Evolution of Urban Agriculture in Hong Kong: Stepping Towards Multifunctionality

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ABSTRACT

Abstract of thesis entitled:
Evolution of Urban Agriculture in Hong Kong: Stepping Towards Multifunctionality
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Urban agriculture (UA) is an irreplaceable component of a city for economic, social and environmental aspects. It can contribute to major problems in highly urbanized cities such as food security, waste-treatments and unemployment of the low-skilled labour. While UA is achieving success in many other metropolises like Singapore and New York, the situation in Hong Kong is rather dimmed. Moreover, research related to UA in Hong Kong is very limited in the past decades.

In the recent decades, UA is studied as a multifunctional land use and it is gaining recognition on the significance on sustainability to a city. This perspective arises from the transformation of productivist agriculture during the era of Green Revolution to the post-productivist one nowadays. It would be a new perspective to assess the UA in Hong Kong and to review if UA can promote sustainability in Hong Kong.

Data are collected through participant observation of agricultural events, questionnaire survey towards stakeholders, in-depth interview with experts of the field and site visits to farms with distinct functions. With reference to archival and official data, analyses are focused on 3 major parts: 1) Review on the transformation of functions of UA in Hong Kong; 2) Assess the current situation of UA in Hong Kong; 3) To propose suitable directions and policies for further development of UA.

Straight after the WWII, the key function of local agriculture was food and social security. In the 1970's, the increased demand of both food and land for urban expansion has turned the farming area into new towns and transformed paddy-rice farming into vegetable, poultry, pig and fish pond farming which are market-oriented.

A major turning point for local agriculture was the increased amount of food import from Mainland China, which crashed the market price of local food and made local farming far less profitable. After the 1990's where farming severely shrunk, local agriculture is now on revival in form of multifunctional urban agriculture, which targets at regaining social recognition by utilizing urban resources and promoting sustainability for the city.

The current strength of multifunctionality is moderate for UA in Hong Kong, with weak performance on economic functions, moderate contributions to social functions and moderately strong functions for environmental one. Synergies can be found when different functions are combined, especially for ecological and educational functions. However, the performance on most functions is currently restricted by the small scale of agricultural production, which requires a careful balance between food production and leisurization to fully realize the potentials of UA.

The current food policy is examined to be unsustainable and susceptible to food disruptions from the food exporters. To ensure a sustainable living of Hong Kong, the peri-urban farms should be moderately multifunctional to produce high quantity and quality of food, meanwhile intra-urban farms can be strongly multifunctional to serve and educate the urban community nearby. Policy recommendations and quantitative projections are provided to revitalize the vast abandoned farmland in Hong Kong and meeting the social and environmental needs of the city.

香港都市農業向多功能性的演進

研究摘要

香港的農業在過往半世紀由盛轉衰。正當農業快要在香港消失時，都市農業在紐約及新加坡等大都會蓬勃發展，透過經濟、環境及社會等層面的功能，解決廢物堆積及產業單一化等都市問題。

在學術研究中，都市農業由２０年紀中葉的綠色革命中追求產量的生產主義 (Productivism)，演變到近年兼顧其他功能的後生產主義 (Post-productivism)。現更融入都市發展元素，衍生出多功能都市農業 (Multifunctional urban agriculture)。當亞洲的發達地區未充份研究這範疇時，正尋求發展路向的香港是相當值得研究的地方。

本研究透過參與觀察農耕活動、問卷調查、深入訪談及實地考察，結合文獻及官方數據後分析出香港農業由戰後至今日的演變。再評核當前的多功能性以及提出相應的農業政策，以增進對社會的貢獻。

香港農業在戰後一直供應充足糧食，同時保障低下階層生計，維持社會安定。但農地面積隨都市化及工業化萎縮，當大陸農產品在八十年代大量進口時，農產價格及本地市場更受到嚴重衝擊。踏入２１世紀，隨著有機耕種的發展，對都市問題的反思以及對鄉郊生活的追求，越來越多團體要求復興本土農業，讓香港達至城鄉共生。

目前香港的都市農業因整體規模太小，未能好好發揮社會、環境及經濟方面的潛能。相信在實施農地保護及食物供應等政策，香港能達至永續發展。

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Agriculture is not simply producing food, but also about living with other creatures with limited resources. My childhood dream was vaguely about environmental protection and to save the Earth with no direction. In the discovery of the multiple functions of urban agriculture, I have found the direction and will continue promoting UA with CUAGRO, to shape Hong Kong a better home for both human and nature.

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ABBREVIATIONS

AFCD	Agriculture, Fisheries and Conservation Department
AFD	Agriculture and Fisheries Department
CSA	Community supported agriculture
CUAGRO	Agricultural Development Group of the Chinese University of Hong Kong
EPD	Environmental Protection Department
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic products
HKD	Hong Kong dollar
HOFA	Hong Kong Organic Farming Association
HKSAR	Hong Kong Special Administrative Region
IU	Intra-urban
KAAA	Kadoorie Agricultural Aid Association
MUA	Multifunctional urban agriculture
NENTNDAs	North East New Territories New Development Areas
NGO	Non-government organization
OECD	The Organization for Economic Co-operation and Development
OFSS	Organic Farm Support Scheme
PRC	People's Republic of China
PU	Peri-urban
SARS	Severe Acute Respiratory Syndrome

TNCs	Trans-national corporations
UA	Urban agriculture
UK	United Kingdom
US	United States
VMO	Vegetable Marketing Organization
WWII	World War Two

Chapter One: Introduction

1.1. Introduction

"To farm or not to farm" – this is the hot topic over the recent land conflicts in Hong Kong. Some of the local citizens believe that local agriculture should not be continued, particularly given the low quantity of local output nowadays (2.3% of self-sufficiency on vegetables as in 2011). Meanwhile, the concern from the public has been growing for conserving and even expanding Hong Kong's urban agriculture (UA) to promote a more sustainable way of living. Interestingly, this idea is not only articulated by local farmers, but also green groups and some urban dwellers.

In fact, in the less well-known part of Hong Kong history, local agriculture was once prosperous and fed a significant amount (48.8% of vegetable self-sufficiency in 1967) of Hong Kong citizens. However, due to rapid urbanization and industrialization since the 1970s, local farming sector collapsed and an increasing proportion of farmland in the territory is abandoned, reaching 69.2% of the total local cultivated area by 2011.

Meanwhile, a global trend is to bring the soil back to cultivation in terms of UA, in and around the urban area of metropolises such as New York City (The New York City Council, 2010), London (Garnett, 2000), Singapore (Agri-Food & Veterinary Authority of Singapore, 2011) and Shanghai (Shanghai Municipal Agriculture Commission, 2012). Under the lens of multifunctional urban agriculture, researchers discovered multiple functions of UA other than food production and economic return. For example, UA can contribute to the reduction of food mile (Deelstra & Girardet, 2000) and consolidation of community (Armstrong, 2000). UA can take place in various forms like community gardens, rooftop gardens or farm tourism. In the context of developed regions, the concept of multifunctionality has been proposed to reappraise the contribution of agriculture to urban sustainability (Lovell, 2010).

Entering the new millennium, a similar diversity of farms has also budded in Hong Kong, but in smaller scale and a rather unorganized manner. To make a better decision on whether to revive agriculture or not in Hong Kong, it is high time for us to critically reexamine the relationships between urban development and the evolution of local agriculture over time. This study will further assess the current and

potential functions of UA, so as to recommend a suitable direction and practical policy measures for optimizing the contribution of UA towards a more sustainable Hong Kong.

1.2. Research background

Agriculture survives as a minor sector in today's Hong Kong. Demographically, with a size of 4,600, agricultural practitioners constitute only about 0.12% of the city's total labour force as of 2011 (AFCD, 2012). Geographically, farmland in Hong Kong totals 5,885 hectares, occupying around 5.3% of the city's total land area. However, almost 70% of the farmland has already been abandoned, much of which being appropriated for container storage in view of its higher returns to landowners (Jim, 1997).

This despairing picture exists in stark contrast to the heyday of local agricultural sector in the mid-20th century. Back in those days, farmers engaged in a much wider spectrum of practices, from paddy-rice and vegetable cultivation to pig rearing and pond fish farming (Lam, 1993; Wong, 1983). Other than producing for subsistence reasons, many farms were oriented at meeting local or even overseas demands of fresh produces (Wong, 1971). As official statistics indicates, the production value of agriculture in Hong Kong was significant in the early 1980s, yielding over 1.5 billion Hong Kong dollars (AFD, 1985), doubling the value in 2011 (AFCD, 2012). The rapid decline and transformation of agricultural sector is seldom discussed while the land conversion is more researched in recent studies.

Despite such a long period of downturn, optimism about agricultural development in Hong Kong has been reignited at the turn of the century. First, successive food scares in the mainland China turned many health-conscious citizens to organic farm produce in Hong Kong (Cheng, 2009). Second, there has been a growing interest among the local urban dwellers to seek pleasure from farming. Farming classes and farming-related tours are organized with increasing popularity in peri-urban areas, alongside with the budding of community gardens across the urban core. These developments signify a revival in local recognition of the value of urban agriculture to Hong Kong. To explore the potential contributions of UA in Hong Kong, the different functions of UA are yet to be studied.

1.3. Research question

The key research question of this study is:

> *How and why has urban agriculture in Hong Kong evolved, and how can it contribute to a more sustainable living through achieving multifunctionality?*

For further in-depth and focused investigation, four sub-questions are developed upon this key question:

i. *How has urban agriculture (UA) in Hong Kong evolved in terms of functions?*

ii. *What are the major factors promoting the functional transformation and adaptation of Hong Kong's UA?*

iii. *To what extent is the current UA in Hong Kong multifunctional?*

iv. *Based on the local context, what should be done for UA in Hong Kong to further contribute to the city's sustainability?*

Through answering these four sub-questions, the following objectives will be achieved.

1.4. Research objectives

This research aims to:

i. Identify the possible functions and contributions of multifunctional urban agriculture (MUA) in a developed city like Hong Kong;
ii. Provide a chronology of the evolution of UA with respect to its functions;
iii. Locate the key driving forces behind the functional evolution of UA in Hong Kong;
iv. Assess the current multifunctionality of Hong Kong's UA, so as to unravel the potential synergies and conflicts between different functions;
v. Propose a suitable direction of MUA to promote Hong Kong's sustainability.

1.5. Significance of research

There are two key contributions of the research. Extensive research on urban agriculture has been undertaken in developing countries to address food security,

while the study of multifunctional agriculture has focused on the rural landscapes in Europe and the United States. The two concepts have rarely been brought together and examined in a highly developed and urbanized geographical context similar that of Hong Kong. As a result, there is a dearth of knowledge delivered by this research.

Moreover, agriculture is relatively a sea of uncharted waters in local studies in Hong Kong, and this study has filled such gap of knowledge from a number of aspects. First of all, the study clear the obscurity of the potential contributions from multifunctional UA to sustainable development in the local academia and beyond, which has hindered the city from advancing further in its quest for sustainability. Second, it sheds light on the potential uses of the vast area of abandoned farmland in the near future, which leads to the practical contribution of improving land efficiency. Third, the account of the evolution of UA introduces a new perspective in theorizing agricultural development with an emphasis on its functions not restricted to economic production, as well as its interactions with urban development. Last but not least, the assessment on the multifunctionality of UA in Hong Kong is targeted at offering policy insights on food issues, which is of surging public concern in the territory. All these facets of the study will contribute to a more solid knowledge base which would stimulate further inquiry in related disciplines, such as urban planning and community development.

1.6. Scope of study

This research attempts to discover the wide range of possibilities to develop MUA. Geographically, the study focuses on peri-urban and intra-urban farms in Hong Kong, with land uses including, but not limited, to agricultural land use under the current official planning system. Locally, peri-urban farms are mostly situated in the northern part of the New Territories, whereas intra-urban farms are dispersed over the major urban areas in the Kowloon Peninsula and on the Hong Kong Island.

Regarding the diversity of farms examined by categories of their produce, this study includes terrestrial farming and fish pond farming (but excluding marine fish-farming). Farms with more significant functions and changes will be studied at a higher priority.

The time span of the study is from the postwar era (mid-1940's) to present (2013), corresponding to the period of time when Hong Kong has undergone rapid socio-physical transformation, notably urbanization and industrialization. More attention is given to the social, economic and political dynamics of the HKSAR regime since July 1997 so as to, in later stage of the study, provide recommendations which would be feasible with respect to the contemporary contexts of Hong Kong.

1.7. Conceptual framework

Fig. 1.1. offers a graphical view of the summary and transitions of concepts of the study. The framework is developed from the notion of urbanization of developed regions, in order to theorize the evolution of UA and multifunctionality. The time of development goes from left to right in the diagram. Two factors of global scale were stressed in the theory of food regimes: the political economy of decolonization and cold war, which facilitated the global trading of food; as well as the technological breakthrough in food preservation which enabled long distance delivery. Upon local scale of food production, the transition from productivist to post-productivist agriculture was propelled by the rising concern on environmental protection, and changes in perception of farming by both the farmers and urban citizens.

Under these dramatic changes, local agriculture evolves and increases in interaction with the expanding urban sector. By studying through the lens of multifunctionality, the significance of the remaining UA can be realized for the multiple functions served to the society and resolve urban problems such as the incapability of waste treatment and detached urban communities. While benefitted by UA, the urban setting can support the agricultural sector by providing voluntary manpower for farm work, as well as food waste to be processed into soil conditioner. At the same time, urban population ensures a stable market for purchasing fresh local food. These mutual benefits between urban living and UA can inspire policymakers to propose more sustainable food policy. Therefore local agriculture can be more adequately supported by the government for enhancing the various functions of MUA. Therefore, a virtuous cycle is constructed between the sustainability of the city and multifunctional urban agriculture.

