FOOD SECURITY ISSUES
AND ARCHITECTURAL INTERVENTION
OF URBAN FARMING
IN SINGAPORE

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FOOD SECURITY ISSUES AND ARCHITECTURAL INTERVENTION OF URBAN FARMING IN SINGAPORE

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A dissertation submitted in fulfilment of the
requirements for the award of the degree of
Master of Architecture

Faculty of Built Enviroment and Surveying
Universiti Teknologi Malaysia

JULY 2022

DEDICATION

This thesis is dedicated to my mother, who encouraged me to pursue my passion in Architecture, my father, who believed that I could achieve more than I thought I could and my wife who has always been my biggest supporter throughout the journey.

ACKNOWLEDGEMENT

I wish to express my sincere appreciation to my dissertation supervisor, Ar. Norshahida binti Azili, for her encouragement, guidance, critics, and trust. I am also very thankful to my supervisor in office, Wang Lai Meng for her support, guidance and the technical knowledge shared. Without their continued support and interest, this dissertation would not have been the same as presented here.

I am also indebted to Universiti Teknologi Malaysia (UTM) for providing the flexibility for me to pursue my Masters in Architecture programme while being employed professionally, which is not offered in any other institutions currently.

Recognition should also go to my fellow postgraduate students for their support and camaraderie. My sincere appreciation also extends to all my colleagues at work and at the university who have provided assistance at various occasions. Their views and tips are useful indeed.

Last but not least, I have to thank my family members, especially my wife for sacrificing her time and effort to allow me to pursue this programme. The gratitude is also extended to my extremely supportive parents and siblings who have kept me going all these years.

ABSTRACT

The purpose of this research paper is to better understand the issue of self-sufficiency in Singapore, in terms of food supply and potential means for the city-state to become more self-reliant in terms of food production. Singapore is a city-state with no natural resources and very limited agricultural land whereby only 1% of the total land mass in Singapore is currently available for farming activities, and 90% of the food consumed is imported from all around the world. However, the Singapore government has embarked on the 30 by 30 initiative, which aims to enable Singapore to produce 30 percent of its own food by the year 2030 in order to address food security concerns. The issue of food security was particularly evident during the COVID-19 pandemic, when panic buying at supermarkets were prevalent due to uncertainties in food supply following the closure of international borders. Research has revealed however that the panic buying was mainly caused by fear and perception rather than actual supply shortage in the market. Therefore, the objectives of this research paper include attempting to understand means to manage public perception with regards to food supply, identifying alternative methods of agricultural production in Singapore and the general supply and demand of food in the city-state. The four main research questions that has guided the study include understanding how dependent the city-state is, understanding why food security is a priority concern in Singapore, investigating the public perception on food security as well as identifying key elements that would help Singapore to achieve its 30 by 30 goal. The research employed a mixed research method, whereby both qualitative and quantitative data were collected and analysed. Qualitative data were collected from literature review, case studies and photographic evidence, whereas quantitative data was obtained through a 28-question online survey questionnaire. The survey results were analysed using statistical methods such as the Chi-Square Test of Independence in the IBM SPSS software. Based on the results of both quantitative and qualitative analysis, it can be concluded that public participation is vital to ensure the success of the 30 by 30 initiative, and that the public's demographic characteristic could have an impact on the participation rate and the perception of urban farming activities. These conclusions culminate in recommendations that could potentially add value to Singapore's self-sufficiency goals in the long run.

