathetic component



4.1.6 Location dimension

The results concerning the location dimension are presented in Table (7).

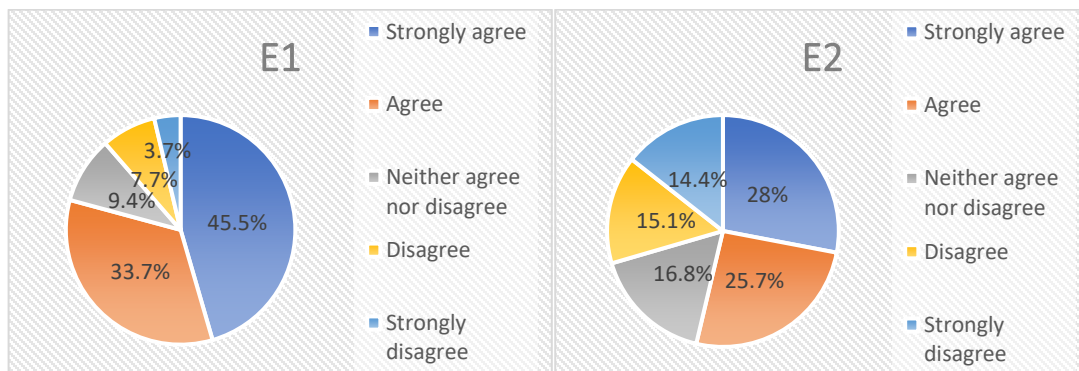
*Codes	Sentence	Strongly agree.	Agree.	Neither agree nor disagree.	Disagree.	Strongly disagree.	Frequency %
E1	Newly developed cities of Bahrain	184 45.5%	136 33.7%	38 9.4%	31 7.7%	15 3.7%	Frequency %
E2	Commercial areas	113 28%	104 25.7%	68 16.8%	61 15.1%	58 14.4%	Frequency %
E3	Vacant areas within the towns	169 41.8%	105 26%	58 14.4%	44 10.9%	28 6.9%	Frequency %
E4	Super and hypermarkets	117 29%	126 31.2%	68 16.8%	44 10.9%	49 12.1%	Frequency %

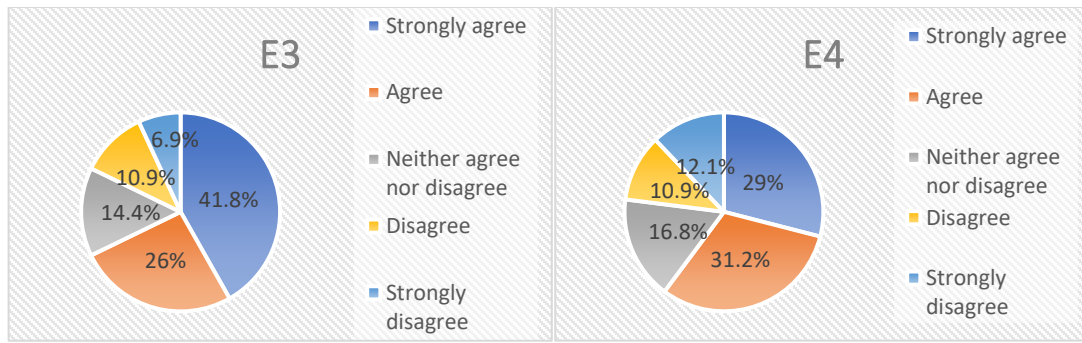
Table (7): The frequency and percentage for the location Dimension of 4 items (n=404)

**Questions codes in the survey, refer to appendix 2*

Table (7) and Fig. 14 show that the majority of the participants strongly agree with the components of the location dimension. The results indicated that 184 participants (45.5%) strongly agreed with constructing VF in newly developed cities of Bahrain, 113 participants (28%) strongly agreed with its implementation in commercial areas (E2). In comparison, 169 participants (41.8%) strongly agreed with using vacant areas within towns (E3) and 117 participants (29%) strongly agreed with implementing VF in Super and Hypermarket (E4).

Fig. 14: Percentage of construction location of VF





4.1.7 Model Fit Indices of the Hypothesized Model

Following Kline (2023) recommendations, multiple fit indices were employed to evaluate model fit, including: (1) the chi-square test of model fit, (2) Tucker-Lewis Index (TLI), (3) root mean square error of approximation (RMSEA), (4) normed fit index (NFI), and (5) comparative fit index (CFI). The indices yielded mixed results regarding model fit. The chi-square statistic, TLI, and RMSEA indicated suboptimal fit, these measures are known to be sensitive to specific conditions: the chi-square test is affected by violations of multivariate normality, while both TLI and RMSEA are influenced by small sample sizes (Kenny et al., 2015). Notably, RMSEA is additionally impacted by model degrees of freedom.

In contrast, the CFI and NFI values slightly exceeded the conventional threshold of 0.90, suggesting acceptable model fit (Hu & Bentler, 1998). These divergent findings imply that the observed fit indices may reflect methodological constraints rather than substantive model misspecification. As Kenny et al. (2015) noted, increased sample size would likely improve fit estimates for the affected indices. Table (8) presents both the recommended thresholds and the obtained values for all fit indices in the hypothesized model.

	χ^2	Df	TLI	RMSEA	CFI	NFI
Good fit model Indices	ns	79	>.95	≤ 0.05	>.95	>.95
Hypothesized Model fit indices	438.14 $p < .001$	79	.88	.11	.91	.89
Note: TLI = Tucker- Lewis index, RMSEA = root mean square error of approximation; NFI = normative fit index ; CFI = comparative fit index						

Table (8): Model Fit indices of hypothesized model

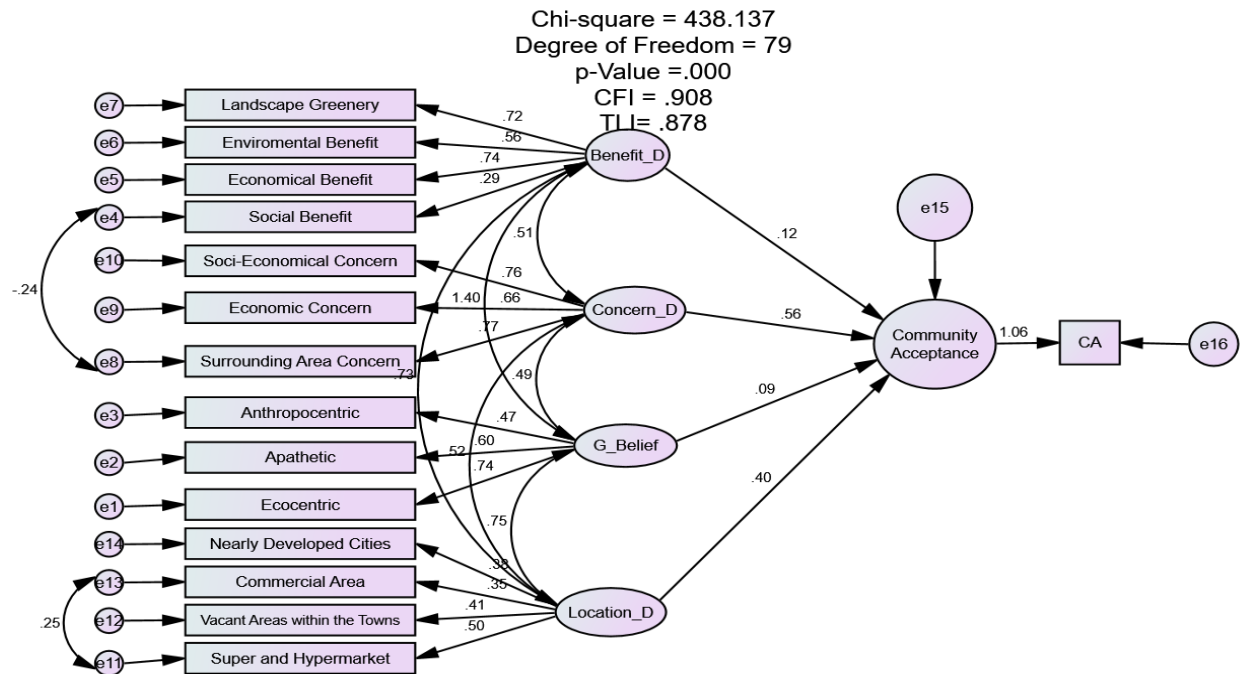
4.1.8 SEM for Benefit, Concert, General Belief, Location Dimensions and Sociodemographic Characteristics effect on CA.

A path model was constructed with the following variables:

- Independent variable: General Beliefs, Concern, Benefits, and location be systematic.
- Dependent variable: Community Acceptance More of a method rather than results.