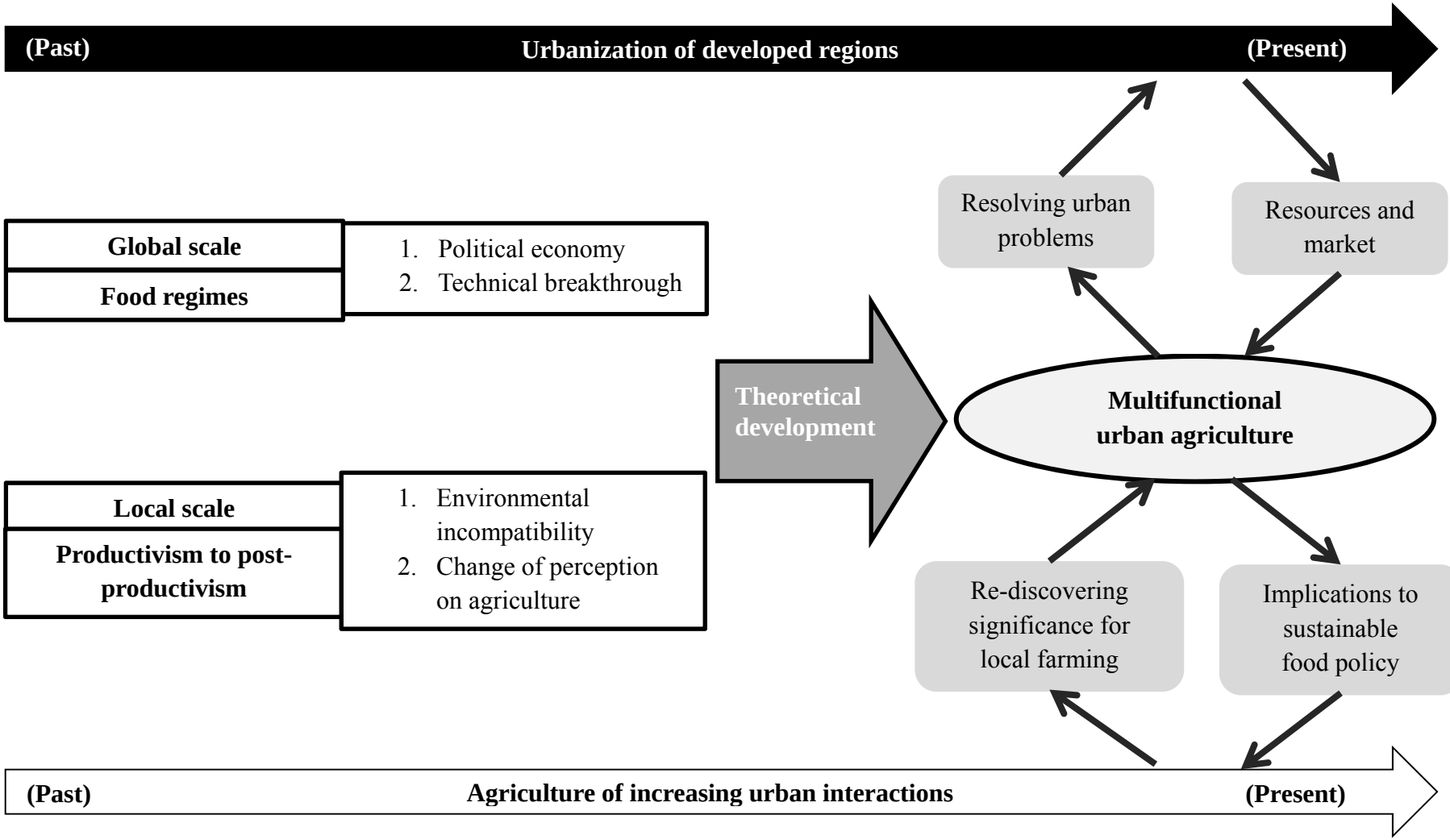


Figure 1.1. Conceptual framework of the study

1.8. Organization of the research

This research is organized into eight chapters.

Chapter One illustrates the agendas of the study, including the research questions and objectives, the significance and scope of the study, as well as the conceptual framework.

Chapter Two constructs the theoretical background of the study through reviewing the literature about the key concepts including the transition of agriculture, multifunctionality and urban agriculture.

Chapter Three presents the methodology of this research. The rationale, sources, methods and results of data collection are clearly described, followed by the framework of data analyzes.

Chapter Four starts with a general account on the background of agriculture of Hong Kong. Afterwards, the evolution of agriculture from late 1940's to early 1980's is analyzed according to the functions served by the agriculture at that time.

Chapter Five analyzes the downturn of local agriculture with emphasis on the increasing interaction with the urban settings from mid-1980's to early 2010's.

Chapter Six discusses the current situation of UA in terms of geographical, demographical and operational aspects. This chapter then explores the potential functions of UA in Hong Kong and assesses its current performance according to three dimensions, namely the economic, environmental and social functions.

Chapter Seven proposes the development of theories of multifunctional urban agriculture (MUA) in accordance with the local context. In light of a direction designed for future development of MUA, policy measures are recommended to assist stakeholder for improving the MUA for more sustainable living of Hong Kong.

Chapter Eight present the summary of finding throughout the whole research. After illustrating the implications and limitations of the study, opportunities for future research are suggested to further promote related disciplines.

References and Appendices are provided in the last part of the thesis.

Chapter Two: Literature Review

This study addresses two important issues in the contemporary development of the agricultural sector, namely, the evolution of agriculture of developed regions, and the multifunctionality of urban agriculture in developed cities. This chapter will review related studies to clarify the definitions of terms, discover the concepts behind the evolution, as well as look for potential functions served towards developed cities. Such review is important in articulating the relevant theoretical underpinning and contextual peculiarities for a critical examination of local agricultural development in subsequent chapters.

2.1. Defining urban agriculture

Although urban agriculture (UA) appears to be a new phenomenon that started in recent decades, it has actually been around us since the dawn of human civilization (Redwood, 2009; Smit, Ratta & Nasr, 2001). It is suggested that the towns of ancient civilizations must accommodate agricultural activities within their physical bounds or in their vicinities, as the very survival of civilizations is dependent upon stable supply of food from the agriculture sector (Smit, Ratta & Nasr, 1996). However, academic research in urban agriculture was poorly developed before the 1980s (Smit, 1996), and agriculture was mostly studied in rural context. Given the changing relationship between agriculture and urban settlement, as well as disappearing polarities between urban and rural environment, researchers such as Bowler and Ilbery (1987) have urged for the incorporation of urban elements into the study of agricultural geography.

As an underdeveloped field of research, UA does not simply focus on the urban location of agricultural activities, but covers various other aspects. Smit et al. (2001) has defined UA as:

> *"…an industry that produces, processes, and markets food, fuel, and other outputs, largely in response to the daily demand of consumers within a town, city, or metropolis, on many types of privately and publicly held land and water bodies found throughout intra-urban and peri-urban areas. Typically urban agriculture applies intensive production methods, frequently using and reusing natural resources*

> *and urban wastes, to yield a diverse array of land-, water-, and air-based fauna and flora, contributing to the food security, health, livelihood, and environment of the individual, household, and community." (*Smit et al, 2001:1)

Considering this broad definition, Mougeot (2000:5-8) provides a six-point checklist for ascertaining whether a particular agricultural operation belongs to UA:

i. The types of economic activities,
ii. Food/ non-food categories and sub-categories,
iii. Intra-urban/ peri-urban character of location,
iv. Types of area where it is practiced,
v. Destination of products, and
vi. Scale of production systems

When intra-urban is easily defined by its existence within concretized urban settlement, peri-urban agriculture is not as well differentiated from rural agriculture. To clarify peri-urban agriculture, Viljoen (2005) regarded it as taking place next to town on its location. The operation can be completely or partly commercial, and type of produce can be market gardens crops as well as poultry and livestock.

While it is difficult to define whether a certain form of agricultural operation belongs to UA by its location, scholars have proposed to distinguish UA from rural agriculture based on its aspatial 'urban' nature, notably, whether it interacts in an intimate manner with urban functions and activities (Smit & Nasr, 1992; Smit et al., 1996; Viljoen, 2005). Alternatively, Mougeot (2000) defines UA with an emphasis on agricultural system as economic and ecological systems:

> *"UA is an industry located within (intraurban) or on the fringe (periurban) of a town, a city or a metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area" (Mougeot, 2000:10)*

This understanding is vital in classifying various kinds of local agriculture in Hong Kong into urban, peri-urban or rural agriculture. The interaction with urban living in Hong Kong is a major factor to be considered. The six parameters defined by Mougeot (2000) will be considered as well, depending on the availability of data.

2.2. Understanding the evolution of urban agriculture

This section reviews the theories and drivers behind the evolution on urban agriculture, focusing on the more developed world. By looking at the evolution, we can better understand how the concepts of urban agriculture and multifunctionality emerge in recent decades, as well as explaining the similarities and discrepancies of the UA evolution in Hong Kong when compared to other cities. The evolution of agriculture would inevitably touch on rural context because agriculture was seldom discussed in urban context until late 1980's. Looking at the historically holistic overview of the evolution of agriculture, vital elements that shaped the UA in developed cities nowadays can be gathered to explain the 're-emergence' of UA in the late 20th Century.

This section will concentrate on two notable and broadly applied theories, while various theories have been put forward to capture the dynamics of agricultural transformation (Robinson, 2004). The two theories are the food regime theory and the transition from productivist to post-productivist agriculture.

2.2.1. Transition between food regimes

To delineate the general trend of the revolution of agriculture, Friedmann & McMichael (1989) systemized the changes into food regimes. Food regime theory is a lucid framework widely used in explaining the political–economic forces behind the structural changes of agriculture (Burch & Lawrence, 2009; Campbell, 2009; van der Ploeg, 2010; Pritchard, 1998; Robinson, 2004). It attempts to relate food production and consumption together in global scale under the concept of capital accumulation (Friedmann & McMichael, 1989).

According the food regime theorists, one can identify at least three distinctive periods of agricultural development – 'food regimes' in their terminology – when reviewing the international history of agriculture since late 19th century. The first food regime is from 1870 to 1914 when international food trade is boasted by

invention of refrigerated ships (Robinson, 2004). It is a Britain-led movement that marks the expansion of agriculture into colonies (Friedmann & McMichael, 1989; Pritchard, 2009). This regime was replaced when colonialism faded after the two world wars, and the second food regime was led by the United States. The decolonization removed the trading barriers between colonizers but was then replaced by the blockade between the capitalist bloc and communist bloc (Friedmann, 1993). Meanwhile, the diversity of food increased in international trade due to the advance in food processing technologies, manufacturing 'durable food' (Pritchard, 1998).

Upon the transition from the second to the third food regime, many scholars suggested a range of driving forces behind the changes. Continuing with the macro-economic perspective, the regime entered the third stage when the global food market was influenced by neo-liberalism in mid-1980's after global food crisis in early 1970's (Burch & Lawrence, 2009; Pechlaner & Otero, 2008). In this era, the trans-national corporations (TNCs) and speculation in food market (i.e. financialization) started to take over the dominance of international political tensions, and thus regarded as 'the corporate food regime' (Friedmann, 1993; McMichael, 2000; McMichael, 2005). The crop types in international food trade further expanded to fresh fruit and vegetables with the technological breakthrough in genetic engineering (Robinson, 2004).

2.2.2. Key factors behind the transition between food regimes

This section reviews deeper on the factors behind the transformation. The international food trade mechanism is not deeply discussed as it is not within the scope of this paper.

The importance of political factor emerges when regional trade could be blocked disregarding actual demand and supply, as signified in the Cold War period (Friedmann, 1993). However when entering the neoliberal third food regime, the growing hegemony of food producing TNCs under globalization replaced the two Blocs and influenced local economy deeply. Further on local level, the role of chain supermarkets in affecting local production cannot be overlooked (Burch & Lawrence, 2009; Konefal, Mascarenhas & Hatanaka, 2005). In metropolises where the market share in food retailing of supermarkets is prevalent, the supermarkets possess the

power on setting standards to dictate food production methods (Konefal et al., 2005). These standards are easier met by the large corporation with uniform and industrialized method of production, hence suppressing local production of smaller scale in many parts of the world (Campbell, 2009; Konefal et al., 2005; McMichael, 2009).

Another significant factor would be the advancement in technology for preserving quality of farm produce, i.e. the advancement on refrigeration. A notable example would be New Zealand, where agriculture flourished and became oriented to meat production after the success of exporting frozen meat by the first ship with refrigeration, the Dunedin, in 1882 (Meat Industry Association of New Zealand, 2009). Another technological breakthrough was the Green Revolution which introduced and deeply intensified the use of inorganic fertilizers and pesticides. This greatly increased the food yield and lowered the food price during the second regime (Tilman, Cassman, Matsons, Naylor & Polasky, 2002). In entering the third regime, genetic engineering greatly facilitated food trade. By modifying the genes of the species such as papaya and tomato, they become more durable in transportation as well as resistant to pathogens which have developed immunity to inorganic pesticides (Pechlaner & Otero, 2008; Phipps & Park, 2002). This compensated the food yield from the loss from degrading farmland quality brought by prolonged conventional farming (Phipps & Park, 2002).

Meanwhile, this new food regime is discovered to be unstable by disconnecting the food from consumers' demand and suppressing the participation of smaller-scaled food producers in the food system (Burch & Lawrence, 2009; Konefal et al., 2005; Pritchard, 2009). This urged studies to consider more than simply 'distance and durability' in investigating transformations, so as to prepare for a more sustainable food system (Campbell, 2009; Friedmann, 1992; McMichael, 2005). Campbell (2009) pointed the usual perspective as 'food from nowhere' has largely neglected the ecological and social impact toward the local environment, therefore ecological feedback mechanisms like food miles should be incorporated. Citizens were thus suggested to purchase local production directly from farmers to facilitate a more sustainable food system (Friedmann & McNair, 2008). This affirms that the factor on environmental protection has changed the production method to local production in the latest regime.

To conclude, political factor prevails as the top-down control of food production is unlikely decreased when the markets break free and passing the scepter from Superpowers to TNCs. On local scale, agriculture is at large manipulated by supermarkets, which encourages massive production from TNCs instead of smaller scale of local production (Campbell, 2009; Konefal et al., 2005; McMichael, 2009). Technology such as genetic engineering is the key propeller behind the transformation because the range of market reach greatly expanded, thus promoting international trade and affect choice of food production for higher durability (Pechlaner & Otero, 2008; Phipps & Park, 2002). However these practices caused environmental degradation that the awakening on environmentalism now calls for more sustainable ways of farming, especially in shortening the food supply chain (Campbell, 2009; Friedmann, 1992; McMichael, 2005).

The food regime theory is potent in depicting the global influence with political and economic factors. However, more concepts are required to be incorporated for a better picture on the evolution of UA in metropolises, especially in light of social and environmental aspect.