ABSTRAK

Kajian ini dilakukan bertujuan untuk memahami isu kebergantungan sumber makanan di Singapura, dan kaedah-kaedah munasabah bagi negara itu untuk menjadi lebih berdikari dari segi pengeluaran makanan. Singapura adalah sebuah negara-kota tanpa sumber asli dan tanah pertanian yang sangat terhad di mana hanya 1% daripada tanah di Singapura pada masa kini digunakan untuk aktiviti pertanian, dan 90% daripada makanan adalah diimport dari sumber-sumber luar di serata dunia. Justeru, kerajaan Singapura telah memulakan inisiatif "30 by 30", yang bertujuan membolehkan Singapura menghasilkan 30 peratus makanannya sendiri menjelang tahun 2030 untuk menangani kebimbangan jaminan makanan. Isu jaminan makanan amat ketara semasa bermulanya pandemik COVID-19, apabila pembelian panik di pasar raya berleluasa disebabkan ketidaktentuan dalam bekalan makanan berikutan penutupan sempadan antarabangsa. Walau bagaimanapun, penyelidikan telah mendedahkan bahawa pembelian panik sebenarnya adalah hanya disebabkan oleh persepsi rakyat dan bukan disebabkan oleh kekurangan bekalan sebenar di pasaran. Oleh itu, objektif kertas penyelidikan ini adalah untuk memahami cara untuk menguruskan persepsi orang ramai berhubung dengan bekalan makanan, mengenal pasti kaedah alternatif pengeluaran pertanian di Singapura dan juga memahami bekalan dan permintaan umum makanan di negara itu. Empat soalan kajian utama yang telah membimbing kajian ini termasuk memahami kadar kebergantungan negara kota itu dari segi sumber makanan, memahami mengapa keselamatan makanan menjadi keutamaan di Singapura, menyiasat persepsi orang ramai terhadap isu jaminan makanan serta mengenal pasti elemen-elemen utama yang akan membantu Singapura mencapai matlamat "30 by 30". Penyelidikan ini menggunakan kaedah penyelidikan campuran, di mana kedua-dua data kualitatif dan kuantitatif dikumpulkan dan dianalisa. Data kualitatif dikumpul daripada kajian literatur, kajian kes dan bukti fotografi, manakala data kuantitatif diperoleh melalui borang soal selidik yang diedarkan di atas talian yang mengandungi 28 soalan. Hasil soal selidik telah dianalisa menggunakan kaedah statistik seperti ujian chi-square menggunakan perisian IBM SPSS. Berdasarkan keputusan analisis kuantitatif dan kualitatif tersebut, dapat disimpulkan bahawa penglibatan orang ramai adalah penting untuk memastikan kejayaan inisiatif "30 by 30", dan ciri demografi orang ramai boleh memberi kesan ke atas kadar penglibatan dan persepsi orang ramai terhadap teknik-teknik pertanian moden. Penyelidikan ini disimpulkan dengan cadangan-cadangan yang berpotensi membantu Singapura untuk mencapai matlamat untuk menjadi negara berdikari dari segi sumber makanan dalam jangka masa panjang.

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LIST OF ABBREVIATIONS

CBD	-	Central Business District
FAO	-	Food and Agriculture Organization of the United Nations
GFSI	-	Global Food Security Index
HDB	-	Housing Development Board
IoT	-	Internet of Things
JFP	-	Jurong Fishery Port
LED	-	Light Emitting Diode
NASA	-	United States National Space Agency
RIE	-	Singapore Government's Research, Innovation & Enterprise
SCDF	-	Singapore Civil Defence Force
SFA	-	Singapore Food Agency
SFP	-	Senoko Fishery Port
SPSS	-	IBM's Statistical Package for the Social Sciences software

LIST OF SYMBOLS

α	-	Alpha
p	-	p-value

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CHAPTER 1

INTRODUCTION

1.1 Problem Background

The issue of self-sufficiency has been a long-standing debate in Singapore, ever since the city-state separated from Malaysia in 1965. From water to other natural resources, it has always depended on its neighbouring countries, including Malaysia, Thailand and Indonesia. However, through its resilience over the years, Singapore has repeatedly defied the odds and managed to become a globally recognised city that seems to have all its issues resolved.

Food security, however, is still a huge topic that is discussed not just amongst the ordinary Singaporeans, but is also a concern within the government, that various initiatives and government-sponsored programmes have been put in place to ensure the secure supply of food locally.

The issue of food security and long-term self-sufficiency was given renewed attention at the start of the Circuit Breaker in response to the COVID-19 pandemic in 2020. Reports of panic buying and perceived lack of supplies started to surface as ordinary Singaporeans worry for their food supply especially when the border between Singapore and Malaysia was closed indefinitely.

A study conducted by the Nanyang Institute of Technology (NTU, 2021) however revealed that the panic buying during the Circuit Breaker was caused merely by fear and perception of lack of supplies and peer pressure rather than actual food supply shortage in the market. This inaccurate perception of food shortage is also an issue that needs to be addressed in order to restore confidence amongst the people in the food supply available in Singapore and move forward to work on a more resilient community in becoming self-sufficient in the future.

1.2 Problem Statement

Based on the issues identified, the following problem statement can be put forward to help with the development of the aim and objectives of this study. Singapore, a small city-state with limited resources has only 1% of farmland available for agricultural activities. Over 90% of food is imported from neighbouring countries. (Singapore Food Agency, 2020). Therefore, access to safe and nutritious food can be a challenge in the city-state during emergencies and situations where movements across the country's borders are limited or blocked entirely.(Devereux et al., 2020)

The importance of addressing this issue was further amplified by the COVID-19 Pandemic when food security in a locked-down Singapore was often questioned. (Teng, 2020). Hence, a thorough study needs to be conducted to better understand the issue of self-sufficiency, which in turn will help in identifying potential new sources for food production. The study should also cover the public perception of alternative methods of food production such as urban and indoor farming techniques to understand the social impact of its implementation.