As shown in Fig. 15 and Table (9). All of the studied dimensions, benefits, concerns, beliefs, and locations exhibited statistically significant positive effects on CA.

Fig. 15: The Structural Equation modeling of the effects of Benefits, Concern, Beliefs, and location on CA



Factors			Standardized Estimate	Estimate	S.E.	C.R.	P
Community Acceptance	<---	Benefit	.120	4.328	1.234	3.508	***
Community Acceptance	<---	Concern	.558	3.472	.266	13.072	***
Community Acceptance	<---	General Belief	.088	.666	.200	3.323	***
Community Acceptance	<---	Location	.402	12.247	3.053	4.012	***
Ecocentric	<---	General Belief	.743	1.000			
Apathetic	<---	General Belief	.600	.425	.027	15.569	***
Anthropocentric	<---	General Belief	.471	.335	.025	13.152	***
Social	<---	Benefit	.287	1.000			
Economical	<---	Benefit	.736	3.743	.387	9.674	***
Environmental	<---	Benefit	.560	2.057	.221	9.318	***
Landscape Greenery	<---	Benefit	.725	3.190	.330	9.661	***

Factors			Standardized Estimate	Estimate	S.E.	C.R.	P
Surrounding Area	<---	Concern	.770	1.000			
Economic Concern	<---	Concern	.659	.467	.031	14.855	***
Socio-Economic	<---	Concern	.760	.811	.046	17.633	***
Super and Hypermarket	<---	Location	.503	1.000			
Vacant Areas within the Towns	<---	Location	.409	.687	.088	7.809	***
Commercial Area	<---	Location	.354	1.036	.130	7.980	***
Newly Developed Cities	<---	Location	.383	.582	.078	7.437	***
Note: Standard Error (S.E.); Critical Ratio (C.R.); Significance Level (P-value or <i>p</i>). Values with C.R. > ±1.96 and <i>p</i> < 0.05 are considered statistically significant.							

Table(9): Path Estimates for Model

The concerns domain had a standardized weight of (B=.558, $p < 0.001$), while benefits had a standardized weight of (B=.12 with $p < .001$), General beliefs have a statistically significant effect positive effect (B=.088, $p < .001$), and locations domain (B=.402, $p < .001$).

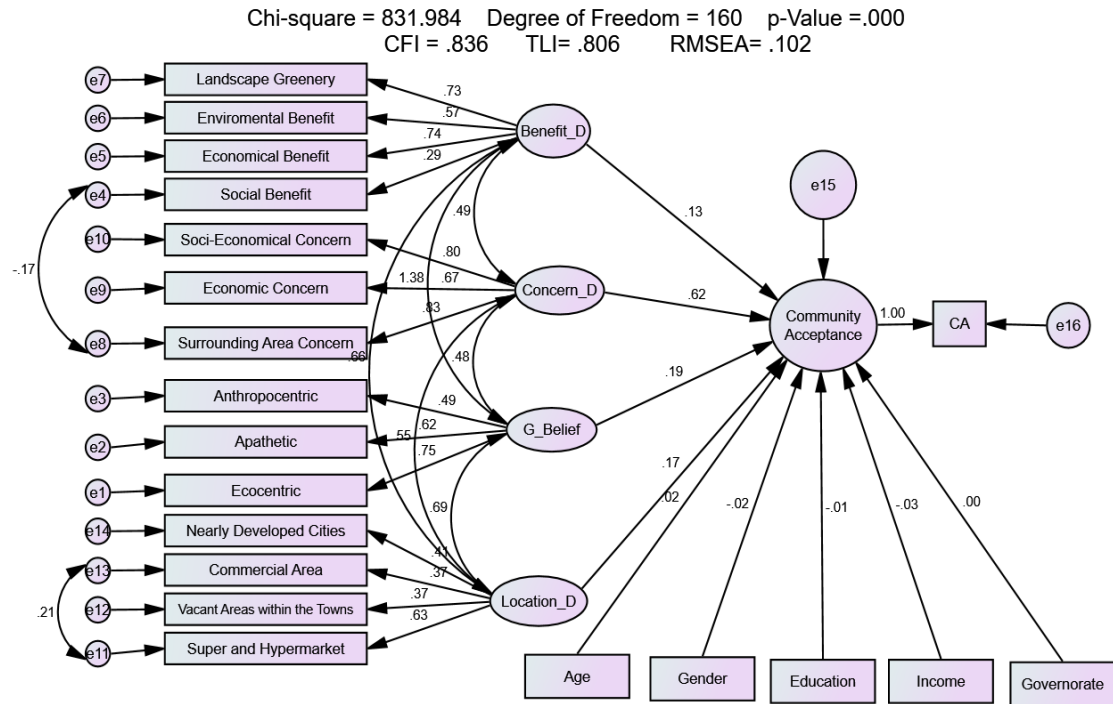
Although all of the studied domains exhibited statistically significant positive effects on CA, the results indicated that the concerns domain had the strongest effect on CA followed by the location, benefits and general beliefs, respectively.

The results presented in Fig 15 and Table (9) revealed, as well, that each components of the four dimensions exhibited statistically significant positive effects on CA. The results of the analysis of the components of the benefits indicated that the economical benefits had the strongest effect on CA (B=.736, with $p < .001$) followed by landscape greenery benefits (B=.725, with $p < .001$), environmental benefits (B= .560, with $p < .001$) and social benefits (B=.287 with $p\text{-value} = .001$) respectively. On the other hand, the surrounding area component of the concerns dimension exhibited the most

substantial effect on CA ($B = .776$, with $p < .001$), followed by the socio-economical concern ($B = .760$, with $p < .001$), and finally the economic concern ($B = .659$, with $p < .001$). When it comes to the components of the general beliefs components, the results indicated that the ecocentric belief component had the strongest effect on CA ($B = .743$, with $p < .001$), followed by apathetic effect ($B = .600$, with $p < .001$) and anthropocentric effect ($B = .471$, with $p < .001$), respectively. Furthermore, the results of the analysis of the location components indicated that the most accepted locations for VF were super and hypermarkets ($B = .503$, with $p < .001$), followed by vacant areas within the towns ($B = .409$, with $p < .001$), newly developed cities ($B = .383$, with $p < .001$), and commercial areas ($B = .354$, with $p < .001$).

To understand the sociodemographic characteristics effect on CA of VF data were analysed using SEM with the addition of the demographic variables to the model. The findings are presented in Fig. 16, and Table (10). The results of the analysis indicated that there were no statistically significant effects for the demographic variables on the CA.

Fig. 16: the hypothetical model for the effects of demographic variables on CA



As shown in Fig 16 and Table(9), age ($B = .021$, with $p = .262$), gender ($B = -.020$, with $p = .272$), education ($B = -.013$, with $p = .470$), income ($B = -.03$, with $p = .110$), governorate ($B = .001$, with $p = .262$) all had non-significant effects on CA.

Factors	Standardized Estimate	Estimate	S.E.	C.R.	P
CA <--- Age	.021	.050	.044	1.121	.262
CA <--- Gender	-.020	-.107	.097	-1.097	.272
CA <--- Education	-.013	-.037	.051	-.722	.470
CA <--- Income	-.030	-.061	.038	<u>-1.597</u>	.110
CA <--- Governorate	.001	.003	.046	.068	.946

Table(10): The effects of demographic variables on the CA

4.1.9 Interviews:

4.1.9.1 The Responses to the Benefit Dimension

The interviews revealed a consistent pattern among the participants, with the majority expressing strong acceptance of the Environmental benefits of the VF. However, in the landscape component, the participants responses were divided into two perspectives. The first perspective highlighted that VF helps in reducing greenhouse gas (GHG), urban heat, benefits the environment, and increases air quality through green spaces. The second perspective emphasizes that these benefits depend on the type of cultivation used, whether it is indoor or outdoor farming. In lowering GHG emissions, outdoor farming can contribute to the reduction of urban heat, as demonstrated in nations in Northeast Asia and Europe, where the average temperatures range from 30C to 35C. Outdoor farming helps in absorbing CO₂ through afforestation. Conversely, GCC countries tend to use indoor farming, where the nature of protected farms involves storing heat during summer. As a result, adaptive auxiliary devices are required for operation, and the nature of the plastic cover exacerbates global warming.

The interviews revealed diverse perspectives on the economic benefits of VF. The participants agreed on the economic benefits of VF. They mentioned that VF can create more job opportunities for the community. In contrast, some responses noted that VF will reduce the number of workers needed. On the other hand, VF would open up opportunities in specialized fields, particularly in sciences such as chemistry, biology, and engineering.