2.2.3. Transformation from productivist to post-productivist agriculture

This section reviews the theory of the transformation from productivist to post-productivist agriculture, in order to look for the factors related to the functional change of UA. Upon productivist agriculture, Lowe, Murdoch, Marsden, Munton & Flynn (1993) proposed a definition that is widely accepted:

> *"…a commitment to an intensive, industrially driven and expansionist agriculture with state support based primarily on output and increased productivity… By the 'productivist regime' we mean the network of institutions oriented to boosting food production from domestic sources which became the paramount aim of rural policy following World War II. These included not only the Ministry of Agriculture and other state agencies but the assemblage of input suppliers, financial institutions, R&D centres, etc., which facilitated the continued expansion of agricultural production."(Lowe et al, 1993:221)*

Emphasis on the incompatible nature of productivist agriculture with environment protection is further addressed by Bishop & Phillips (1993). They extracted the mindset known as agriculture fundamentalism. This mindset arose from the food shortage during WWII that encouraged boosting production by injecting much, often too much inorganic fertilizers and pesticides, ending up in severe environmental degradation (Pretty,1995). Unfortunately, this was not realized until the awakening of environmental concern after the publication of *Silent Spring* by Rachel Carson in 1963. For tactical purpose, urban agriculture was promoted during war time in the US in form of Victory Gardens. Urban household production was promoted so as to boost vegetable production and spare large scale production for military consumption (Brown & Jameton, 2000).

Significant restructuring took place in the 1980's, about two decades after the increased awareness on environmental degradation and food safety (Argent, 2002; Lowe et al.,1993). Fundamental transformation took place in 1984 when milk quota was posed upon European dairy farmers, in order to protect the farmland from over-grazing (Bishop & Phillips, 1993). This signifies the shift of policy direction away from maximizing farm product. The transition was, in Bishop and Philips's (1993:324) language, "less about growing more - and more about growing less".

2.2.4. Factors behind the transition to post-productivist agriculture

To put the transition in more systematic manner, Wilson, G.A. (2001) suggested seven dimensions to summarize the current concepts. They are ideology, actors, food regimes, agricultural production, agricultural policies, farming techniques and environmental impacts. The following section would not cover all but most vital changes are selected with respect to urban living and implications to urban agriculture.

For the dimension of ideology, there is drastic change where farmers are no longer conceived to be the protectors of rural landscape. Instead, their exploitation and excessive use of inorganic agrochemicals to farmland resulted in environmental degradation, thus becoming the 'villains' (Marsden et al. 1993 in Wilson, G.A., 2001:80). Moreover, the perception of rural space shifted from farmland towards other social representation. In Cloke and Goodwin's wordings (1992:328), the

romance of rural landscape is reproduced into a ‘sanitized’ form, mainly for leisure and marketed as ‘problem-free’ commodity.

As agricultural policies evolved, the production methods depending heavily on state intervention have changed to a more public-driven way (Marsden, 1999). Regulation tightened on farming seeking to minimize pollution. Actually this was not only done by the government but the middle-class newcomers from urban-rural migration. They played significant role in closely scrutinizing the farming practices (Ward, Lowe, Seymour & Clark, 1995), sometimes ending up in conflicts within neighbourhood (Lowe et al., 1993). In response, the farming practices were persuaded or forced to be more compatible with the natural and human environment. One significant measure would be adjusting price of irrigation water to prevent groundwater depletion in Australia (Argent, 2002). Meanwhile, farmers faced increasing uncertainty towards land ownership under urbanization, especially when land price is heightened for other land uses of higher rent (Losada et al, 1998; Robinson, 2004; Wilson, G.A., 2001).

Key factors behind the changes are summarized here. One is the agricultural fundamentalism that contributed to the profit-maximizing mindset of productivist agriculture. Together with the invention of inorganic fertilizer and pesticide during the Green Revolution, the devastating effect towards the environment aroused the public awareness on environmental protection (Wilson, G.A., 2001).

The transition from productivist to post-productivist agriculture filled the gap of food regime perspective by considering socio-environmental factors and drivers to the evolution of agriculture. However, it would be an over-simplified conceptualization to put post-productivist agriculture as the ‘mirror image’ to productivist one (Wilson G.A., 2001) and Robinson (2004) agrees that the dichotomy is not an integrated approach in reviewing transformations of social and environmental aspect. Moreover, Evans, Morris & Winter (2002) proposed ecological modernization as a better explanation to the recent changes related to producing food in more environmentally friendly ways. This is a more focused approach than the broad and loose concept of post-productivist agriculture.

In order to recruit more ideas and wider aspects of urban agriculture, the concept of productivist to post-productivist transition is still applicable with the supplement on

ecological modernization. To encompass factors more than environmental protection, more recent evolution of agriculture can be depicted by 'multifunctional agricultural regime' (Wilson, G.A., 2001).

2.3. Stepping towards multifunctional urban agriculture

After understanding the concepts behind the evolution of agriculture in the recent centuries, a framework of on multifunctional agriculture will be studied. As the concept is based on farmlands mostly in rural area, the latter part of this section will review on researches related to applying multifunctionality onto urban agriculture in developed cities.

2.3.1. Development of multifunctional agriculture

The multifunctional agriculture perspective was a conceptual innovation formulated upon the context of more developed regions of the world. The Organization for Economic Co-operation and Development (OECD) was inspired from the statement of the United Nations at the Rio Summit (1992):

> *'…Agricultural policy review, planning and integrated programming in the light of the multifunctional aspect of agriculture, particularly with regard to food security and sustainable development.' (Agenda 21: Chapter 14)*

The OECD then further elaborates on the perspective in 1998:

> *'Beyond its primary function of supplying food and fibre, agricultural activity can also shape the landscape, provide environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of bio-diversity, and contribute to the socio-economic viability of many rural areas.' (OECD: Ministerial communiqués related to agricultural policies in 1998)*

This approach attempts to raise the concern on the private goods and public goods of agriculture, particularly when the social and environmental costs were previously overlooked and subsequently caused socio-environmental problems (Vatn, 2002; Wilson, G.A., 2008). The concept is widely accepted along with the global concern

of sustainability (Batie, 2003; Wiggering et al., 2006; Wilson, G.A., 2008), however the measures face heavy criticism (Garzon, 2005; Potter & Burney, 2002). The European Union utilized domestic subsidies to assist farms in overcoming the extra cost in switching to more sustainable practices. This is regarded as 'a smokescreen to trade protectionism' by the more developed countries, claiming that the subsidized export price distorts international food trade (Potter & Burney, 2002). Paarlberg, Bredahl and Lee (2002) suggested that trade protectionism can be derived from over-subsidizing on environmentally friendly farming practices, and it is intrinsically difficult to define an appropriate extent of introducing such financial incentives.

Despite the accusation on justifying trade protectionism, scholars have urged to utilize the concept for integrated assessment on agriculture (Holmes, 2006; Wilson, G.A., 2008).

2.3.2. Dimensions of multifunctional agriculture

Before looking into the related functions, one critical issue arises as what is agriculture within the boundary of multifunctional agriculture. Wilson, G.A. (2007:225) believes the key is the main role of certain landscape, and the size or scale of plantation should not become a rigid demarcation. This concept is particularly applicable in urban setting where the scale of farms is usually smaller and scattered within the urban fabric (Mougeot, 2000). However, confusion exists as Bell (2004) reflects on understanding agriculture in the sense of nurturing lives or cultivation instead of food production, and to describe the space by gardens instead of farms. It is agreed that what constitutes agriculture should not be defined literally but upon local context, especially when urban agriculture is the main concern (Mougeot, 2000; Wilson, G.A., 2007).

Batie (2003) suggested three dimensions if functions related to multifunctional agriculture as developed by Aldington (1998): the food security function, the environmental function, and the socioeconomic function. Meanwhile, Wilson, G.A. (2007:229) incorporates nine parameters when defining multifunctionality in to three categories known as strong, moderate and weak. This framework is illustrated in Table 2.1..

Table 2.1. Parameters to 3 levels of multifunctionality (Modified from Wilson, G.A., 2007: 229)

	Strong Multifunctionality	Moderate Multifunctionality	Weak Multifunctionality
Productivist tendencies	Low	Moderate	High
Environmental sustainability	High	Moderate	Low
Local embeddedness	High	Moderate	Low
Length of food supply chain	Short	Medium	Long
Intensity and productivity of farming	Low	Medium	High
Integration into global capitalist market	Weak	Moderate	Strong
Degree of diversification	High	Moderate	Low
Perception on agriculture by farming/ rural populations	As a process that go beyond productivist food and fibre production	Partly as going beyond food and fibre production	Almost exclusively concerned with productivist food and fibre production
Perception on agriculture by societies	The value is in the process of change (open-minded societies)	The value is in the process of change (moderated open-minded societies)	The nature of agriculture has not changed

These 3 types of multifuntionality are defined on comparative basis without rigid boundaries over the 9 parameters. Strong multifunctionality is theoretically preferred over the weak ones.

Among the nine parameters from Wilson, G.A. (2007), the environmental sustainability is more valued in the strong category. Also the parameters are actually interlinked – for instance, increasing local embeddeddness in form of promoting local production can also shorten food chain and increase environmental sustainability by reducing food mileage (Donald & Blay-Palmer, 2006; Grewal & Grewal, 2011).

Apart from the parameters above, Wilson, G.A. also further developed along the findings from Bowler (1992), who differentiated three types of multifunctionality by six phenomena as shown in Table 2.2.. Weak multifunctionality can be characterized by an industrialized mode of production and limited diversification in both farming method and species selection. This aims at 'maintaining a viable agricultural enterprise' in Bowler's term. Wilson, G.A. (2007) suggested an example of an export-driven economy attempting to maximize food and fibre production as a major practice of the weak type.

Table 2.2. Multifunctional quality and farm diversification phenomena (Modified from Wilson, G.A., 2007:231)

Weak multifunctionality	Moderate multifunctionality	Strong multifunctionality	Beyond agriculture
Industrial model of production	Structural diversification	Part-time farming/ semi-retirement	When food and fibre production is of too minor in purpose
Agricultural diversification	Income diversification	Reduced farm activities	

When a farm begins to hold activities and earn income more than by selling produce, it steps into the moderate type of multifunctionality. The structure of farm is diversified when investment is put not only on buying fertilizers, but also on installing facilities like seats and paving better footpaths for farm tourism. Profits from farm tours and other activities signify the diversification of income. Meanwhile, the farm becomes more environmentally sustainable with tighter relationship with the local community, especially when produce are sold at the farm gate (Wilson, G.A., 2007).

For strongly multifunctional farms, further reduction on farming activities and higher ecological value is achieved by even less disturbance to soil and vegetation. Stakeholders are more open-minded to see farming not only for food production, and practitioners are less likely to farm for income, as well as reluctant to adopt practices like using genetically modified crops for increasing produce. For farmers' background, they may have different fulltime occupations or semi-retired where farming is only a part-time activity (Bowler, 1992 in Wilson, G.A., 2007).

Although the reduction of farming activities is a sign for strong multifunctionality, Wilson, G.A. (2007) stresses certain level of food production should be secured in strong multifunctionality. Otherwise it is 'beyond agriculture' and should not be recognized as agriculture. This in the meantime echoes with the emphasis on supporting food security by maintaining local production (Aldington, 1998; Batie, 2003). An inevitable doubt arises when stepping into the magnitude of functions to the society, not only about the strength multifunctionality. As an example, the function on securing food security strengthens with higher quantity of food, but yield likely decreases with less farming activity in strong multifunctional agriculture.

2.3.3. Application of multifunctionality on agricultural evolution

Agriculture is inherently multifunctional because of the various contributions to the society (Lovell, 2010; Pretty, 2001; Wilson, G.A., 2008). Thus the evolution of agriculture can be reviewed with respect to multifunctionality when there is no period of farming being 'non-multifunctional'. The evolution of agriculture in the developed world is illustrated in Figure 2.1. as modified from Wilson, G.A. (2007: 301).

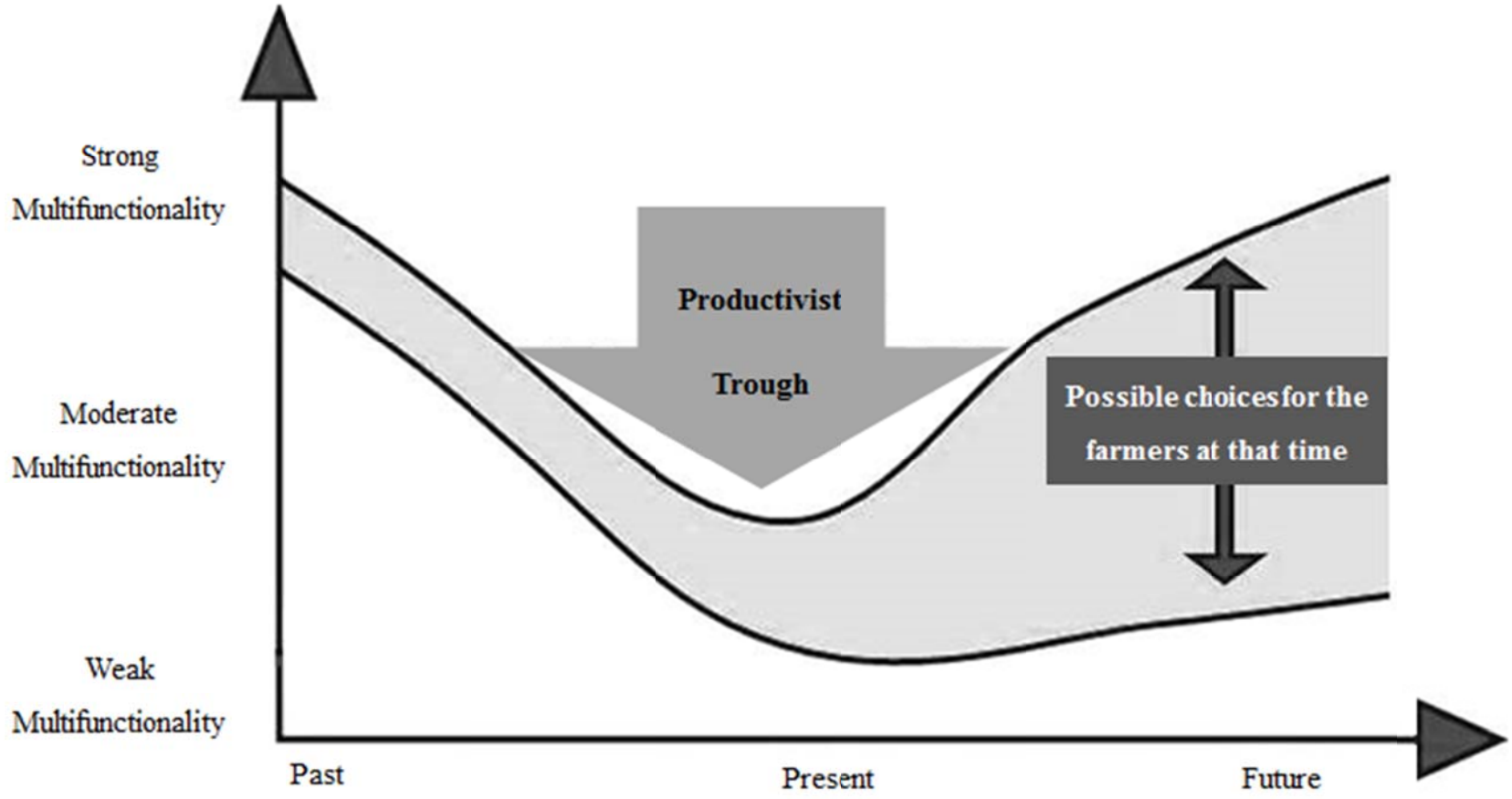


Figure 2.1. Evolution on the multifunctionality of agriculture in the developed world (Modified from Wilson, G.A., 2007: 301)

In the developed regions, farms were strongly multifunctional when soil was less intensively cultivated before the steam-powered mechanization. Meanwhile, international trade was less established that the food was mainly grown for subsistence and surrounding markets, this is named 'agrarian multifunctionality regime'.