The outcome of the study would hopefully provide guidance on ways to improve the long-term prospect of self-sufficiency in a highly urbanised community like Singapore, which is in line with the Singapore Government's aim to produce 30% of food locally by 2030, in the "30 by 30 Roadmap". (Singapore Food Agency, 2020).

1.3 Research Questions

The basis of the research can be formed around four research questions that relate to the main themes, namely the issue of dependency, the significance of the topic of food security, the perception of the public in relation to food scarcity and finally the question of the methods and preparedness of achieving self-sufficiency in Singapore.

1.3.1 How Dependent is Singapore?

This question attempts to gauge the extent of the issue of Singapore's high dependence on external sources for its food. The answer to this question would provide a relevant context to the subsequent studies and recommendations that may be produced.

For instance, the higher the dependency of a certain country on external sources in terms of commodities and raw material, the higher the impact would be on the country's local economy should there be a major global event that disrupts the international supply chain. On the other hand, a self-reliant country that produces its own food and raw material, especially countries that are rich in natural resources, would be less likely to be impacted by global supply chain events.

However, it is worth noting that in today's extremely globalised world, no single country on earth would be spared from being impacted by global events, only that the severity of the impact would vary from one country to another depending on the degree of dependence to external sources. In the case of Singapore, a city-state with a mere 728.6 km² of land mass and a population of 5.6 million, it needs to constantly look outwards for its source of food and other resources such as water and electricity.

1.3.2 Why is Food Security Important?

Unlike countries with a vast land mass such as the United States and China, which has the resources to produce its own food enough to feed its population, Singapore must constantly re-evaluate its methods to ensure sufficient food supply for its growing, and highly consumer-centric urban population.

Food security is important to ensure that the society could still survive should a catastrophic event take place in the surrounding regions, for instance in the event of a war. If there are disruptions in the supply of food from external sources, and there

are no backups to the supply, the people residing in Singapore, including locals, expats and visitors could face shortage of food, which in turn leads to a shift in the economic equilibrium of the country which may be disastrous to the survival of the country as a sovereign nation. For example, according to the International Food Policy Research Institute (Gustafson, 2019), the main drivers of acute hunger and food crises in 2018 were persistent conflict and adverse weather events. The report also further mentions that acute hunger suffered by roughly 74 million people were due to conflict or civil unrest happening in 21 countries and territories, mainly in Africa, Western Asia and the Middle East.

Therefore, in order for Singapore to continue functioning as per normal during a period of global crisis, it needs to be able to ensure food security to provide for its urban population.

1.3.3 What Does the Public Think about Food Security?

This research question attempts to gauge the social and cultural response to the issue of food security and ascertain the level of public awareness on the topic. The goal of this question is to ultimately formulate potential solutions to the issue of food security that are related to public participation in the process of securing the food supply. For example, it would be helpful to be informed that the panic buying and food hoarding during the early days of the COVID-19 pandemic were more socially charged (i.e., perceived food supply shortage, rather than actual shortage.)

Knowledge on this issue could then be used in recommending a suitable approach to securing the local food supply, one that involves the public in order to better manage public perceptions in future global events.

1.3.4 What Would It Take to Reach the Goal?

It is important to know what it would take to reach the goal of the Singapore government's 30 by 30 aim in proposing programs and architectural interventions that would help propel us closer towards the goal. For instance, what are the categories of food considered to be part of the 30% locally produced food, and how much would Singapore need to have produced in order to reach the intended production yield? It is also important to first understand the consumption pattern of Singapore residents in understanding the volume of production needed to be considered as "self-sufficient".

1.4 Research Goal

The goal of the research is to identify the issues related to fresh food supply in Singapore from both local and imported sources and ascertain the impact that it would have on improving the prospect of building a self-sufficient (in terms of food supply) nation. The findings of the research would be used to formulate an architectural scheme that would allow the highly urbanised community in Singapore to coexist with resources to help build a sustainable and self-reliant food supply in Singapore.

1.4.1 Research Objectives

In order to meet the goals of the study, the following objectives are set to provide a focal point for the paper:

(a) Understanding the Supply & Demand of Food in Singapore

(b) Analysing the potential for the cultivation of food in the city-state

(c) Identify and examine potential issues and managing public perception

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