Opinions also varied regarding the impact of VF on food prices within cities. The first perspective depended on the type of technology used. Initially, prices were high at the start of VF projects but stabilized over time. A second perspective was dependent on the economic theory of supply and demand, emphasizing that the high production capacity of VF could lead to lowering the prices of the produced crops.

A third perspective argued that while VF could decrease food prices in urban areas, prices would still fluctuate during certain seasons, particularly in the summer, which ranges from mid-June to mid-September. During this period, harsh weather conditions make it necessary to use more energy for cooling systems, thereby increasing production costs which affects the final product's price drastically.

The interviews highlighted the role of VF in increasing economic opportunities in areas suffering from land shortages, while also offering significant benefits.

The final question in this component addressed energy costs and VF potential to reduce them. Participants expressed differing opinions. Some highlighted that VF can decrease energy costs, while others pointed out that energy costs remain high when renewable energy sources are not utilized.

The majority of participants expressed strong agreement on the social benefits of VF. They emphasized that growing crops in a protected environment, free from pollutants and pesticides, ensures that the food to be provided to the customers is healthy, which, in turn, leads to healthy consumers.

Participants also agreed that VF is an advanced agricultural technology requiring certain level of academic knowledge and skills. At a minimum, a technical level of education is needed to operate and manage modern devices, equipment, applications,

and artificial intelligence. This includes the ability to use remote control and monitoring systems for tasks such as fertilization, irrigation, temperature regulation, and humidity management in the protected environment.

Self-development was deemed crucial for individuals to keep pace with advancements in VF technology. Participants suggested that investors could capitalize on this demand by establishing universities and educational institutions dedicated to training individuals in VF practices.

4.1.9.2 The Responses to the Concern Dimension

The participants revealed mixed responses to the components of the concerns dimension. While some participants expressed skepticism about these concerns, others highlighted specific issues. For instance, one participant raised a concern about the surrounding component, noting that devices with special fans might cause inconvenience in nearby areas. However, many participants argued that VF does not generate any noise that would affect the surrounding environment.

Regarding waste production, participants agreed that it will produce green waste, which can be converted into compost and organic matter. They emphasized that selecting a suitable location for VF is crucial, as improper placement could lead to conflicts between business owners and neighbors. Participants suggested that VF should be organized, properly designed, and coordinated with the local community. Some participants raised concerns about the potential for VF to produce a bad smell in certain conditions, attributing these to the presence of bacteria and fungi, which could otherwise cause disputes with nearby residents.

The participants in the economic component highlighted that developing VF in urban areas is expensive and will affect the final price of the product. Also, the implementation and maintenance of VF are very costly. Interviewees expressed varying perspectives on the economic impact of VF on local farmers. While some believe that in most cases, technology prevails over conventional methods and VF will create rival markets, others hold the view that there are no negative economic impacts on local farmers. Therefore, VF can benefit conventional farm owners if they start using it, potentially allowing them to double their output.

One participant shared his experience regarding the advantage of reducing the number of laborers after using VF. For instance, in VF, we only need one worker per hour for picking and packing in a protected house measuring 10 meters by 6 meters by 4 meters high. In contrast, with conventional agriculture covering one-third of a dunum (equivalent to 330 square meters), we require 2-3 workers for picking and packing. VF reduces the need for labor by 75%.

Moving to the socio-economic component, the interviewees highlighted the following points: Firstly, they believe that VF will increase property values in the surrounding area. Secondly, concerns about VF products being perceived as unnatural, resembling laboratory creations, are unfounded. VF crops are no different from natural plants; they receive all their basic needs, such as light and fertilizer, and the only difference is that the plants are kept in a protected and controlled environment. Additionally, the participants did not seem concerned about potentially altering the fabric of society by employing too many farmworkers in the company. Since the projects will be implemented within the Kingdom of Bahrain.

4.1.9.3 The Respondents of General Belief Dimension

General belief is one of the most important dimensions examined in the current study. The interviews revealed participants orientations in the following components: ecocentrism, apathy, and anthropocentrism. Participants noted that the Kingdom of Bahrain has been a pioneer in protecting the desert environment since 1976 (e.g., Al Areen reserve). Additionally, Bahraini law prevents the conversion of green agricultural lands into urban areas. The primary reasons for developing VF in urban areas are to preserve the urban environment and ensure human survival.

Moving to the apathetic component, initiatives such as saving the environment, addressing environmental issues, implementing programs to preserve land, reduce pollution, and conserve resources in urban areas have a positive impact on communities and must be supported. However, if communities remain apathetic toward the environment or resource conservation, it will have negative impacts that will be reflected in environmental sustainability. Therefore, reforming society's beliefs is necessary.

The final component, which is the anthropocentrism, is no less important than the previous components. A primary reason for growing vegetables inside urban areas through VF is to provide fresh and affordable food, which are among the benefits of VF. Therefore, implementing VF projects as part of land development in Bahrain is a good idea as long as a high quality of life can be preserved. However, rejecting VF does not imply a lack of concern for the environment; many practices can support the environment, and VF is one of them.

4.1.9.4 The Respondents of Location Dimension

The interview was conducted with participants to understand their perspectives towards the proposed construction locations of VF. Overall, the interviews illuminated diverse perspectives on the constructed location for VF. All participants agreed to construct VF in newly developed cities and vacant areas within the towns in The Kingdom of Bahrain. They also highlighted that VF would provide economic benefits to the community. However, careful planning is necessary during the initial stages of construction in newly developed cities. All participants emphasized the importance of avoiding establishing VF on agricultural lands, VF can be constructed anywhere else. The participants expressed significantly different opinions based on food safety and economics when super and hypermarket were concerned. The academics emphasized that having VF in super and hypermarket locations can affect consumers' health and the reputation of VF products. The customers with poor personal hygiene can negatively affect the hygiene of the crops and can be potential contamination source, which eventually affects the consumers health and the reputation of VF products along with the reputation of the super and hypermarket.

Moreover, participants emphasized the high cost of sites, impacting not only product prices but also business profits making some projects more favourable to lenders than agricultural ventures. This is due to the different returns between the profits of commercial projects and agricultural projects.

4.2 Discussion

The present study showed that the benefits dimension had statistically significant effects on the CA of VF ($B = .12, p < .001$). This effect could be largely attributed to economic and landscape greenery benefits, which recorded the highest impact within the dimension. The results point toward a strong public recognition of tangible and visible benefits, but also highlight areas where perceptions may be overly optimistic or in need of clarification.

Within the benefit domain, the economic benefits exhibited the highest impact on CA ($B=.736$, with $p<.001$). The results revealed that 42.6% of the participants strongly agreed that VF generates more job opportunities. In addition, the interview responses revealed that VF is expected to generate opportunities in specialized fields, especially in the field of basic sciences, which include chemistry, biology, and engineering. Several studies have also emphasized the economic advantages of VF in urban settings. They highlighted its potential in expanding employment opportunities (Thomaier et al., 2015; Kalantari et al., 2018; Elghonaimy & Albadal, 2021). This is aligned with Kozai et al. (2021) findings that VF can create demand for agricultural technicians, engineers, and logistics professionals. An opportunity Bahrain could leverage, especially given its focus on diversifying its knowledge-based economy under Vision 2030.

Additionally, 37.1% of the participants strongly agreed that VF contributes in reducing food prices. In this regard, the interview responses revealed various points of view. Some showed that the price of the food produced by VF depends on the type of technology used., whereas others related the prices to the economic theory of supply and demand. A third perspective argued that while VF could decrease food prices in urban areas, prices would still fluctuate during certain seasons, which

depends on the type of energy used. It was documented that the cost of food is closely linked to oil prices, as an increase in oil prices typically leads to higher food costs (Kalantari et al., 2018). However, the adoption of renewable energy sources can help decouple food price from oil price fluctuations (Waheed et al., 2018). It is also important to note that VF products may be more expensive due to several factors, including energy costs, technological infrastructure, operational expenses, market positioning, consumer perception, and supply chain dynamics (Stein, 2021; Stanghellini & Katzin, 2024). According to Bunge (2022) energy costs, LED lighting, and climate control are major operational expenses that can increase the price of crops produced by VF. Accordingly, adopting renewable energy such as solar energy can stabilize or even reduces the price of crop production using VF system (Bunge et al., 2022). This result shows and highlights the need for policies that support the integration of renewable energy in various agricultural practices, including VF to mitigate high operational costs and achieve stability in product prices.

Furthermore, 51% strongly agreed that VF promotes opportunities to address land shortage, a concern particularly relevant in Bahrain, where urban sprawl and limited landmass create mounting pressure on agricultural spaces (Aljenaïd & Kadhem, 2019). The VF model aligns with this geographic constraint, allowing food production without competing with residential or industrial development. This makes the benefit both strategically and spatially contextualized.