The 'industrial multifunctionality regime' followed when intensified farming by machines and the invention of chemical fertilizers caused land degradation. The drop on environmental compatibility was one of the key reasons for the productivist trough annotated in Fig. 2.1., which is around the 1950's to 1990's for the case of Western Europe (Wilson, G.A., 2007).

The agrarian and industrial multifunctionality regimes are very similar to the 1st and 2nd food regimes respectively (Wilson, G.A., 2007: 304). For the current condition of agriculture, the developed world is stepping out from the productivist trough and entering the 'contemporary/ future multifunctional regime'. The rising multifunctionality reflects the pursuit for agriculture more compatible with the environment and society. The widened pathway refers to the wider possibilities for farmers to develop for, i.e. to choose between the three levels of multifunctionality.

2.3.4. Application of multifunctionality to UA in developed cities

Urban agriculture focuses on local food system that involves less global trade, but more interaction with local livelihood (Smit et al, 1996). There is high potential for farms in urban fringe, in other words the peri-urban area, to serve distinct multiple functions (Gallent, 2006; Wilson,G.A., 2008). For instance, community supported agriculture (CSA) has strengthened the social bonding of the communities in both rural and urban settings in many developed countries such as Japan. Scholars such as Lovell (2010) and Deelstra, Boyd and van den Biggelaar (2001) have reviewed over the wide potential of multifunctional urban agriculture to contribute to sustainability in more developed countries in the United States and Europe. However, related research is yet to be developed for the context of Asian cities.

In light of the prospects of promoting multifunctional agriculture in urban settings, the actual functions served by UA will be reviewed in the next section.

2.4. Multiple functions of urban agriculture in developed cities

Urban agriculture possesses very diverse functions to a range of recipients. According to Smit et al. (1996), UA serves the following functions in three categories, well-being, environment, and economy. Incorporating functions studied by other scholars, the functions are further classified with respect to the three pillars of sustainability: social development, economic development and environmental protection (United Nations, 2005). Major functions are summarized in Table 2.3., majority of the findings conclude with the contribution of UA to sustainability of a city (Deelstra and Girardet, 2000; Lovell, 2010; Midmore & Jansen, 2003; Smit et al., 1996). Each of the functions will be further reviewed in the coming sections.

Table 2.3. Functions of urban agriculture

Social functions	Environmental functions	Economic functions
• Food security • Food safety • Health improvement • Social solidarity • Food education	• Facilitation on waste and nutrient recycling • Improvement on microclimate • Enrichment on biodiversity • Reduction of food mile	• Stronger economic base • Land use economics • Employment and enterprise developments
Source from: Armstrong, 2000; Brown & Jameton, 2000; Community Food Security Coalition, 2003; Deelstra & Girardet, 2000; French & Wechsler, 2004; Hassink, Zwartbol, Agricola, Elings & Thissen, 2007; Mougeot, 2000; Pawelek, Frankie, Thorp & Przybylski, 2009; Smit et al, 1996;Takebayashi & Moriyama, 2007		

2.4.1. Social functions of UA

Food security

Food security is defined by the Food and Agriculture Organization of the United Nations (FAO) as:

> *"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability." (FAO, 2009:1)*

FAO further declared to sustain increase in food production. Many developed cities and countries in the world are promoting urban agriculture to increase local production in supporting the availability, access, utilization and stability of food security. The context of food security in developed region is quite different from the developing ones, because the former one possesses sufficient capital to afford food import. Therefore the developed world is unlikely to suffer starvation or famine.

The accessibility and stability then becomes the focus when we discuss food security for the developed cities. Fresh food is not always accessible by the poor in some parts of the United Kingdom, which are known as 'food deserts'. The underprivileged lacks purchasing power to attract stores to serve closer for the community (Whelan, Wrigley, Warm & Cannings, 2002). UA can definitely alleviate the problem by local production in which freshness is guaranteed (Heimlich, 1989). Basing on this major strength of UA, accessibility of fresh and quality produce towards low-income families hence becomes the primary function of certain project proponents such as North America (Community Food Security Coalition, 2003). Local production becomes critical during human-induced or natural hazards that disrupt food production from export countries.

Several metropolises have taken proactive measure to promote UA for the reasons above. Singapore has targeted at increasing the self-sufficiency of vegetables from 7% to 10% by improving technology of farming in the city (Agri-Food & Veterinary Authority of Singapore, 2011). Despite the food supply from rural areas in the New York State, New York City is committed to UA and has proposed a series of policies such as protecting the existing 600 community gardens, providing incentives to roof top farming by waiving floor to area ratio, as well as improving the local sales network by community supported agriculture (The New York City Council, 2010). In spite of being the most populous city in the world, Shanghai is acting proactively in

securing high level of food self-sufficiency by means of vitalizing farmland in peri-urban area (Shanghai Municipal Agriculture Commission, 2012).

Food safety

The quality of food, in terms of food safety also influences the health and nutrition implications on citizens. Freshness of food is guaranteed in urban agriculture where time for transportation is greatly reduced compared to food imported from afar (Brown & Jameton, 2000; Leake, Adam-Bradford & Rigby, 2009; Lovell, 2010; Nugent, 2000; Smit, 1996). One of the major concerns and skepticism would be on the potential contamination of food grown on urban and peri-urban areas from air and water pollution of various pollutants like heavy metals (Deelstra and Girardet, 2000; Garnett, 2000; Leake, Adam-Bradford & Rigby, 2009). Researches have suggested solutions like rinsing fruits and vegetables thoroughly before eating (World Health Organization, 2000), and careful species selection such as avoiding green leafy vegetables in soil contaminated with heavy metals and to plant more resistant ones like fruit trees instead (Smit et al., 1996). It is generally agreed that the benefits on health outweigh the potential risks, especially under soil testing, site selection and careful selection of species (Armar-Klemesu, 2000; Garnett, 2000; Leake et al, 2009; Lovell, 2010; Smit et al., 1996; World Health Organization, 2000).

Social solidarity

UA has its strength in providing platform for interactions in community building. Two most notable platforms are called community gardens and community-supported agriculture (CSA) which have widely succeeded (Cooley & Lass, 1998; Irvine, Johnson & Peters, 1999; Nugent, 2000; Sharp, Imerman, Peters, 2002). CSA is regarded as a 'social movement' (Cone & Myhre, 2000) or a 'community-oriented agricultural enterprise' (Sharp et al., 2002) connecting the food consumers and producers, often taking place in urban-rural interface. Consumers buy shares from farmers, and farmers in turn providing fresh food every week. This relationship develops mutual trust between consumers and farmers (Cooley & Lass, 1998). This is further evidenced in Sharp et al.'s (2002) research on Sweet Peas CSA project in a Mid-western college town, where the farmers and consumers previously disconnected were brought together, creating a stronger social tie.

Community gardens increases interaction in the neighbourhood by providing plots of land to individuals for growing food and ornamental plants under a communal environment (Blaine, Grewal, Dawes & Snider, 2010; Kingsley, Townsend & Henderson-Wilson, 2009). The participants would share their produce and significant improvement on the attitude towards neighbours is recorded (Armstrong, 2000). Meanwhile, these two means are capable in serving other functions such as health functions, which would be discussed in the next section.

Health improvement

The health function is composed of both physical and psychological health. In physical health, safe and nutritious food is the major contributions as mentioned above. In addition, Blaine et al. (2010) discovered a significant change in healthier diets after participating in community gardens, and Henderson & Hartsfield (2009) also suggested promoting UA in light of combating obesity in US. High social solidarity is suggested and testified to improve psychological health (Kawachi & Berkman, 2001; Seeman, 1996; Uchino, Cacioppo & Kiecolt-Glaser, 1996). Good social relationship is valuable particularly for the prevention stage of psychological illnesses (Bellows, Brown & Smit, 2004).

Furthermore, UA can be utilized as a therapy to patients with mental illnesses, with a successful case known as 'Care Farms' in The Netherlands (Hassink, Zwartbol, Agricola, Elings & Thissen, 2007). A research on farm animals as 'animal-assisted therapy' in Norway proved the positive effect on psychiatric patients (Berget, Ekeberg & Braastad, 2008). The function on improving both physical and mental health is obvious for UA under these diverse studies.

Food education

One of the best ways to learn about food is to experience how it is grown. A direct tool to education would be in form of school gardening. Hands-on experience of farming has been incorporated in teaching for more than a century, and proven to be effective in teaching within curriculum (French & Wechsler, 2004; Smith & Motsenbocker, 2005).

Besides teaching within the curriculum, UA also plays a vital role of education in form of 'farm-to-school' projects. In Los Angeles, the fresh fruit and vegetables from

a peri-urban farm assisted the teacher to persuade students to choose greener diet. Meanwhile, the school tour to nearby farms also bridged the gap for teenagers to know the source of food behind the supermarkets (Vallianatos, Gottlieb & Haase, 2004). This food education is vital to lower the enormous food wastage by teenagers (Parfitt, Barthel & Macnaughton, 2010) and thus reduces the ecological footprint posed from food wastage (Engstro¨m & Carlsson-Kanyama, 2004).

However, there are safety precautions for farm visit by students. Food poisoning from drinking raw milk has been recorded in UK where students from urban livelihood may not have the immunity for the food when compared to rural children (Evans, Roberts, Ribeiro, Gardner & Kembery, 1996).

2.4.2. Economic functions of UA

Employment and enterprise development

Employment of the less educated labour and income generation by the urban poor are one of the most notable economic functions by UA (Mougeot, 2000; Schmelzkopf, 1995; Smit et al., 1996). This is possibly in response to the unemployment and inequality in the developed world due to computerization and mechanization which reduces the demand for manpower, as well as the mismatch of labour and market under the economic restructuring (Howell, 2002). Schmelzkopf (1995) observed some community gardens had employed the jobless to devote long hours in weekdays and even actively joining events during weekends. Moreover, homeless people were employed in UA sector according to the findings of Community Food Security Coalition (2003). This function is tightly linked to enterprise development as UA also serves in revitalizing the agriculture-related industries known as ‘multiplier effect’.

UA-related industries can provide a wide range of jobs, from primary to tertiary levels. For instance, not only farmers are required in UA, but also seeds, fertilizers and tools production, food processing and transportation, as well as food retailing, consultants to farming operations and even food waste composting (Community Food Security Coalition, 2003; Smit et al., 1996). Moreover, UA seems to fit urbanized city well as agricultural sector is often left behind or replaced in

urbanization and urban sprawl (Nugent, 2000), one notable example would be China (Lu & Chen, 2006).

Income generation

For income generation by UA, it can be viewed in both business revenue and cost reduction in living. In business aspect, it is relatively easy to enter when the requirement of starting capital is low, and the resources required are inexpensive, especially when urban wastes like food waste and grey water for are utilized for composting and irrigation (Smit & Nasr, 1992; Mougeot, 2000). Successful cases of UA on rooftop have been reported in Brisbane in for creating stable income (Wilson, G., 2002).

For the nature of business, food is the 'most basic consumption item' that remains stable under economic fluctuation (Smit et al.,1996). This can be further benefited from the rise in global food price in recent years (World Bank, 2011), at the same time easing the food stress from poverty when the cost of imported food rises by human or natural disasters. Some of the urban poor would grow food for self-consumption, so as to reduce expenditure on purchasing fresh food and spend them on others (Bellows et al, 2004; Deelstra & Girardet, 2000). This is regarded as the most direct function of UA by Redwood (2009). However, it should be noted that the magnitude of functions depends on the proportion of income spent on food, where there is a trend of decreasing proportion of expenditure with higher level of development of the city (Frazão, Meade & Regmi, 2008). This implies the cost reduction function would be less significant for the middle to higher classes in developed cities.

Land use economics

There is a significant proportion of vacant land in a city to be revitalized, amounting to 15% in case of various cities of US (Pagano & Bowman, 2000). It can be a consequence of rapid urban development without appropriate planning (Deng & Huang, 2004). Another reason is the residential or industrial market becoming less energetic in certain stage if developed cities (Mogk, Kwiatkowski & Weindorf, 2010). To better utilize the land resource, UA fits the role as it is a flexible usage of land. UA is of flexible shapes that can be integrated to the unused part of other

industries such as hospitals and airports, as well as different idled lots in a city (Smit & Nasr, 1992; Smit et al., 1996). Despite the wise uses possible, the magnitude of the function is hampered by uncertain land ownership in various cases (Armar-Klemesu, 2000; Mogk et al. 2010, Mougeot, 2000).