Additionally, 42.3% of the participants acknowledged the benefit of VF in producing more valuable food. On the other hand, interviews acknowledged this benefit. One key economic advantage of VF is the production of desired crops for the consumers year-round, ensuring stable supply that meets market demands

(Kalantari et al., 2017; Jürkenbeck et al., 2019). Consistency in supply supports food security, particularly relevant for import dependent nations like Bahrain.

The environmental benefits exhibited a significant impact on CA ($B=.560$, with $p<.001$). The participants in the interviews agreed on the environmental benefits. While 39.4% strongly agreed on the environmental benefit of VF in reducing fuel emissions for food transportation within the city, similar findings were reported by Birkby (2016). He further noted that VF products are typically transported only a few blocks from the production site, reducing carbon emissions compared to conventional farming, where products are transported over long distances to reach markets and consumers. However, in Bahrain, imports dominate food logistics, often via long-haul shipping or airfreight. This local production model reduces both emissions and import-related vulnerabilities.

In addition, 49% of participants strongly agreed on the advantage of VF in accessing healthy and fresh food. These results are aligned with the findings of Butturini and Marcelis (2020). Their study highlighted that VF technology enhances the nutritional quality of food. Since the plants are grown in a controlled environment, they will be protected from pests and diseases, which in turn reduces the need for hazardous fungicides. This contributes to producing safer and healthier crops (Butturini & Marcelis, 2020). Furthermore, the study showed that 46.8% strongly agreed that VF restores urban ecosystems through efficient land use. Kalantari et al. (2018) argue that converting agricultural activities to indoor spaces enables former farmland or green spaces to be repurposed for environmental or recreational use. In

Bahrain, this concept resonates with efforts to revitalize coastal and desert areas affected by urban expansion.

Social benefits also showed a statistically significant impact ($B = .287, p < .001$). 44.8% of participants strongly agreed that VF enhances emotional, mental, and spiritual health. Interviews reinforced this view, associating clean, pesticide-free produce with general well-being. 41.6% also believed that VF fosters community social interaction a relevant point in Bahrain's tightly-knit yet urbanized neighborhoods. Kalantari & Akhyani (2021) similarly linked VF with strengthened community ties through shared spaces and educational outreach.

Most notably, 46.5% of participants, supported by the majority of interviewees, believed that VF would create new educational opportunities. This was highlighted as a key area for cross-disciplinary education linking agriculture, engineering, environmental sciences, and IT (Kozai, 2018; Despommier, 2011). For Bahrain, this could support workforce development goals and contribute to innovation in the agri-tech sector.

Regarding landscape greenery, VF had a significant effect on CA ($B = .725, p < .001$). A substantial proportion of participants, 33.4% strongly agreed that VF helps reduce urban heat, a concern especially relevant in Bahrain's hot climate. Moving from indoor farming to outdoor farming contributes to improving surrounding air quality through the exchange of O_2 and CO_2 in the external atmosphere (Elghonaimy & Albadal, 2021). However, interviews nuanced this benefit, clarifying that outdoor VF systems are more likely to yield such effects than indoor systems. These distinctions must be addressed in urban planning policies. Also, there is a misunderstanding within the community regarding the term, particularly when it comes to VF and landscape greenery.

On the other hand, (36.1%) of the participants strongly agreed that VF increases air quality through its greenery. Whereas (49.3%) of the participants strongly agreed that VF is characterized by its greenery, providing sites for rest, joy, and amusement for the community and landscape. The studies show that VF can significantly reduce indoor CO₂ concentrations and improve air quality, contributing to healthier indoor environments (Chen et al., 2021). In Bahrain, incorporating greenery on rooftops or public structures not only improves the climate but also supports ongoing urban beautification initiatives, and, importantly, does not overlook the type of cultivation, whether indoor or outdoor.

The results of the study showed that the concern domain had a standardized weight of ($B=.558$, $p<0.001$). The surrounding area component of the concerns dimension exhibited the most substantial effect on CA ($B= .776$, with $p <.001$). 34.9% of the participants neither agreed nor disagreed that VF contributes to noise in the surrounding area. During the interviews, participants expressed skepticism about this issue. Some noted that specific devices equipped with special fans could cause inconvenience in nearby areas. However, many participants contended that VF does not generate noise levels significant enough to affect the surrounding environment. Mechanical equipment noise and vibrations from HVAC systems have been identified as factors that can negatively impact urban environments (Ruan & Yin, 2021; Martin et al., 2019). Therefore, compared to traditional mechanical systems, VF operations are generally associated with lower levels of noise pollution, making VF a more environmentally friendly option for urban areas.

Additionally, 27.5% of participants were neutral about whether VF generates waste. Interviews clarified that VF does produce green waste, but its impact is minimal if properly managed. Still, poor site selection or mismanagement could provoke

neighborhood disputes. This suggests a need for local regulatory frameworks that guide VF waste disposal especially in compact urban settings like Bahrain's central municipalities. Previous research (Sanyé-Mengual et al., 2015; Gómez et al., 2019) supports this, emphasizing the importance of environmentally conscious waste management. Bahrain's small urban footprint makes these strategies even more critical. Similarly, 28.7% neither agreed nor disagreed that VF leads to conflicts with neighboring communities. However, interviews and literature suggest that unmanaged organic/inorganic waste can trigger social tensions (Sanyé-Mengual et al., 2015; Gómez et al., 2019). These tensions may be heightened in Bahrain, where residential and commercial zones often overlap. Thus, fostering community awareness and engagement is essential in preventing conflict.

However, (25.7 %) agreed that VF may produce a bad smell in the surrounding area. While in the Interviews, the participants raised concerns about the potential for VF to produce a bad smell in certain conditions, attributing these to the presence of bacteria and fungi, which could otherwise cause disputes with nearby residents. The Bacteria and fungi that can grow under certain environmental conditions in VF systems can lead to the production of unpleasant odors, especially in low pH environments in organic composting can foster the growth, which is known for generating bad smells (Sundberg et al., 2013). Therefore, VF systems maintain high standards of sterilization and hygiene, preventing infections in their agricultural setups (Vertical Farming Directory, 2023).

The present study indicates that 46% strongly agreed that the price of land to develop VF in the urban area is so expensive. While the findings from the interviews aligned with the result that developing VF in urban areas is expensive and will affect the final price of the product. The price of land for developing VF in urban areas is one

of the most economic perceived concern (Ren et al., 2016; Sanyé-Mengual et al., 2016; Specht et al., 2019; Sanyé-Mengual et al., 2019; Broad, 2020; Milestad et al., 2020). High real estate costs in urban Bahrain, especially in areas like Seef or Diplomatic Area, could hinder investment in VF. Therefore, urban agriculture initiatives should explore government subsidies or rooftop farming options to overcome this barrier.

Additionally, 25.7% of respondents revealed that local farmers may suffer financial consequences as a result of VF. It is frequently difficult to compete with VF efficiency and year-round crop production potential when using conventional farming practices (Despommier, 2011). Therefore, even if VF offers chances for sustainable food production, more research is necessary to fully understand its financial effects on the current agricultural sectors. This highlights the need for transitional policies that protect traditional farmers while integrating modern techniques.

Followed by the socio-economical concern ($B=.760$, with $p<0.001$). The present work further showed that 26% strongly disagreed that VF may decrease property values in the surrounding area. This suggests that participants do not perceive VF as a factor that negatively impacts real estate and reduces its value in markets. Moreover, 23.3% strongly disagreed that VF products are far from natural. This perspective aligns with existing research, which emphasized that VF implements all elements needed for crop production, which are similar to conventional farming. The only difference is that the plants are grown under controlled indoor environments (Specht et al., 2016). Among the participants, 24.8% agreed that VF can cause a change in the fabric of the society by having too many farm workers in the company. The arrival of a large workforce can introduce social, economic, and cultural

challenges within local communities (Holmes, 2013; Portes & Rumbaut, 2001). Notably, the farm workers often come from different cultures. These changes lead to challenges, especially in integrating them into the local community (Portes & Rumbaut, 2001). Furthermore, an increase in requests for healthcare, education, and housing can lead to social tensions between the new farm workers and existing residents (Gutiérrez-Li, 2024).

However, VF may not require as many staff members as conventional farming, according to the interview results. One participant stressed that the primary economical advantage of VF on his farm was the decreased dependency on human labor. VF operations employ state-of-the-art technologies that automates fertilization process, monitor and adjust growing conditions, and even harvest crops with minimal human help, in contrast to the conventional agriculture (Despommier, 2010). As a result, VF can decrease labor expenses significantly and increase productivity (Benke & Tomkins, 2017; Despommier, 2010). This positions VF not as a labor threat, but as a productivity enhancer, particularly relevant in the Bahrain context where labor cost and availability are key concerns. It is essential to equip workers with foundational knowledge of vertical farming systems prior to engagement in any operational tasks, ideally through a formalized training program to ensure competence and efficiency.

The results of the current study indicated that the general belief dimension had a significant positive effect on CA ($B = .088, p < .001$). Among its components, the ecocentric belief exhibited the strongest influence ($B = .743, p < .001$). These results suggest that participants in Bahrain exhibit strong ecocentric attitudes toward environmental conservation. For instance, 155 participants (38.4%) strongly agreed that it makes them sad to see desert environments cleared for agriculture or

construction. Similarly, 159 participants (39.4%) strongly agreed that one of the most important reasons to develop VF in urban areas is to preserve the urban environment.

Interview responses further supported these findings, as participants emphasized Bahrain's historical commitment to environmental protection specifically referencing initiatives like the establishment of the Al Areen Wildlife Park in 1976. These findings align with the principles of deep ecology introduced by Naess (1973), which emphasize the intrinsic value of nature, asserting that all living organisms have a right to exist regardless of their utility to humans. According to the VBN theory, individuals who hold strong biospheric values are more likely to act in environmentally responsible ways (Reed et al., 2015).

Moreover, previous literature suggests that communities with strong biospheric orientations are more inclined to support sustainable practices (Märting & Czellar, 2017). The participants in this study demonstrated similar concerns, particularly regarding the shrinking green belt due to urban expansion. While 117 participants (43.8%) strongly agreed that VF is important for the environment, it remains uncertain whether these attitudes will translate into behavioral or political action. Further research is needed to examine this gap between values and action.

In addition, 192 participants (47.5%) expressed strong concern about the transformation of agricultural greenbelt areas into urban spaces. Furthermore, 176 participants (43.6%) strongly agreed that the most important reason for protecting land through VF is human survival, which reflects a blend between ecocentric and anthropocentric perspectives.

The second most influential component was apathy, showing a strong negative association with CA ($B = .600, p < .001$). Findings revealed low levels of environmental apathy among participants. For example, 36.1% strongly disagreed with policies that neglect urban conservation, pollution control, and land protection. Similarly, 35.9% strongly disagreed with the notion that protecting the environment is not their responsibility, and 36.6% strongly disagreed with the statement that they do not care about environmental issues.

These results suggest a proactive environmental stance among participants and refute apathetic tendencies, which are typically defined as indifference toward ecological matters (Gifford, 2011). In contrast with findings from other contexts, participants in this study demonstrated a collective environmental consciousness, reinforcing the importance of embedding sustainability and VF into urban planning and national strategies.

Regarding the anthropocentric dimension ($B = .471, p < .001$), participants also expressed pragmatic views grounded in human-centered benefits. Specifically, 179 participants (44.3%) strongly agreed that a key motivation for implementing VF in urban areas is to ensure access to fresh and affordable food. Additionally, 157 participants (38.9%) strongly agreed that rejecting VF does not imply a disregard for the environment, and 195 participants (48.3%) expressed strong support for adopting VF as part of Bahrain's national land development initiatives. These attitudes reflect a dominant anthropocentric perspective among participants, wherein environmental protection is justified primarily through its contributions to human welfare. This perspective is consistent with Norton's (1984) argument that anthropocentrism supports sustainable development insofar as it benefits human life (Norton, 1984). Interestingly, this view does not necessarily conflict with ecocentrism; instead, it

demonstrates a balanced worldview where sustainability is pursued for both ecological and societal gains. Moreover, participant interviews emphasized VF's role in reducing food imports, stabilizing prices, and boosting local economies. objectives aligned with Bahrain's Food Security Strategy (Supreme Council for Environment, 2020).

The locations domain showed a significant positive effect on CA, ranking as the second most influential factor after the concern domain ($B = .402$, $p < .001$). The current study indicates that the most accepted locations by the community were Super and Hypermarket areas ($B = .503$, $p < .001$) and Vacant Areas within Towns ($B = .409$, $p < .001$).

According to the NIMBY theory, opposition often increases as proximity to residential areas decreases, with concerns about quality of life, environmental disruption, and property devaluation (Sun et al., 2016; Devine, 2015). However, while quantitative survey data showed high acceptance for Super and Hypermarket locations, qualitative interviews uncovered contrasting views. Many interviewees, especially academics, expressed concerns about food safety, citing the risk of contamination from customers with poor personal hygiene. Such contamination could damage consumer trust and the overall reputation of VF products, particularly when grown in retail spaces.

Additionally, participants emphasized that the high cost of commercial locations, such as supermarkets, could drive up product prices and limit profitability. These economic constraints may make VF projects less attractive to lenders compared to traditional commercial investments. This reflects previous findings in the literature (Ren et al., 2016; Sanyé-Miguel et al., 2016; Specht et al., 2019; Broad, 2020;

Milestad et al., 2020). But in Bahrain's context, the limited availability of affordable urban land intensifies these financial barriers, necessitating government support or land use incentives.

Furthermore, all interview participants agreed that newly developed cities and vacant urban spaces were more suitable for VF. They emphasized that VF should not replace existing agricultural land, but rather complement it by utilizing underused urban zones, aligning with sustainable development principles.

The contradiction between survey and interview results highlights a need for integrated planning and stakeholder engagement. While the public may support supermarket-based VF for convenience, experts highlight operational and ethical concerns that must be addressed through clear regulations and public education campaigns.

Regarding demographic variables, age ($B = .021$, $p = .262$), gender ($B = -.020$, $p = .272$), education ($B = -.013$, $p = .470$), income ($B = -.03$, $p = .110$), and governorate ($B = .001$, $p = .262$) showed no significant effect on community acceptance (CA). This finding stands in contrast to previous research, where demographic variables were often found to be significant predictors of VF acceptance (Jürkenbeck et al., 2019; Specht et al., 2016). However, this divergence may reflect context-specific factors unique to Bahrain.

In particular, Bahrain has witnessed growing national awareness around issues of food security, climate resilience, and land scarcity, promoted through government initiatives and Vision 2030 strategies. This may have led to a more homogenized public perception toward innovative agricultural practices, transcending age, gender,

or income levels. Similar observations have been reported in other small or highly urbanized nations, where national campaigns and shared vulnerabilities reduce demographic variation in attitudes (Siegner et al., 2018; Lal, 2020).

Furthermore, the lack of demographic significance may suggest that psychographic variables such as personal environmental values, perceived behavioral control, and trust in institutions may play a stronger role in shaping acceptance. Studies applying the VBN frameworks have similarly found values and perceived norms to be more predictive than basic demographics (Schäfer & Keppler, 2020; Ajzen, 1991).

4.3 Conclusion

The present study explored the CA of VF using hydroponic systems in the Kingdom of Bahrain. The benefits have a standardized weight ($B = .12$, $p < .001$), specifically the economic and landscape greenery advantages, which showed significantly positive influences. The economic benefits have the highest impact ($B = .736$, $p < .001$). 42.6% of participants strongly agreed that VF generates more job opportunities for the community. Regarding the concern dimension, results showed stronger effects on CA compared to the benefits dimension ($B = .558$, $p < .001$). The most significant component was for the surrounding area concerns. While 34.9% of participants neither agreed nor disagreed that VF contributes to noise, interview data provided more insight. Some participants expressed skepticism, noting that devices with specialized fans might create some disturbance. Nevertheless, many believed that VF does not generate noise levels high enough to affect nearby environments.

About waste, 27.5% of participants remained neutral about whether VF generates waste. Interviews confirmed that VF produces green waste. Participants emphasized

the importance of choosing appropriate locations. Additionally, the locations domain had a significant positive effect on CA, and it is the second most effective domain on CA after the concern domain ($B = .402, p < .001$). The interviews revealed opposition to placing VF in supermarkets and hypermarkets. Participants cited food safety concerns, such as the risk of contamination from customers with poor hygiene, potentially impacting consumer trust in VF products. They also pointed to the high cost of retail locations, which could drive up product prices and reduce business profitability. These challenges make agricultural ventures less attractive to lenders compared to commercial projects. However, some studies indicated that VF initiatives may benefit from government subsidies and financial support.