2.4.3. Environmental functions of UA

Improvement on microclimate

Microclimate in urbanized area tends to be more extreme in sense of hotter, wetter and more vigorous storms (Mok, Leung, Lee & Wu, 2006) due to increased aerosols and decreased albedo by asphalts etc. (Lamptey, Barron & Pollard, 2005). To resolve the increasing discomfort in urban living, measures such as reflective paint and green roofing have been considered to mitigate the micro-climate by increasing albedo and evapotranspiration respectively (Takebayashi & Moriyama, 2007). Green roofing is now widely applied (Grant, 2006) and rooftop farming is also a viable form serving wider functions such as food production and community development (Kingsley et al., 2009). However, the scientific basis of the actual ability of rooftop farming in mitigating urban heat island effect is comparatively weak towards the well investigated rooftop greening by grass or others.

Enrichment on biodiversity

Urbanization has put concrete and asphalt on much of the natural vegetation cover and water bodies, in other words, the natural habitats. Biodiversity is threatened and native species are expelled by various ways such as pollution and diminishing food source (McKinney, 2002; Wilby & Perry, 2006). UA improves the biodiversity by increasing vegetation and soil cover as well as food source and nesting sites. A notable example would be inviting native bees back to urban community gardens by incorporating species selection as food course (Pawelek, Frankie, Thorp & Przybylski, 2009) and artificial materials such as punched tin cans for bee nesting (Smith, Gaston, Thompson & Warren, 2005). Research found mutualism between community gardens where fruiting produce like cucumbers attract pollinators as bees, as the increased pollination in turn contributed to higher fruit yield (Werrell, Langellotto, Morath & Matteson, 2009). Moreover, a study in Phoenix, Arizona reveals the parks in low-income settlements are lower in biodiversity (Kinzig,

Warren, Martin, Hope & Katti, 2005), where UA can improve the ecology. Together with the crucial socio-economic functions UA provides to the poverty, improving the ecological environment by UA is also vital to the sustainability of the livelihood.

Reduction of food mile

The increasing reliance on imported food not only affects the food security of the cities, but also implies long distance of transporting the food (Grewal & Grewal, 2011). High food mile of metropolises poses heavy carbon emission as well as development of road network that intensifies climate change by both greenhouse gas emission and land cover change (Donald & Blay-Palmer, 2006). Developing UA can directly tackle this problem as it generates food closer to the consumers (Deelstra & Girardet, 2000; Garnett, 2000). In this sense, the 'local' nature of UA grants it strong function on decreasing food mile of the city.

Facilitation on waste and nutrients recycling

Food waste treatment is a major challenge to many metropolises as it occupies a significant proportion of solid waste generated in city (Bai & Sutanto, 2002; Lee, Choi, Osako & Dong, 2007). Treating it by landfilling is land-demanding and polluting; and incinerating it is of high cost and causes air pollution, moreover, both of these traditional measures emit plenty of greenhouse gases (Lee et al., 2007). Out of diverse methods, home composting is the most environmentally friendly treatment (Lundie & Peters, 2005).

Nonetheless, Kim and Kim (2010) discovered the prerequisite of successful treatment lies within the final use of product. Even though Seoul succeeded in recycling the majority of food waste into animal feed and compost (Lee et al., 2007), the incineration of under-utilized feed and compost still causes great amount of greenhouse gases (Kim & Kim, 2010). At this point, UA will be the best option for using the treated waste and prevent second disposal (Lovell, 2010; Smit & Nasr, 1992; Mougeot, 2000). UA not only utilizes the treated waste but also encourage recycling by setting up 'community composting' within community gardens (Kingsley et al., 2009).

UA can close the open loop of 'food-growing nutrient cycle' as we look into the waste recycling in wider scope. As depicted in Fig. 2.2., the highly urbanized

metropolises receive production from rural areas, consumed in city and then exports waste and pollution (McDonnell et al., 1997; Smit et al., 1996). The function of reusing waste by UA can reduce the pollution and exploitation of the resources, achieving a more sustainable city (Garnett, 2000; Horrigan, Lawrence & Walker, 2002; Lovell, 2010; Smit & Nasr, 1992). Nevertheless, the farming practices related must be organic because conventional agriculture has been damaging the biodiversity for long (Horrigan et al., 2002; Wilby & Perry, 2006).

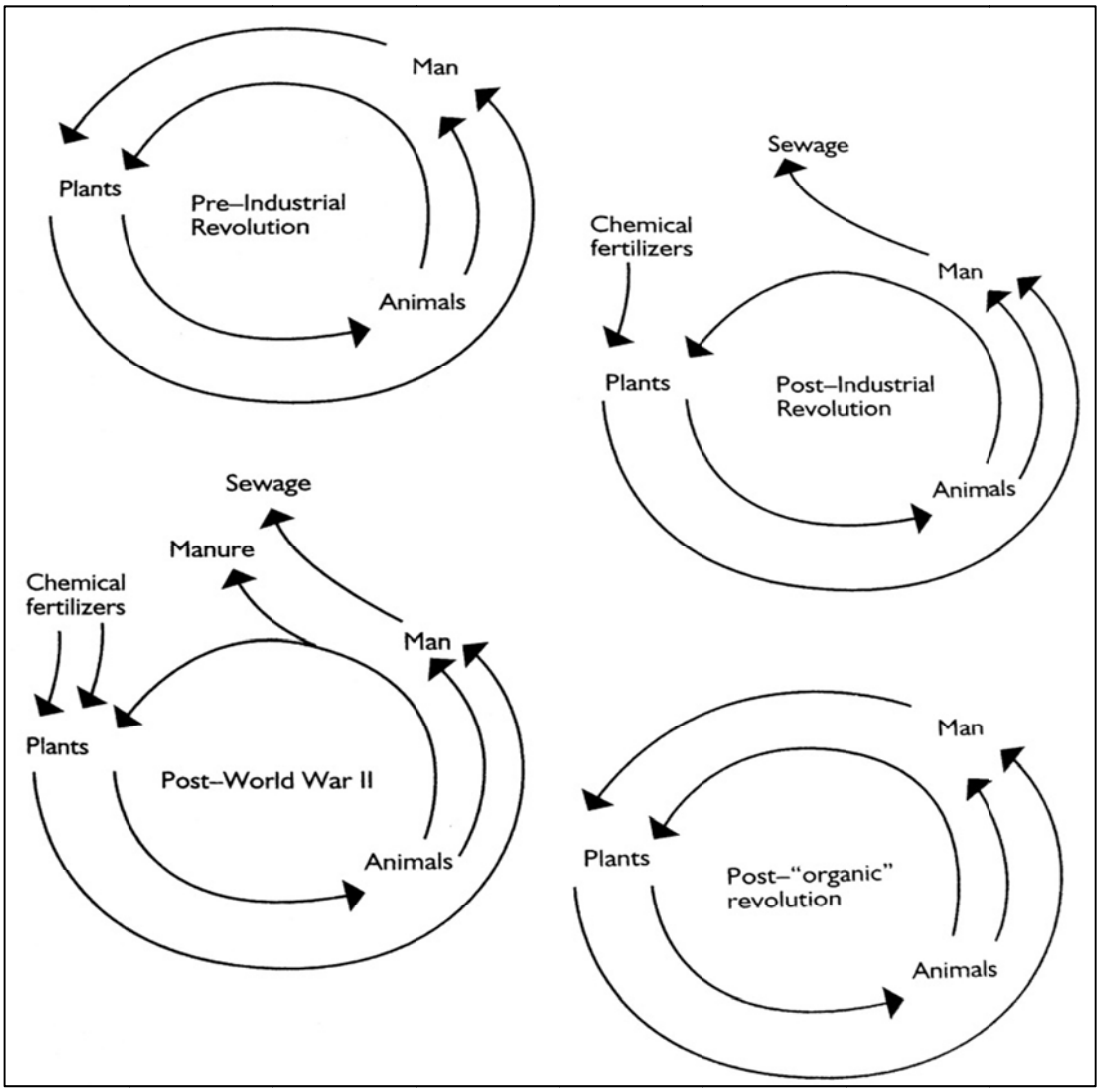


Figure 2.2. Evolution of the food-growing nutrient cycle (Source from Light, [1978] in Smit et al., [1996:13])

2.5. Factors affecting the performance on multiple functions of UA

After understanding the multiple functions of UA, this section will review on how UA can realize its multifunctionality better according determining factors.

2.5.1. Land resources

Scarcity of land is generally considered as the most substantial constraint for urban agriculture (Lovell, 2010; Mougeot, 2000; Robinson, 2004; Yeung, 1985; Zasada, 2011). In peri-urban area, there is vigorous land use competition from non-agricultural uses such as residential land use. Before conversions of land use, farm land is often speculated and abandoned for non-agricultural purpose in the future, which has much higher land rent. These result in drastic reduction of farmland area (Lovell, 2010; Yeung, 1985; Zasada, 2011). For the case of urban areas, large lots of farmland are rare in the built environment. The geographical pattern of potential intra-urban farmland can be scattered, fragmented and flexible in any shape of vacant space. Therefore diverse production systems of UA can fill up the vacant, underutilized space (Mougeot, 2000). The intra-urban farms can function in form of community gardens in schools, public or private estates, and even indoor environment (Lovell, 2010; Mougeot, 2000; Smith & Motsenbocker, 2005).

Another dimension on land resource is the type of ownership. Wilson, G.A. (2007) suggested tenant farmers are more restricted on pursuing more functions on farming, as different expectations from land owner and farm practitioner may conflict with each other. Meanwhile, farms in multi-member ownership and ultimately owner occupier are much more empowered to decide for stronger or weaker multifunctionality. Besides decision-making by farm owners and practitioners, Freshwater (2002) pointed the difficulty on policy setting when half of the farms are rented in US. Without achieving a consensus between the interests of land owners and farmers, multifunctional agriculture is doomed to failure, as witnessed in policies on National Forest management in US (Freshwater, 2002).

2.5.2. Human resources

As aforementioned, UA is able to open diverse job opportunities for the jobless population (Schmelzkopf, 1995), to involve ethnic minorities (Saldivar-Tanaka & Krasny, 2004) as well as to empower the women who face difficulty in connecting of formal occupation with house-holding (Mougeot, 2000). Despite the high quantity the human resource from the underprivileged sectors of most developed cities, Lovell (2010) suggested the long disconnection of urban living from agriculture has

disarmed the urban dwellers from basic farming skills, which has become an obstacle to expanding UA in most developed cities.

2.5.3. Urban planning and policies

Urban agriculture is often underrated and even neglected in urban planning (Bryld, 2003; Lovell, 2010; Mougeot, 2000; Smit, 1996; Young, 1985). This can be resulted in the mindset of citizens when farmland and agriculture is often seen as 'reminiscence of the past' and unwelcomed by the planners (Bryld, 2003:83). Another reason for the impeded growth of UA is the externalization of the multidimensional benefits like community solidarity (Young, 1985).

Meanwhile, once the urban planning of a city recognizes the significance of multifunctional urban agriculture, appropriate policy setting can boost the different contributions served. Mogk et al (2010) advocated a wide range of policy measures to further promote UA in Detroit. Measures such as tax reduction and amendment on zoning ordinance can provide great incentives and flexibility to citizens to take part in UA. The New York City Council (2010) also incorporated UA into the food policy framework. Even with vast farmland in the surrounding New York State, the city is determined to protect the 600 existing community gardens, putting them into the census by the official department of agriculture and create a platform for citizens to identify space suitable for UA in the city.

In Asia, the Ministry of Agriculture, Fisheries and Forestry of Japan (2009) initiated 'biomass towns'. It is aimed to build waste conversion facilities in 300 towns that the urban waste can be processed into fertilizers for supporting agriculture in vicinity, thus completing the biological loop as mentioned in Fig. 2.2.. The Agri-Food & Veterinary Authority of Singapore (2011) is actively developing vertical farming in urban area, and increasing local production is put in the city's policy agenda to enhance food security.

The Section 2.5. has reviewed international findings on the functions of UA and attempts of bringing multifunctionality with UA. The next section will further identify the rooms for further study.

2.6. Related researches in local context and knowledge gaps

This section studies on the researches related to UA and multifunctionality done under the local context of Hong Kong, so as to discover the rooms for further researches in this study.

2.6.1. Local researches on evolution of agriculture and multifunctionality

On the development of agriculture in the postwar period, Wong (1971) researched deeply on the vegetable farming of Hong Kong and later did a holistic review over the farm land in the whole territory (Wong, 1983). Significant decline of paddy rice cultivation was witnessed in 1970's and the wet bed fields were replaced by vegetable farming. Detailed data and factors on both physical and human aspects were provided on the agricultural evolution but transitional theories on agriculture were not studied for deeper understanding. Meanwhile, focus was put on the economic functions of agriculture while other functions were rarely discussed.

In 1990's, Lam (1993) concisely depicted the trend of evolution of agriculture at that time. Farming system was proposed to make use of pig waste to decrease environmental pollution from pig farm discharge and to produce fertilizer. Under the incapability of feeding all of the population of Hong Kong, function on food security was focused on to "tide over any period of supply vacuum at times of serious disruption of imported supplies" (Lam, 1993:115). Policy measures were suggested to cope with the phenomenon of farm land abandonment.

The decline and destruction of farmland was investigated by Jim (1997) in view of land policy changes. The dynamics of farmland conversion was further investigated by Tang (2002) by a detailed case study in Kam Tin, one of the centres of agriculture in Hong Kong. The values other than economic function of farmland were introduced for that period of time. The perspective of urban agriculture was rarely touched before Wong's (2004) study on sustainability of UA in Hong Kong. Questionnaires were used to check for the sustainability of farming practices but some indicators such as food waste utilization for composting was not included.

For researches on interactions between stakeholders, Chan (2007) thoroughly narrated the cooperation and conflicts along with the operation of the Vegetable Marketing Cooperative Societies. Archival data such as official documents and news

clippings were reviewed from 1947 to 1997, forming a solid study on the politics especially in sales of vegetable in the agrarian history of Hong Kong. In another dimension, under the rise of organic movement in Hong Kong, Cheng (2009) depicted the livelihood and interactions of the local organic food community through close participant participation. These can help formulating the mindset, culture or genes of the agriculture of Hong Kong.

Besides dry bed farming, Cheung (2011) researched on the status of fish pond farming in view of cultural conservation. Emphasis is put on the importance of preserving traditional method of fish farming for the sake of indigenous knowledge and also the synergy with eco-tourism and ecological conservation.