These findings suggest several strategic insights. First, public concerns about noise, waste, and location, especially in high-traffic commercial areas, indicate that regulatory guidelines are essential. Policymakers should establish clear zoning and safety protocols to ensure VF projects gain public trust and minimize perceived risks. Second, despite these concerns, the strong recognition of economic benefits and job creation presents an opportunity for targeted investment and government incentives, particularly in urban areas with underutilized land. Third, the alignment of VF with Bahrain's Vision 2030 and several Sustainable Development Goals underscores its potential as a national strategy for food security and environmental resilience. Government agencies such as the Ministry of Municipalities Affairs and Agriculture and the Ministry of Sustainable Development can play a key role in scaling VF through supportive policies and public awareness campaigns. Future implementation should focus on transparent communication, pilot projects in appropriate zones, and stakeholder engagement to address concerns and enhance acceptance.

Finally, this study highlights the role of VF in supporting Bahrain Vision 2030 and contributing to several United Nations Sustainable Development Goals (SDGs), including Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation, and Infrastructure), Goal 11 (Sustainable Cities and Communities), Goal 12 (Responsible Consumption and Production), Goal 13 (Climate Action), Goal 15 (Life on Land), and Goal 17 (Partnerships for the Goals).

4.4 Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Stakeholder Engagement

- Institutions such as the Bahrain Center for Strategic, International and Energy Studies (Derasat) should facilitate multi-stakeholder engagement platforms. These forums can align VF implementation with Bahrain food security strategies and ensure the active participation of farmers, businesses, and local communities.

2. Pilot Projects and Government Support

- The Ministry of Municipalities Affairs and Agriculture is encouraged to support pilot VF initiatives, particularly those that demonstrate sustainable use of limited land and water resources. Policy incentives, land-use regulations, and public-private partnerships should be considered to accelerate adoption.

3. Integration of Renewable Energy

- The Sustainable Energy Authority should collaborate with agricultural technology providers to promote the integration of renewable energy solutions, such as solar power, into VF systems. This approach aligns with national energy goals and supports environmentally sustainable food production.

4. Addressing Public Concerns

- Given that the concern dimension had the strongest impact on CA, policymakers and developers should prioritize addressing issues related to environmental, socio-economic, and operational factors in order to strengthen public trust.

5. Public Education and Awareness

- Continuous educational initiatives should be launched to raise awareness of the benefits of VF technology. Transparent communication is essential to address public concerns regarding waste, noise, hygiene, and other potential environmental impacts.

6. Future Research Directions

- Conduct cost-benefit analyses to assess the financial feasibility of VF using

hydroponics in Bahrain.

- Explore longitudinal studies to track changes in CA over time.
- Investigate noise levels and the environmental implications of VF systems.
- Examine the economic impacts on existing agricultural sectors and potential displacement effects.
- Pilot community-based interventions to test public engagement models and refine VF adoption strategies.

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Appendices

Appendix 1:

الزراعة العمودية

تعرف الزراعة العمودية بأنها من الأنظمة الزراعية الداخلية التي تسمح بنمو المحاصيل فيها بشكل عمودي في مباني شاهقة أو على أسطح منحدرية أو على أرفف رأسية. تسمح الزراعة العمودية بإنتاج المحاصيل بشكل مستدام طوال العام وذلك من خلال التحكم في الظروف البيئية المحيطة بالنبات والتي تضمن إنتاج المحاصيل بكمية وفيرة في ظل استخدام مساحات صغيرة نسبياً. للزراعة العمودية العديد من المزايا كونها تحافظ على التنوع البيولوجي وتقلل من استهلاك الطاقة الإنتاجية وكما توفر كميات كافية من المواد الغذاء للمجتمع المحلي. هذا ويمكن اعتبار ارتفاع تكلفة الإنشاء، مقارنة بالأنظمة الزراعية الأخرى، من أهم العوائق التي تحول دون استخدام الزراعة العمودية.

Vertical farming

Vertical farming is known as an indoor, urban farming technology in which crops grow in high-rise buildings, on sloping surfaces, or in vertically stacked layers that maximizes the use of the land. The vertical farming has been designed for sustainable crop production. It operates under carefully selected and well-monitored conditions that ensures optimum crop production year-round in a relatively small



Appendix 2:

Benefit

Environmental Benefit	B1- Requiring less emission fuel to transport the food because the food is produced in the city.
	B14- Helping to repair more of the urban ecosystem by using less land.
	B11- Accessing healthy and fresh food.
Social Benefit	B12- Increasing social interaction between communities.
	B13- Providing new educational fields for producing food and relevant technologies.
	B2- Providing well emotional, mental, and spiritual health and social well-being of the community.
Landscape greenery	B3- Reducing the urban heat.
	B8- Increasing the air quality by its greenery.
	B6- Island by its greenery providing sites for rest, joy, and amusement for community and landscape view.
Economical Benefit	B4-Offer more job opportunities for the community.
	B5-Decreasing the price of food within cities.
	B7- Promoting the economic opportunity for land shortage.
	B9- Producing more valuable food and selling in markets.
	B10- Minimising the energy cost.

Concern

Surrounding area concern

C1- Vertical farming may make noise in the surrounding area.

C7 Produce waste in the surrounding area.

C9- Provide conflict between neighbourhood and Farm Company.

C10- Vertical farming may produce a bad smell in the surrounding area.

Economic concern

C2- The price of land to develop vertical farming in the urban area is so expensive.

C6- The implementation and maintenance of vertical farming are so expensive.

C8- It may have negative economic impacts on local farmers.

Socio- economical concern

C3- May decrease property values in the surrounding area.

C4- Vertical farming is like a laboratory and the products are far from natural.

C5- Change the fabric of society by having too many farmworkers in the company.

General belief

Anthropocentric

D1- A key reason to grow vegetables inside urban areas by vertical farming is for people to have fresh and cheap food.

D2- Rejecting vertical farming does not mean that I don't like the environment.

D4- Implementation of vertical farming project as land development in Bahrain is a good idea as long as the high quality of life can be preserved.

Ecocentric

D3- Sometimes it makes me sad to see the desert environment being cleared for agriculture or building construction.

D5- One of the most important reasons to develop vertical farming in urban areas is to preserve the urban environment.

D8- It makes me sad to see the transformation of the green belt of agricultural lands in Bahrain into urban areas.

D9- The most important reason for land protection by vertical farming is human survival.

D11- I believe that vertical farming is important for our environment.

Apathetic

D6- I am opposed to programs to preserve land, reduce pollution and conserve resources in urban areas.

D7- I don't care about environmental issues.

D10- I think the saving environment is not my duty.

Location	Vertical farms can be constructed in	E1-Newly developed cities of Bahrain
		E2-Commercial areas
		E3-Vacant areas within the towns
		E4-Super and hypermarkets

Appendix 3:

دراسة حول قبول المجتمع للزراعة العمودية باستخدام نظام الزراعة المائية في مملكة البحرين

السلام عليكم ورحمة الله وبركاته

أنت مدعو للمشاركة في هذا الاستبيان كجزء من إجراء مشروع بحث لرسالة الماجستير "قبول المجتمع للزراعة العمودية باستخدام نظام الزراعة المائية في مملكة البحرين". هذا الاستبيان هو جزء من دراسة أجريت للوفاء بمتطلبات درجة الماجستير في برنامج العلوم البيئية والتنمية المستدامة في جامعة البحرين. يرجى تحديد الإجابات بناءً على وجهة نظرك الشخصية.

السرية

سيتم التعامل مع جميع ردودك بسرية تامة، والتي ستستخدم لأغراض بحثية وعلمية بحتة ولن يتضمن الاستبيان أي معلومات شخصية حساسة مثل الاسم ورقم الهاتف.

شكراً لوقتكم وتعاونكم.

معلومات التواصل

إذا كانت لديك أي أسئلة في أي وقت، سواء قبل أو أثناء أو بعد مشاركتك، يمكنك التواصل مع الباحثة عن طريق البريد الإلكتروني التالي:

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دعاء يوسف العجيل

الزراعة العمودية

تعرف الزراعة العمودية بأنها من الأنظمة الزراعية الداخلية التي تسمح بنمو المحاصيل فيها بشكل عمودي في مباني شاهقة أو على أسطح منحدر أو على أرفف رأسية. تسمح الزراعة العمودية بإنتاج المحاصيل بشكل مستدام طوال العام وذلك من خلال التحكم في الظروف البيئية المحيطة بالنبات والتي تضمن إنتاج المحاصيل بكمية وفيرة في ظل استخدام مساحات صغيرة نسبياً. للزراعة العمودية العديد من المزايا كونها تحافظ على التنوع البيولوجي وتقلل من استهلاك الطاقة الإنتاجية وكما وتوفر كميات كافية من المواد الغذائية للمجتمع المحلي. هذا ويمكن اعتبار ارتفاع تكلفة الإنشاء، مقارنة بالأنظمة الزراعية الأخرى، من أهم العوائق التي تحول دون استخدام الزراعة العمودية.