Valuable information can be extracted from all these studies, yet a few of them could encompass the different sectors within agriculture (i.e. vegetable and fish farming etc.), as well as depict the rapid changes of agriculture over the decades. This reveals a need for more holistic research to study wider on the functions of urban agriculture. Meanwhile, multifunctionality can be a powerful framework in researching the evolution and potential contributions of UA to Hong Kong.

2.6.2. Summarizing the studies and identifying rooms for further research

By reviewing the theories behind the evolution of agriculture, the factors of both international and regional scale, physical and mental are drawn out to better portray the complicated transitions. Sustainability is of prime concern in urban development nowadays under the emergence of different crises. Being the foundation of civilization, agriculture must respond proactively to address the problems.

The extent of contribution by urban agriculture is highly dependent on local context. Yet, multifunctionality of urban agriculture has been studied for more than a decade. However the functions are not researched adequately in the developed world, especially in Asian cities. Applying the research framework onto the Eastern world can contribute to understanding the opportunities and constraints of UA under different contexts.

For the case of Hong Kong, agriculture has been investigated in different dimensions but no holistic study has been focusing on the functions and purpose of agriculture of Hong Kong. Both the theories behind the evolution of agriculture and the possible

functions of UA in Hong Kong remain as knowledge gaps, which is yet to be discovered in this study. Significant researches reviewed in this chapter will also be further developed and analyzed with the local data in the latter chapters.

Chapter Three: Research Design

After reviewing the concepts and research potentials in the last chapter, this section elaborates the methodology of the research, including the theoretical background, rationale of the methods, the data source, result of data collection, and the analytical framework of data collected.

3.1. Research methodology

This study develops a research methodology with reference to multifunctionality of urban agriculture. The details will be delineated in following sections.

Many functions, especially for social and environmental functions cannot be comprehended by quantitative measures alone particularly on social and mental aspects. Thus, for a more holistic view, the study is based on qualitative approach to look for wider potential of urban agriculture in Hong Kong, and supplemented by quantitative data where available. This approach echoes with McCracken's (1988) recognition as qualitative approach captures the complexity and width of information, while quantitative approach enables high precision over more focused and narrower scope.

This study will utilize qualitative data supplemented with quantitative data so as to 'add credibility and importance' (Brewer, 2001:123) to this study. Moreover, the wider agricultural sectors of Hong Kong can be holistically captured where previous researches focused on specific crops.

This study will use such qualitative methods as participant observation, in-depth interview as well as site visit to farms, with the supplement of qualitative questionnaire survey and statistical data from the government. Secondary data from local researches of related disciplines will also be analyzed to enrich the context.

3.2. Source of secondary data

Official documents and archive serve as a reliable source of data particularly for statistics on the general picture of the whole agricultural sector. Meanwhile different views may be shared by other stakeholders such as green groups and academia. Therefore, to make the source of information more reliable, publications from different stakeholders will be reviewed for a wider picture. An analysis on different

stakeholders in UA for the context of Hong Kong will be presented in the latter section.

Another source is the researches done in related studies, related unpublished theses such as those mentioned in Section 2.6. will be analyzed critically. Previous researches preserved critical information for study like the state, the mindset of the people and rationale behind policy-making at the time. The documentations are vital for understanding the changes of farming in the past, as well as validating first hand data such as opinions and experience of the interviewees.

3.3. Source of primary data

For more holistic analysis in the later stage, the primary data is gathered by several methods and later on analyzed systematically. They are listed together with the targeted stakeholders in Table 3.1. below. The details of each method will be elaborated in the following sections.

Table 3.1. Primary data collection methods and targeted stakeholders

Method used	Target information	Targeted stakeholders
Participant observation	Understand the operation and observe people's reaction during the activities	Farmers Government officers Researchers NGOs
Questionnaire survey	Situation and people's perception towards UA	
In-depth interview	Life experience for enriching the context of changes in the UA history	
Site visit	Visual evidence of good and bad practices of UA	

3.3.1. Participant observation

Redwood (2009) urges agricultural researchers to perform participant observation for the significance on understanding the unique characteristic of farmers in a region, as well as detecting the propellants behind changes. Becker & Geer (1970) regards participant observation as able to provide the 'most complete form of sociological datum'. It shall be achieved by precede and following social events, to observe and collect the response and action by the participants and spectators along the incidents.

It can be particularly beneficial when combined with interviews for the following synergies in agricultural research in Hong Kong:

i. To learn the farmers' language when agriculture has been distant from daily living, the researcher has to be trained for more efficient interviews;
ii. To discover matters the interviewees are unable or unwilling to tell, especially when aged farmers in Hong Kong received little formal education; and
iii. To spot and avoid possible bias by different stakeholders

Cheng (2009) did close observation to understand the local organic community. When evolution, or change, is the focus of the study, the researcher participates into major events organized by stakeholders of urban agriculture. These include seminars, festivals, farm visiting tours, meetings, voluntary farm work, and even protests. To better understand how UA is valued in the society, the writer also reaches the interested but not yet participating citizens when setting up an organization related to agriculture. A balance between being friend or stranger is carefully struck to prevent biased data if the researcher is of close friends with the target group, yet the depth and availability of data is restricted when the researcher is too much a stranger (Bonnie & Tolhurst, 2002; Jarvie, 1969). In case of distrust from the target group, false information might be provided for resistance. Fortunately this is unlikely to happen in this study for the hospitality from the local farming communities. They are very eager to share their experience and seek for assistance. Upon this situation, their opinions will be further compared and verified with the secondary data to minimize the bias.

3.3.2. Questionnaire survey

Apart from the data provided by government officials, it is necessary to update the situation of the practitioners for a closer look. Short questionnaire is desirable as it can reach a certain number of farmers with less cost and acquire a wider range of information (Hill, 2001). There are seminars and events gathering a group of farmers, which serve as good opportunities to conduct the survey. The short questionnaire is constructed with simple questions of three categories on the background of farmer,

operation of farm and their opinion towards UA. The information targeted is listed in Table 3.2.:

Table 3.2. Types of information from questionnaire

Background of farmer	Size of farm	Years of farming experience	Types of land ownership
Operation of farm	Farming method	Sales channels	Animals raised
Opinions for UA	Critical problems to the further development of UA		

The interviewees were encourages to leave their contact at the end that becomes a significant method to reach them for in-depth interview according to their characteristics. A sample of the questionnaire can be found in Appendix I with the English translations in Appendix II.

3.3.3. In-depth interview

Sampling for in-depth interview can be a challenge when the distribution of farmers in Hong Kong is rather dispersed and detailed personal data are not provided by the government for the concern of privacy. It is inefficient to visit every farm without basic information of them particularly when the history of agricultural evolution requires experience stakeholders to answer.

This is overcome by a sampling method of 'modified snowball', which is to gather basic information and personal contact during farmers' events. Afterwards, practitioners are selected according to distinct characteristics such as year of farming experience and types of farm produce. The interviewees are then asked for recommending other stakeholders with profound knowledge for more interviews. One major drawbacks of this sampling method is potentially biased opinions received among the group of interviewees within similar social networks. This is overcome by careful selection of the interviewees for higher diversity.

The interviewees are selected according to several criteria. The first criterion is the year of farming experience, which reflects the memory and knowledge of different generations of farmers. The second criterion is the types of produce and it is targeted to cover wider types of farming for the breadth of knowledge in this study. The third

criterion is the farming practice, i.e. conventional or organic farming, which the practice influences the farm design and perception of agriculture.

For setting more focused questions over UA studies, Redwood (2009) suggested the following directions:

i. *Who is growing what and why?*
ii. *How are the interests of the local people reflected by the research?*
iii. *What are the economic factors influencing decisions?*
iv. *What institutions are involved and in what capacity?*

With reference to the directions recommended, the interview questions are set into two parts. The first part is the standard questions about each period of farming history for comparing between different produce and practices. Questions are related to the functions served, opportunities and constraints, major changes and events faced in each decade from the 1960's to 2000's This covers question *i*, *ii* and part of the question *iv* as proposed by Redwood (2009).

The second part is on the current operation and multiple functions of the specific farm, as well as opinions towards the future development of UA. Other than the two parts, there are follow up questions depending on different background of interviewees and situation of the farms. This extended the question *iii* to more than simply economic factors as proposed by Redwood (2009), and covering questions of all *i, ii* and *vi* over the multiple functions. A sample of questions asked in an interview is attached in Appendix III.

3.3.4. Site visit and field observation

To better understand the various functions served by the farms, in-depth interviews are most desired to be conducted within the farm. This is crucial to observe the actual operation and facilities in the farm for both verifying the 'good practices' suggested by interviewees', and look for synergies and conflicts between different functions of a farm. Photographs are taken as evidence during data analysis.

3.4. Result of data collection

This section indicates the data collection result during the period from Jul 2010 to Jun 2013. Emphasis is put on primary data and secondary ones will be mentioned in data analysis.

3.4.1. Result of participant observation

Various events related to urban agriculture in Hong Kong were attended and observed. Memos and photographs were taken for record at various activities participated.

Farming class and the foundation of a UA organization

In the beginning of the research, the researcher joined a series of farming classes taught by a local farm in Ma Shi Po, Fanling, from September 2010 to November 2011. It aimed to consolidate basic knowledge of agriculture and to better understand the concerns of a farmer in Hong Kong. The design of a farm, plant selection, and a school of farming style named permaculture that utilizes food waste compost as fertilizers were included in the curriculum. Meanwhile, the situation of farmers and agriculture was narrated by the teacher, who is experienced in teaching numerous organic farmers for a decade.

Alongside the agricultural movement in Hong Kong, an interest group was founded in the Chinese University of Hong Kong. The author assisted in the foundation that observed the reaction of students when talking about agriculture in HK, and received valuable information along the process.

Seminars, sharing and meetings by key stakeholders

Several seminars on topics related to the local agriculture of Hong Kong were attended and some major events are recorded here. The first one was the 'Seminar on the Destiny of Hong Kong Local Agriculture' (香港農業誰主浮沉研討會) held by the Hong Kong Local Agricultural Development Concern Group (香港本地農業發展關注組) on 16 January 2011. Speakers invited were of diverse background including four farmers facing the threat of expropriation of their farmland, an urban planner investigating on rural development, a researcher studying on the relationship

between the government and local farmers, and a scholar researching on the livelihood of agricultural communities. They all provided insights for both the cause and effect of the changes of UA-related policies in Hong Kong, as well as problems and opportunities the UA faces nowadays.

The second event was the meeting on organic seed-saving issues on 18 March 2011. The green groups, researchers, government officials and farmers discussed the technological issues around seed-saving, which is a critical step in the development of organic farming in terms of preserving distinct local varieties of produce.

A pioneer scholar in promoting UA in Mainland China shared his experience in Choi Yuen Tsuen on 1 April, 2011. He also gave critical advice on the development of local agriculture in Hong Kong.

'Leisure Farming Seminar 2011' was held by the AFCD on 26 August 2011. There were sharing by distinguished leisure farms from both Hong Kong and Taiwan.

Farmers of new and old generations held a sharing on 26 March 2012. Possessing experience form the past and innovative ideas, they are trying to create a new system of farming in Hong Kong to connect better with surrounding communities. Another sharing by a pioneer on UA in Taiwan was held in the Star Ferry Pier on 21 October 2012. He shared his experience in bringing urban dwellers to the peri-urban farms in Taiwan.

More recently, a forum with the theme 'Agricultural forum in Hong Kong: Agriculture as an essential component of a city' (香港農業論壇：農業是都市的重要構成) was organized on 27 January 2013. It was one of the biggest forums over local agriculture in Hong Kong[1]. The speakers were of diverse background such as farmers, a representative from farmer's cooperatives, green groups, an NGO of religious background, and researchers on land policy as well as geography. The output of the forum covered multiple functions of UA to Hong Kong and challenges, which are critical information for exploring the direction of future development of farming.

[1] Recording of the forum is available online via *http://www.youtube.com/watch?v=XvVOWJ6O5No&feature=youtu.be* for part one, and *http://www.youtube.com/watch?v=-OpGuKLVK54* for part two.

These sharing, seminars and meetings are valuable for providing the practical experience and innovative ideas from key stakeholders. The knowledge enabled the researcher to perform interviews more effectively and analyze the subject matter more critically.

Voluntary farm activities and events by UA-related organizations

Besides acquiring basic agricultural knowledge in the farming class, the researcher also participated in different farm activities to recognize the different functions served by local UA in practice. For example, rice planting and harvesting are experienced in the summer of 2012 with observation and interactions with other participants, so as to better conceive the synergies or conflicts between different functions. Farm tours in Kam Tin, Northern Fanling, Nam Chung and Tsuen Wan were joined as well for further practical experience in revitalizing agriculture in diverse geographical setting over Hong Kong.

'Farmfest 2012' organized by the government was held on the New Year holidays of 2012. Different farms and organizations participated in various booths with wide range of products. The interaction between the farmers and general public was observed. Moreover, the composition of different background of booths can be analyzed for assessing the success of the festival, which reflects the performance of the related official departments as well.

To keep up-to-date upon the current agricultural movement taking place in Hong Kong, social movements such as protests and press conference were observed. They include protests in Nam Sang Wai in the winter of 2010 for defending the fish ponds from property development, another one in Ma Shi Po in the spring of 2011 to oppose the massive farmland abandonment by private developers. Press conference gathered many active key stakeholders and the common statement reflected the stand of their bloc. Green groups and farmers co-organized one outside the Government Headquarters to fight against government policies promoting genetically modified papaya on 2 May 2012. A few months later on 19 July 2012, politicians, student organizations and villagers' alliances joined farmers to defend the massive active farmland from urban development by the North East New Territories New Development Area (NENTNDA).

3.4.2. Result of questionnaire survey

A major seminar called 'Leisure Farming Seminar 2011' was held by the AFCD on 26 August 2011. It gathered over a hundred farmers and the organizer kindly allowed the author to conduct the short survey during break. Data collection was successful with 92 respondents, and 71 of them were willing to leave their contacts for further interview.

The basic characteristic of the farmers were very diverse. Farming experience ranged from two months to fifty years. They farm on field with sizes from 160 to over 350,000 sq. ft, or about 15 m^2 to 3 hectares. Some patterns can be observed from the organized dataset. The land is mostly rented by the farmers, only a few of them reared animals in farms. Majority of the farmers are optimistic about the future development of agriculture in Hong Kong, but almost all of them face difficulty in land issues such as insecure land ownership. Despite the efficiency on gathering information from a number of farmers, there is potential bias because some farmers not interested in leisure farming were not included in the sampling. This requires data from other sources for more balanced analysis.

3.4.3. Result of in-depth interview

In order to gather more information over the agriculture in the past, stakeholders with farming experience longer than 20 years, and diverse background according to the criteria in Section 3.3.3. are selected from the 71 farmers who provided their contacts. Some selected interviewees further recommended knowledgeable persons such as scholars in related fields and NGOs, therefore enabling wider and deeper research.

25 stakeholders are identified and interviewed in total. 23 of them were interviewed face-to-face, two of them were interviewed by telephone conversation. The interviews were recorded and transcribed for analysis.

In terms of stakeholder types, there are 11 farmers, 4 farming instructors, 4 NGOs officers, 2 retired officials, 2 community builders cum farmers, 1 seed producer and 1 scholar. 19 of the interviewees have been engaged in agriculture for over 20 years, while the rest have experience around 5 years.

About the types of farms, there are 7 vegetable farms of which 4 perform organic practice with certification, 2 are self-claimed organic farms, and 1 conventional farm. About other produce, 3 fish pond farms, 2 bee farms, 1 orchard, 1 flower farm, and 1 mixed farm (mixed with fish, vegetables, bees and fruit trees) and 2 farms run by NGOs for special purposes were interviewed. Farms visited will be described in the next section. A list of interviewees with their background is illustrated in Appendix VI, coding of interviewee numbers are randomized for privacy concern.

3.4.4. Sites visited and studied

Together with farms related to stakeholders from face-to-face in-depth interview, 18 sites were visited for field observation and photographs were taken as evidence to certain practices and how agriculture interacts with the environment. Geographically, the farms and fish ponds are situated in the peri-urban areas ranging from Ping Che, Hok Tau, Ma Shi Po, Long Valley, Sha Tin and Ma On Shan in the Northeastern and Eastern part of New Territories; to Lok Ma Chau, Mai Po, Lut Chau, Nam Sang Wai, Ngau Tam Mei, Kam Tin and Tuen Mun in the Northwestern and Western part of New Territories. In the urban setting, one school garden in Lok Fu and one roof top garden and bee farm in the industrial area of Ngau Tau Kok were visited to see the different functions served. The locations and attributes of sties visited are listed in Table 3.3. below:

Table 3.3. List of sites visited

No.	Location of site	Attributes of site (PU=Peri-urban; IU=Intra-urban)
1	Choi Yuen San Tsuen, Kam Tin (錦田菜園新村)	PU vegetable farm
2	Hok Tau, Fanling (粉嶺鶴藪)	PU vegetable farm
3	Hok Tau, Fanling (粉嶺鶴藪)	PU mixed farm
4	Kin Sang, Tuen Mun (屯門建生)	PU vegetable farm
5	Lok Fu (樂富)	IU school garden
6	Lok Ma Chau (落馬洲)	PU orchard
7	Ma On Shan (馬鞍山村)	PU mixed farm
8	Long Valley, Sheung Shui (上水塱原)	PU mixed farm
9	Lut Chau (甩洲)	PU fishpond
10	Ma Shi Po, Fanling (粉嶺馬屎埔)	PU mixed farm
11	Mai Po (米埔)	PU fishpond
12	Mong Kok (旺角)	Annual farm festival*
13	Nam Chung (南涌)	PU mixed farm
14	Nam San Wai (南生圍)	PU fishpond
15	Ngau Tam Mei (牛潭尾)	PU fishpond
16	Ngau Tau Kok (牛頭角)	IU bee farm
17	Pai Tau Village, Sha Tin (沙田排頭村)	PU bee farm
18	Ping Che (坪輋)	PU vegetable farm
19	Ping Shek, Choi Hung (彩虹坪石)	IU community garden
20	Sha Tin Hang, Kam Tin (錦田沙田坑)	PU vegetable farm
21	Shouson Hill, Aberdeen (香港仔壽臣山)	PU seed nursery
22	Tai Kong Po Tsuen, Kam Tin (錦田大江埔村)	PU vegetable farm
23	Tai Lung, Sheung Shui (上水大隴)	PU mixed farm
24	Tai Lung, Sheung Shui (上水大隴)	PU mixed farm
25	Tai Wo (太和)	Farmer's market*
26	Tsz Tong Tsuen, Kam Tin (錦田祠堂村)	PU paddy rice farm
27	Yuen Kong San Tsuen, Kam Tin (錦田元崗新村)	PU vegetable farm
		*Special off-farm events

3.5. Analytical framework

With respect to the wide scope of study and vast amount of data, the following framework is proposed to analyze the subject more systematically in two stages.

The first stage responds to the first and the second sub-questions of the research, 'How has the urban agriculture (UA) in Hong Kong evolved in terms of functions?' and 'What are the major factors dictating the functional transformation and adaptation to urban development?'. According to both the holistic agricultural data such as the agricultural land use and the opinions from the interviewees, the evolution of urban agriculture in Hong Kong will be dissected into different temporal intervals according to the key functions served and its multifunctionality. Emphasis is put on the interaction between the city under urbanization and the evolving local agriculture, as delineated in Fig. 1.1.. The key factors will also be extracted into themes of the specific changes of UA and its functions. This will constructs a solid background of the characteristics of UA in the local context, which is critical to the second stage of the research.

The second stage will contribute to the discussion over the third and fourth questions of the study, 'How multifunctional is the current UA in Hong Kong?' and 'Basing on the local context on multifunctional UA, what should be done for the UA to further contribute to sustainability in Hong Kong?'. The current and potential functions served by UA in Hong Kong will be assessed together with the current synergies and conflicts between different functions of the farms. As a result, the study aims at refining the current theories on multifunctional urban agriculture in developed regions by the context of Hong Kong. Practical recommendations will be proposed basing on the current food-related policy, for instance, how multifunctional the farms should be, as well as policy measures for UA to contribute best for the sustainable living of Hong Kong.

Chapter Four: Prospering local agriculture alongside with urban development from late 1940's to early 1980's

This chapter starts with a description on the general back ground of agriculture in Hong Kong. Then it attempts to chronologize the evolution of agriculture according to the key functions served to the particular stage of development of Hong Kong. With respect to the research focus on urban agriculture, it puts emphasis on the linkages between local agriculture and local urban development.

4.1. General background of agriculture in Hong Kong

4.1.1. General characteristics of farming regions

From coastal wetland to mountain ranges, from plains to steep slopes, a great diversity of landscape coexists in the pint-sized territory of Hong Kong, which is about 1,000 km^2. The rugged landscape was formed by marine deposition and violent volcanic activities more than 100 million years ago (Owen & Shaw, 2007). Volcanic tuff and granite are the major rock types, while sedimentary rocks can be found in the Northeast New Territories, and modern silt and sand spreads over the Northwest New Territories. Similar diversity is also observed in the dimension of micro-climate due to the atmospheric variations in a year brought by seasonal monsoons. There are valleys with average annual rainfall reaching 3,000mm, as well as coastal region receiving only around 1,600mm per annum (Hong Kong Observatory, 2012). These physical parameters have jointly played a significant role in governing the distribution of different types of farming in specific patterns. Needless to say, human factors such as transportation, even the origin of farmers of whether indigenous or recent immigrants also affected the distributions on different types of crops. Both the physical and human factors have nurtured a wider diversity of farms in Hong Kong

4.1.2. Characteristics of different types of farms

The farmland is classified by the types of crops (including fish pond farming) and whether the land has been fallowed for long or not. It is tabulated Table 4.1. below. About the paddy rice fields, not only the milled rice is harvested but also the paddy straw could be sold as horse feed or other purposes. The vegetables marketed can be leafy or fruiting ones that are usually cooked before consumption in Chinese dietary

habits. Flowers are cultivated mainly for decoration and worshipping. Field crops in the local contexts refers to starchy or root vegetables occupying minor market shares and grown under rain-fed condition. It is more like a miscellaneous category and pineapples were also included as well for the unique growing pattern which is different from orchard. Orchards mostly situated on the hillslopes for less requirement on irrigation. Fishponds mostly situates in estuaries or low lying areas in the northen part of New Territories, where the texture of soil is less permeable to contain water. Regarding abandoned/fallow farmlands, according to verification by officers from AFCD, land which were laid fallow for a year or two is considered active in production and falls into other categories of active usage. Land plots permanently excluded from the categorization of farmland are usually those which have been converted to container storage or carpark, whose concrete surface prohibit any attempt to practice agriculture again.

Table 4.1. Basic attributes of differents types of farm land

Types of farmland	Types of produce	Examples of produce	Physical requirement
Paddy	2-cropping fresh water paddy	Sze Miu (絲苗) and Fa Yiu Tsai (花腰仔)	Fresh water abundant area, where dry terraces or brackish water areas yield less cropping
	1-cropping brackish paddy and dry paddy	Ham Moon (鹹滿) in brackish soil and Hon Chim (旱粘) on hillside terraces	
Market Garden Crop (Vegetables)	Leafy vegetables and	Choi sum (菜心), *Brassica parachinensis*	Closer to roads for delivering fresh harvest and stable water source for irrigation
	Fruiting vegetables	Aubergine (矮瓜), *Solanum melongena*	
Market Garden Crop (Flowers)	Cut flowers and	Sword lily (劍蘭), *Gladiolus spp.*	Closer to roads for delivering fresh harvest and stable water source for irrigation
	Trees	Peach blossom (桃花), *Prunus persica*	
Field Crops	Less perishable crops	Sweet potato (蕃薯), *Ipomoea batatas* Ginger (薑), *Zingiber officinale*	More versatile requirement and mainly rain-fed
Orchard	Sweet fruits	Longan (龍眼), *Dimocarpus longan* Banana (香蕉), *Musa spp.*	Mainly hill slopes with lower rent for offsetting the unstable income
Fish Pond	Mainly freshwater fishes	Grey mullet (烏頭), *Mugil Cephalus* Grass carp (鯇魚), *Ctenopharyngodon idellus*	Clayey soil for retaining the water in pond
Abandoned/ fallow	N/A	N/A	Mostly abandoned for land speculation

Land uses on poultry and pig farming are not recorded officially because of the small area occupied. As described by the government official, the classification is based on the experience and observation of trained field officers. Rigid rules are not preferred with respect to the peculiarities of local farming habits – farmers usually grow a small variety of crops such as papaya trees next to vegetable field for self-consumption. Even for large scale single crop farming such as paddy rice, some farmers grow sweet potato as a catch crop during the dry season in winter, aiming to sustain income during the gap between growing seasons of major crops. The general topographic pattern of different crops in the farming regions is depicted by Wong (1971:34) as modified into Figure 4.1.

Regarding Fig. 4.1., the farm design is without doubt a genius design to utilize the hydrology of the rugged landscape of Hong Kong. However, some practices have been phased out nowadays owing to different regulations such as the prohibition on unauthorized cultivation on hill slope as well as household keeping of poultries. The reasons behind the policies will be dicussed in Chapter 5.

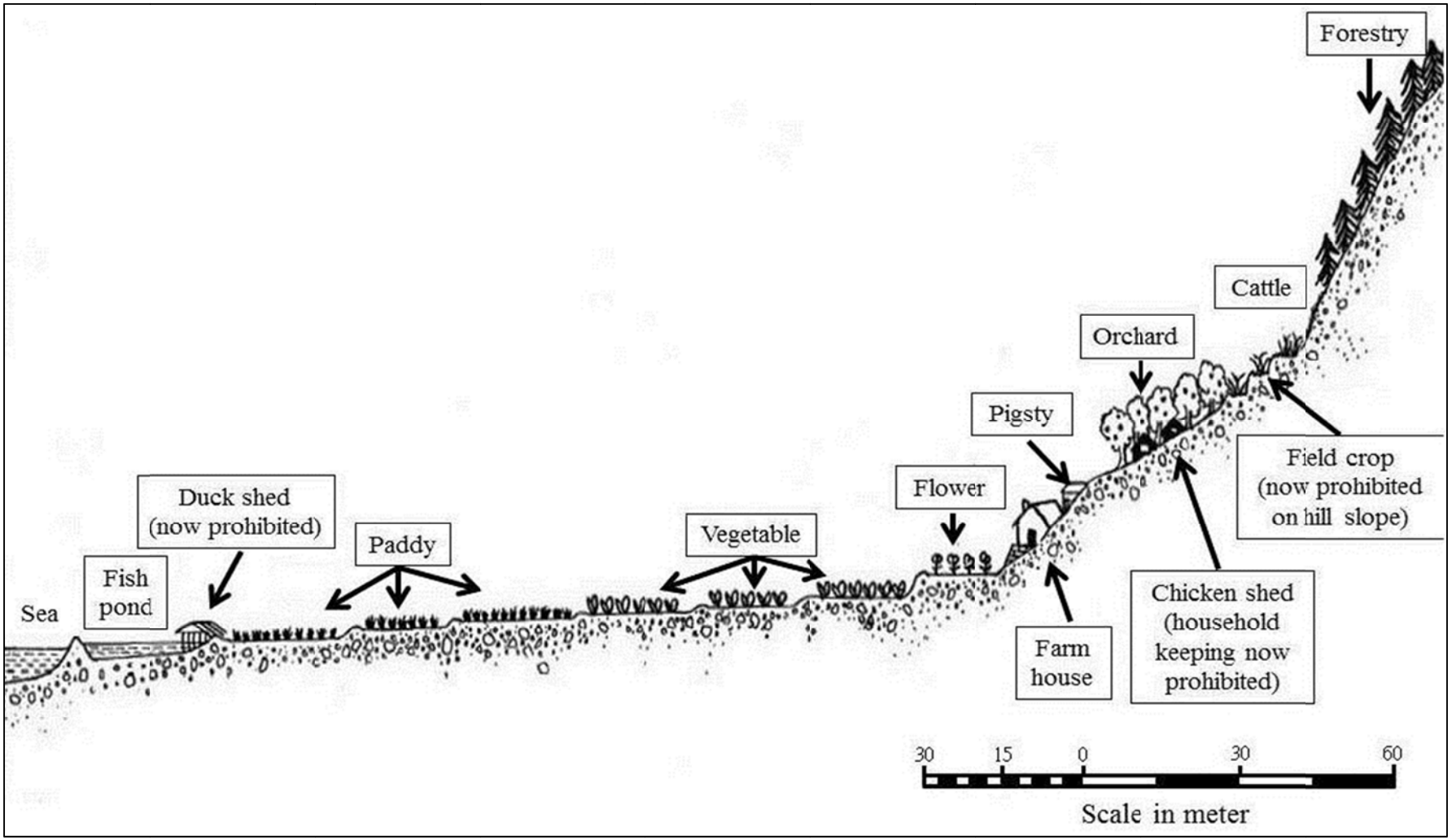


Figure 4.1. Topographical pattern of different types of farms (Modified from Wong, 1971:34)

4.1.3. Land use transformation of agriculture in Hong Kong

As discussed in Section 1.2., agriculture was once prosperous in the mid-20th century but diminished towards the end of the century. This cannot be more effectively represented by the change of the sizes of different agriculture land uses, the fundamental indicator of farming activities, according to official record by the AFCD (previously AFD) from the year 1953 to 2011. The data from 1945 to 1952 is not included due to the absence of certain land uses such as flower farms, orchards and abandoned farm land. Complete data can only be obtained after the first large scale survey of farmland, which was completed in 1953.