نماذج للزراعة العمودية

نموذج ١



نموذج ٢



نموذج ٣



الخصائص الاجتماعية والديموغرافية					
١- عمر المشارك.	العمر 18-27	العمر 28-37	العمر 38-47	العمر 48-56	العمر > 56
٢- الجنس.	ذكر	أنثى			
٣- التعليم.	أقل من شهادة الثانوية العامة	شهادة الثانوية العامة	درجة البكالوريوس	درجة الماجستير	درجة الدكتوراه
٤- الدخل الشهري للعائلة.	٤٠٠-٦٠٠ دينار بحريني	٦٠١-٨٠٠ دينار بحريني	٨٠١-١٠٠٠ دينار بحريني	١٠٠١-١٢٠٠ دينار بحريني	١٢٠١ دينار بحريني أو أكثر
٥- المحافظة.	محافظة العاصمة	محافظة المحرق	محافظة التمامية	محافظة الجويرية	

الفوائد المكتسبة من الزراعة العمودية					
١- تستهلك الزراعة العمودية كميات أقل من الوقود لنقل الطعام الذي يتم إنتاجه في المدينة.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٢- الزراعة العمودية مصدر للصحة النفسية والعصبية والرفاهية المجتمعية.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٣- الزراعة العمودية تساعد على خفض درجة حرارة المدن.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٤- المزارع العمودية ستزيد من فرص العمل في المجتمع.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٥- تساهم الزراعة العمودية في خفض أسعار المواد الغذائية داخل المدن.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٦- توفر المزارع العمودية بمساحاتها الخضراء ومناظرها الجميلة مواقع للراحة والمتعة والتسلية لأفراد المجتمع.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٧- تعزز الزراعة العمودية من الفرص الاقتصادية للمناطق التي تعاني من نقص الأراضي.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٨- تزيد الزراعة العمودية جودة الهواء من خلال توفير المساحات الخضراء.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
٩- تساهم الزراعة العمودية في إنتاج أغذية ذات قيمة أكبر وبيعها في الأسواق.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
١٠- تقلل من استهلاك الطاقة مما يعني تكلفة أقل.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
١١- تؤمن الحصول على طعام صحي وملائم.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
١٢- تساعد الزراعة العمودية على رفع معدل التفاعل الاجتماعي في المجتمع.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
١٣- توفر الزراعة العمودية مجالات تعليمية جديدة لإنتاج الغذاء والتقنيات ذات الصلة.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة
١٤- تساعد الزراعة العمودية في إصلاح النظم البيئية الحضرية باستخدام مساحات أقل من الأراضي.	لا ينفق بشدة	لا ينفق	لا ينفق ولا أرض	لا ينفق	لا ينفق بشدة

القلق المتعلق باستخدام تقنية الزراعة العمودية					
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١- الزراعة العمودية قد تسبب ضوضاء للمناطق المحيطة بها.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٢- أسعار الأراضي المطلوبة لإنشاء المزارع العمودية في المناطق العمرانية باهظة الثمن.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٣- قد تؤدي المزارع العمودية إلى خفض قيمة العقارات في المناطق المحيطة بها.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٤- الزراعة العمودية مثل المختبر ومنتجاتها بعيدة كل البعد عن كونها طبيعية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٥- تسبب مشاريع الزراعة العمودية في إحداث تغير في نميج المجتمع وذلك عن طريق استقدام عدد كبير من العمالة.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٦- تكاليف إنشاء وصيانة الزراعة العمودية عالية للغاية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٧- تسبب الزراعة العمودية في تراكم النفايات في المناطق المحيطة بها.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٨- للزراعة العمودية آثار اقتصادية سلبية على المزارعين المحليين.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٩- المزارع العمودية مصدر للخلافات بين سكان الحي وأصحاب الشركات.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١٠- قد تسبب الزراعة العمودية رائحة كريهة في المناطق المحيطة بها.

المعتقدات العامة					
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١- أحد الأسباب الرئيسية لزراعة الخضروات باستخدام الزراعة العمودية داخل النطاق العمراني هو سهولة الحصول على الطعام الطازج وبأسعار تنافسية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٢- رافضي للزراعة العمودية لا يعني أنني لست مهتماً بالبيئة.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٣- يحزنني في كثير من الأحيان أن يتم إزالة البيئة الصحراوية واستبدالها بمشاريع زراعية أو تشييد مباني حديثة.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٤- تنفيذ المشاريع الزراعية العمودية لتنمية الأراضي في البحرين فكرة صائبة طالما يمكن الحفاظ على جودة الحياة العالية في المملكة.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٥- من أهم أسباب إنشاء المزارع العمودية في المناطق العمرانية المحافظة على بيئتها.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٦- أنا معارض لجميع البرامج التي تهتم بالحفاظ على الأراضي وتقليل التلوث والحفاظ على الموارد الطبيعية في المناطق العمرانية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٧- أنا لا أهتم بالقضايا البيئية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٨- يحزنني تحول أراضي الحزام الأخضر الزراعية في مملكة البحرين إلى مناطق عمرانية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٩- السبب الرئيسي وراء حماية الأراضي باستخدام الزراعة العمودية المحافظة على بقاء الإنسان.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١٠- أعتقد أن المحافظة على البيئة ليمتد من اختصاصي.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١١- أعتقد أن الزراعة العمودية مهمة لبيئتنا.
المواقع المقترحة لإنشاء المزارع العمودية					
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	١- مدن البحرين الحديثة.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٢- المناطق التجارية.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٣- المساحات الخالية داخل المدن.
لا أوافق بشدة	لا أوافق	لا أوافق ولا أرفض	أوافق	أوافق بشدة	٤- المراكز التجارية الأسواق المركزية.

The Community Acceptance of Vertical Farming Using Hydroponic System in the Kingdom of Bahrain

Dear sir/madam,

You are invited to participate in this survey as part of a research project entitled, "The Community Acceptance of Vertical Farming using Hydroponic System in the Kingdom of Bahrain". This survey is part of a study conducted to fulfill the requirement of a master degree in Environmental Sciences and Sustainable Development Program at the University of Bahrain. Please select the answers based on your personal point of view.

Privacy

All of your responses will be kept strictly confidential. The survey will not include any sensitive personal information, such as names or phone numbers. It would be great if you could spend few minutes filling out the given questionnaire as completely and accurately as possible.

Thank you for your time and support.

Contact Information

If you have any enquiries, whether before, during, or after your participation, you can contact the researcher via the following email:

Duaa3018@gmail.com

20190231@stu.uob.edu.bh

Duaa Yousef Alojail

Vertical farming

Vertical farming is known as an indoor, urban farming technology in which crops grow in high-rise buildings, on sloping surfaces, or in vertically stacked layers that maximizes the use of the land. The vertical farming has been designed for sustainable crop production. It operates under carefully selected and well-monitored conditions that ensures optimum crop production year-round in a relatively small area.

Implementing vertical farming in cities can conserve the biodiversity, reduces wastage and restricts energy consumption. Vertical farming is used to produce and provide sufficient food for the public. However, the main disadvantage of vertical farming implementation is the high costs of its establishment.

Models of vertical farming

Figure 1



Figure 2



Figure 3



Socio- demographic Characteristics					
1- Participant age.	Age 18-27	Age 28-37	Age 38-47	Age 47 - 56	Age > 56
2-Gender,	Male	Female	"	"	"
3-Education.	Lower Than High School Certificate	High School Certificate	Bachelor Degree	Master Degree	PhD Degree
4-Family salary,	BD400-600	BD601-800	BD801 - 1000	BD1001 - 1200	BD 12001 or more
5-Governorate.	Capital	Northern	Southern	Moharraq	

Benefit dimension of Vertical farming						
	1-Requiring less emission fuel to transport the food because the food is produced in the city.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	2- Providing well emotional, mental, and spiritual health and social well-being of the community.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	3- Reducing the urban heat,	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	4- Offer more job opportunities for the community.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	5- Decreasing the price of food within cities.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	6- Island by its greenery providing sites for rest, joy, and amusement for community and landscape view.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	7- Promoting the economic opportunity for land shortage.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	8- increasing the air quality by its greenery.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	9- Producing more valuable food and selling in markets.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	10- Minimising the energy cost.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	11- Accessing healthy and fresh food.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	12- Increasing social interaction between communities.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	13- Providing new educational fields for producing food and relevant technologies.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	14- Helping to repair more of the urban ecosystem by using less land.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Concern dimension of Vertical farming						
1- Vertical farming may make noise in the surrounding area.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
2- The price of land to develop vertical farming in the urban area is so expensive.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
3- May decrease property values in the surrounding area.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
4- Vertical farming is like a laboratory and the products are far from natural.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
5- Change the fabric of society by having too many farmworkers in the company.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
6-The implementation and maintenance of vertical farming are so expensive.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
7- Produce waste in the surrounding area.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
8-It may have negative economic impacts on local farmers.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
9- Provide conflict between neighbourhood and Farm Company.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
10- Vertical farming may produce a bad smell in the surrounding area.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	

General belief dimension						
1- A key reason to grow vegetables inside urban areas by Vertical farming is for people to have fresh and cheap food.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
2- Rejecting Vertical farming does not mean that I don't like the environment.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
3- Sometimes it makes me sad to see the desert environment being cleared for agriculture or building construction.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	
4- Implementation of Vertical farming project as land development in Bahrain is a	Strongly agree	Agree	Neither agree	Disagree	Strongly disagree	

good idea as long as the high quality of life can be preserved.			not disagree		
5- One of the most important reasons to develop vertical farming in urban areas is to preserve the urban environment.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
6- I am opposed to programs to preserve land, reduce pollution and conserve resources in urban areas.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
7- I don't care about environmental issues.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
8- It makes me sad to see the transformation of the green belt of agricultural lands in Bahrain into urban areas.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
9- The most important reason for land protection by vertical farming is human survival.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
10- I think the saving environment is not my duty.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
11- I believe that vertical farming is important for our environment.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Location dimension Vertical farms can be constructed in:					
1- Newly developed cities of Bahrain.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
2- Commercial areas.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
3- Vacant areas within the towns.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
4- Super and hypermarkets.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Appendix 4:

Dimension	mean	Std	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Environmental Benefit	9.32	1.48	1													
2. Social Benefit	9.36	1.42	0.3	1												
3. Greenery Benefit	8.85	1.78	0.4	0.3	1											
4. Economical Benefit	15.25	2.06	0.53	0.39	0.41	1										
5. Surrounding Area Concern	11.09	2.97	0.18	0.08	0.31	0.15	1									
6. Economic Concern	8.96	1.66	0.25	0.23	0.3	0.24	0.51	1								
7. Socio-Economical Concern	7.95	2.5	0.17	0.16	0.36	0.22	0.61	0.46	1							
8. Anthropocentric	9.25	1.36	0.56	0.57	0.4	0.58	0.1	0.23	0.15	1						
9. Ecocentric	14.84	2.58	0.64	0.37	0.78	0.68	0.29	0.29	0.32	0.47	1					
10. Apathetic	9.24	1.35	0.4	0.26	0.46	0.69	0.1	0.18	0.19	0.34	0.35	1				
11. Newly Developed Cities	3.19	0.73	0.24	0.17	0.26	0.21	0.12	0.09	0.07	0.21	0.23	0.27	1			
12. Commercial Areas	3.38	1.4	0.04	0.09	0.3	0.04	0.16	0.15	0.19	0.01	0.23	0.08	0.15	1		
13. Vacant Areas within Towns	3.01	0.8	0.16	0.15	0.16	0.22	0	0.15	0.01	0.14	0.16	0.27	0.18	0.11	1	
14. Super and Hypermarkets	2.96	0.95	0.22	0.14	0.41	0.1	0.3	0.25	0.36	0.12	0.35	0.08	0.2	0.38	0.19	1

الملخص

يعد التدهور البيئي والأمن الغذائي والتوسع السكاني من أهم التحديات التي تواجه البشرية. تعد الزراعة العمودية أحد الحلول المقترحة لحل هذه التحديات الملحة. تعتبر الزراعة العمودية نوعاً من الزراعة الحضرية الداخلية حيث تزرع المحاصيل في طبقات مكدسة رأسياً، أو على أسطح مائلة، أو في هياكل شاهقة الارتفاع. يعد الأمن الغذائي أولوية رئيسية للمسؤولين في مملكة البحرين، وفقاً لمنندى دراسات الرابع تؤدي القيود الزراعية الطبيعية، مثل مناخ البحرين الصحراوي، ونقص المياه الجوفية، واستخدام الأراضي الزراعية للتنمية الحضرية، إلى انخفاض الإنتاج الزراعي. تهدف هذه الدراسة إلى فهم العوامل الرئيسية المؤثرة على قبول المجتمع للزراعة العمودية باستخدام أنظمة الزراعة المائية في مملكة البحرين. أجريت دراسة استكشافية ما بين شهر سبتمبر وأكتوبر 2023 كما تم توزيع الاستطلاع عبر الإنترنت باستخدام نماذج قوئل. كان إجمالي عدد المستجيبين الفرديين للاستطلاع 402. وبينما كانت الطريقة الأخرى المستخدمة في الدراسة إجراء مقابلات مع أحد عشر من المشاركين. أجريت جميع المقابلات عبر مكالمات الفيديو عبر الإنترنت على منصات مثل مايكروسوفت تيمز أو على زووم ما بين شهر سبتمبر إلى نوفمبر 2023. تم استخدام الإحصاءات الوصفية لتحليل بيانات البحث باستخدام IBM SPSS (الإصدار 25) تم عمل اختبار ألفا كرو نباخ لتقييم الاتساق الداخلي وموثوقية الاستبيان للأبعاد الدراسة الخمسة (44 عنصراً). تم تلخيص الاستجابات عددياً باستخدام مقاييس الاتجاه المركزي والتشتت الإحصائي. بالإضافة إلى ذلك، تم تقديم التكرارات والنسبة المئوية للبيانات على شكل رسومي لعرض النتائج وتحليلها وتوضيحها وتفسيرها بصرياً. تم تطبيق التحليل الاستدلالي باستخدام نمذجة المعادلات البنوية (SEM) باستخدام برنامج AMOS (الإصدار 29). تم استخدام نمذجة المعادلات الهيكلية (SEM) لاختبار آثار الفوائد والمخاوف والمعتقدات والموقع على قبول المجتمع للزراعة العمودية في مملكة البحرين، لاستكشاف آثار المتغيرات الديموغرافية على قبول المجتمع. في حين أن الفوائد كان لها وزن موحد ($B = .12$ مع $p < .001$)، فإن المعتقدات العامة لها تأثير إيجابي ذو دلالة إحصائية ($B = .088$ ، $p < .001$)، على الرغم من أن الفوائد والمخاوف والمعتقدات العامة كان لها آثار ذات دلالة إحصائية على قبول المجتمع إلا أن بُعد المخاوف كان له أقوى التأثيرات على قبول المجتمع ($B = .558$ ، $p < .001$) . ومجال المواقع ($B = .402$ ، $p < .001$). أظهرت النتائج أن محلات السوبر ماركت والهايبر ماركت هي أكثر المواقع قبولاً لإنشاء VF في مملكة البحرين. فيما يتعلق بالخصائص الاجتماعية والديموغرافية، لم تكن هناك آثار ذات دلالة إحصائية للمتغيرات الديموغرافية على قبول المجتمع. وأخيراً، تسلط هذه الدراسة الضوء على دور الزراعة العمودية في دعم رؤية البحرين 2030 والمساهمة في العديد من أهداف التنمية المستدامة للأمم المتحدة، بما في ذلك الهدف 2 (القضاء على الجوع)، والهدف 3 (الصحة الجيدة والرفاهية)، والهدف 6 (المياه النظيفة والنظافة الصحية)، والهدف 7 (الطاقة النظيفة وبأسعار معقولة)، والهدف 9 (الصناعة والابتكار والهياكل الأساسية)، والهدف 11 (مدن ومجتمعات محلية مستدامة)، والهدف 12 (الاستهلاك والإنتاج المسؤولان)، والهدف 13 (العمل المناخي)، والهدف 15 (الحياة على الأرض)، والهدف 17 (عقد الشراكات لتحقيق الأهداف). تُبرز هذه الرؤى إمكانات الزراعة العمودية في دعم أهداف البحرين في إنتاج الغذاء والمساهمة في تحقيق أهداف التنمية المستدامة، وذلك في حال تم التعامل مع المخاوف الرئيسية التي يثيرها المجتمع. ومع ذلك، يجب على صناع السياسات والمعنيين معالجة هذه المخاوف لضمان دمج تقنيات VF بنجاح ضمن استراتيجيات التخطيط الحضري في البحرين.

جامعة البحرين

برنامج البيئة والتنمية
المستدامة



كلية العلوم

دراسة حول قبول المجتمع للزراعة العمودية باستخدام نظام الزراعة المائية في مملكة البحرين

أطروحة مقدمة كجزء من متطلبات الحصول على درجة ماجستير في البيئة والتنمية المستدامة

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