As shown in Fig. 4.2., the total area of agricultural land peaked during the 1950's to late 1960's. It then decreased by half in the 2000's. More significant phenomena can be observed when we classify the types of land use into three purposes, paddy rice fields for staple food production, more market-oriented produces including vegetables, flowers, pond fish in fish ponds and fruits in orchards (field crops is excluded for unclear market orientation), as well as abandoned land. As demarcated in black arrows, paddy rice field dominated from 1953 to 1969 in size. The largest share was taken over by market-oriented produce from 1970 to 1991. Since 1992, most of the farmland are abandoned.

When looking at abandoned farmlands, it only occupied a small proportion (about 5%) of the total farmland in early 1960's. It significantly expanded when entering the 1970's, from 2288 ha in 1970 to 4260 ha in 1981, and remained stable at about 4000 ha. At the same time, the area of active farmland, summing up the five categories excluding the abandoned, dropped rapidly from the 1970's. It declined from 11950 ha in 1969 to 8660 ha in 1976, and then a straight fall to 1814 ha in 2011. Consequently, the proportion of active farmland in total farmland, or here represents the farmland utilization rate, greatly decreased from the 88.6% in 1969 to only 30.9% in 2010.

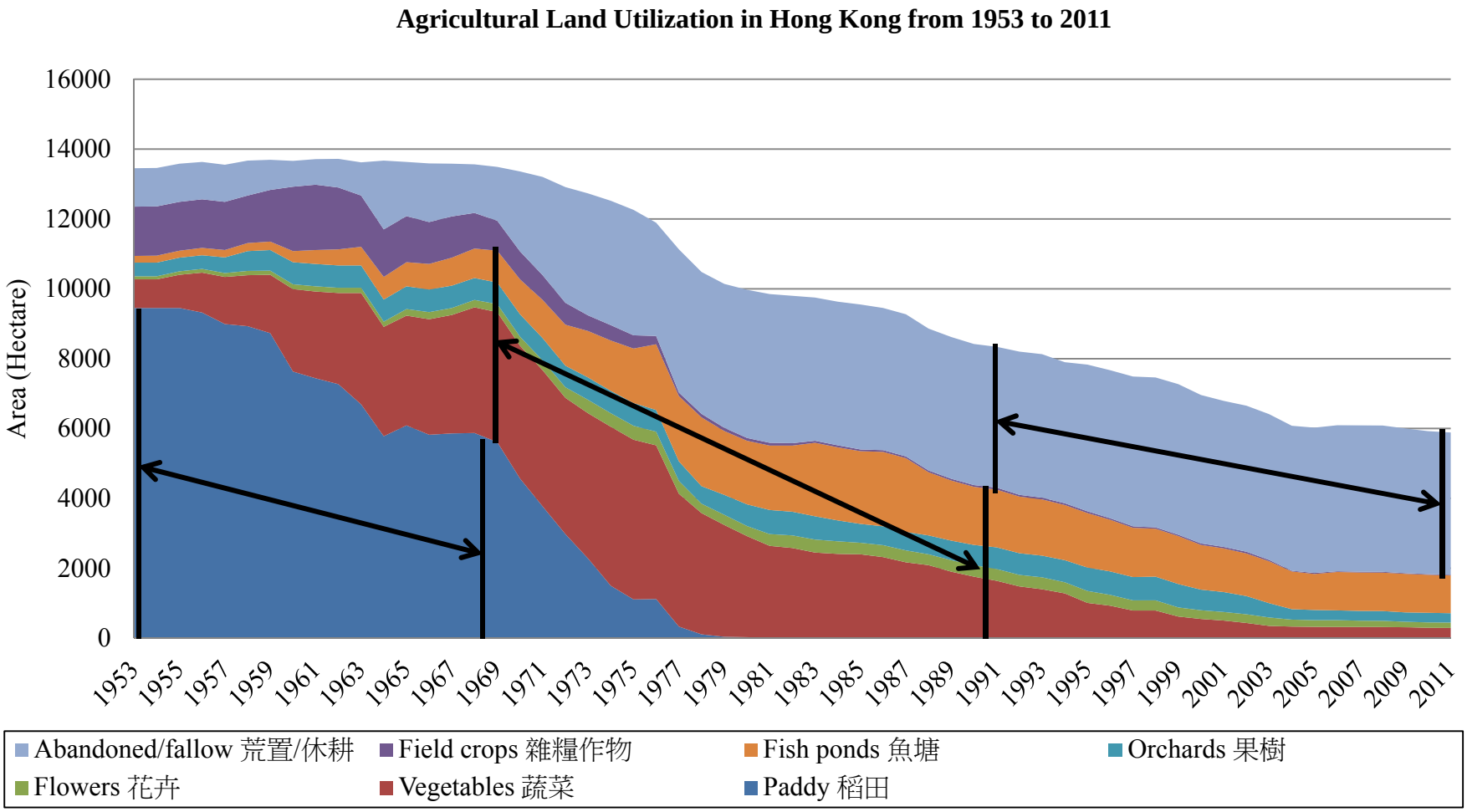


Figure 4.2. Agricultural Land Utilization in Hong Kong from 1953 to 2011 (Source from: AFD and AFCD)

4.2. Farming for food security: From late 1940's to late 1960's

Local agriculture in Hong Kong in the prewar era was mostly subsistence farming for rice by the farmers in the rural areas, in addition to a small share of production for exporting overseas (Hayes, 2006). After the WWII, tremendous changes took place in Hong Kong between the late 1940's to late 1960's when over 3,000,000 refugees escaped from the civil war and the newly found communist government in China (Blackie, 1972).

4.2.1. Farming for bottom-up security

At the dawn of the post-war period, paddy rice covered 80% of the territory's farmland (AFD, 1951). According to a retired official (Interviewee #1), rice was planted everywhere in form of wet-bed paddy, brackish paddy rice and even some on upland soil. During the winter time, which is too cool and dry for paddy rice, sweet potato was planted as catch crop to sustain yield between the rice planting seasons.

> *"The indigenes could not forget the hunger during wartime. They preferred to grow starchy food ensuring adequate calorific intake." (Interviewee #1)*

However, hygiene was of minimal concern due to some bad practices witnessed by interviewees #1 and #10. Interviewee #10 witnessed dishonest farmers selling pigs that died from diseases at low price which could probably poison consumers. A shocking experience by interviewee #1 was how he swam with dead and rotten chickens in a beach, which is totally unimaginable in Hong Kong nowadays. These reflect the low concern on hygiene and people's dogmatic belief of treasuring every bit of food, even at the risk of their health. This mindset echoes with the notion of 'agricultural fundamentalism' which originates from fear for wartime hunger (Bishop & Phillips, 1993).

Besides food for survival of citizens, farming was also acting as a safety net for the underprivileged. In the 1960's, the colonial government played an active role in promoting mechanized farming techniques together with the Kadoorie Agricultural Aid Association (KAAA) who focused in promoting vaccination of poultry and livestock. Many interviewees are still very grateful towards the assistance of the

department and the organization as reflected from the interviews. According to the Kadoorie Farm and Botanic Garden's (KFBG) exhibition on KAAA held on 20 Jun 2011, many male soldiers passed away and left about 9,000 widows behind in the New Territories during the WWII. The widows' lives were tough they could only work for inferior jobs such as weeding. Receiving the pigs and poultries for husbandry and cattle as farming stock to assist the physically demanding works in farming, the widows thus became more economically independent.

Accommodation of the massive immigrants from Mainland was made possible with the assistance by KAAA, where in the New Territories, a million of the refugees settled down (Blackie, 1972). The farmland provided both the site for building houses as well as farming for making a living (Wong, 1971). This reflects the importance of agriculture in supporting the poor in the New Territories.

From these evidences, the major function of agriculture on food security seems mostly bottom-up, sprouting from the unforgettable memories deep inside every farmer surviving from WWII. However an incident in the late 1960's reflects the other side of the story. The Leftist Riots in 1967 not only disturbed daily living of citizens, but also posed immense impact on policy-making.

4.2.2. Farming for top-down security

The government's agricultural policy was quite consistent after WWII according to the records of the annual departmental report until 1967. The following is a capture of the policy in 1964:

> *"The farming policy of the department is to encourage maximum economic production of crops and livestock by means of a wide range of advisory, research and ancillary services… thereby achieving a progressively higher standard of living for the farming community." (AFD, 1965:1-2)*

A key turning point of food production policy was likely influenced by the 1967 Hong Kong Leftist Riots. As recorded in the departmental report in 1967:

> *"The disruption during the summer of 1967 of supplies of animal protein rich food from China and the consequent shortages of slaughter livestock resulted in high prices of meat. These events emphasized the degree of Hong Kong's normal dependence on China as a source of food and the desirability of fostering home production…" (AFD, 1968:2)*

To understand the incident in the summer of 1967 better, Cheung (2009) reported that 60% of food consumption in Hong Kong was imported from China during that time. The PRC government managed to cut the food supply to pressurize the British Colonial government. This doubled the price of vegetable and the government had to harvest the vegetable pre-maturely in New Territories to stabilize the food supply. Egg and pork were almost absent in the market at that period.

Food reserve is undoubtedly vital for strategic function during political turmoil that the colonial government was well prepared in rice storage by stable import from Thailand, and meanwhile promoting vegetable farming in the New Territories in the post war period (Zheng & Wong, 2005). The contribution of local and foreign supply of food in Hong Kong was sufficient to support the basic living of citizens that the food strike only caused short term fluctuation in price (Cheung, 2009). The local and foreign trading companies even expanded their market share during the strike by the leftist companies who shrunk in market share at the same time. Some leftist hawkers complained on the strike for killing the leftist sellers before damaging the governance of the colonial government. The leftist tactic on reducing food supply "failed to bring the colonial government to its knees" (Cheung, 2009:66), proving the victory for the colonial government on actively maximizing local food production.

Shortly after suppressing the riots, the agricultural policy of Hong Kong shifted from maximizing yield to "favour 'free trade' and to refrain from any 'protectionist' measures" (AFD, 1971:8). This implied the change on the role of government in supporting local agriculture at the end of this period.

4.3. Additional functions and features of agriculture in this era

4.3.1. Cultural importance of local agriculture

Produce from local farming was of high cultural importance before industrialized production prevailed in local market. Interviewees #10 and #18 recalled that during the 1960's, chickens were treated as gifts when farmers visit their relatives elsewhere. In comparison, nowadays citizens usually earn money to buy manufactured products as gifts, instead of making or raising the presents. An interesting scene was described by interviewee #18, "It was a common scene on train to see people holding bags designed with a hole on a side, so as to let the chicken stretch out its neck and not running everywhere." This is supported by Liu (2008) who stated that chickens possess ritual status in South China, and it was expensive until the 1970's when mass-production of poultry by industrialized system was popularized.

Other than chicken as gifts, interviewee #7 enriched the context by another scenario relating to the function of flowers at the time. The interviewee indicated that the demand for flower was quite high and stable. Unlike in present time, the usual price of flower is cheap except once a year when used as New Year Trees before Lunar New Year Holiday:

> *"Flowers were used in high class restaurants in Kowloon and Hong Kong Island as decoration. The flowers must be kept fresh, sustaining a stable demand for high quality fresh flowers. You have to imagine the period was even earlier than industrialization of Hong Kong, when long-lasting plastic products became popular." (interviewee #7)*

The agricultural practice for flower can be of high indigenous knowledge. Interviewee #16 demonstrated a practice of sword lily (*Gladiolus* spp.), a popular decorative flower, in crop rotation with paddy rice. The sword lily can be planted in winter, which is the gap season for paddy rice. Interviewees #7 and #16 both agreed on the synergism of this crop rotation. In their experience, the flowers can absorb the excess fertilizer left in soil when growing rice, and make a good fortune if the flowering period could catch up with the Lunar New Year Holiday for the highest market price in a year. In turn the wet-bed condition during rice farming can adjust the acidity raised from flower farming.

These two cases signified the typical functions served by agriculture in support of daily social interactions, when other products were not mass-produced in industrialization. This is an interesting interaction between the agricultural society in the New Territories and the urbanized Kowloon and Hong Kong Island at that time.

4.3.2. Economic return from exporting harvest

Regarding the economic function, the input was more on labour from family than machinery. This can be reflected of the childhood memories of most of the interviewees who have now reached the age of 50. They had to assist in farm work after other work, which some of them found tiring and not joyful at all. This practice saved the families' spending and sowed the seeds for agricultural development as the children learnt certain knowledge of farming practice.

There was some very 'rural' agriculture, the products of which were sold overseas, not for local consumption. According to interviewee #4, the well-known variety of paddy rice in Yuen Long known as 'Yuen Long Sze Miu' (元朗絲苗) was exported to the Chinese communities in San Francisco in early 20th Century. Moreover, interviewee #1 added that the ginger grown in Pat Heung (八鄉) was of high quality that would be processed into crystalized ginger, which was popular in Western Europe. In Wong (1971), another major produce for export was water chestnut which was preserved in cans, which made quite a profit together with ginger and other produces. This prosperity ended in early 1960's when the produce from Taiwan out-competed Hong Kong in the international trade. In this aspect, although not of major scale, the agricultural sector contributed to the economy of Hong Kong by exporting high quality produce, before the massive export of manufactured products of light industries in the later period.

For local consumption, the economic benefit from farming was low particularly for paddy rice, which was out-competed by imported rice from Thailand in the 1960's (Liu, 2008). This is further supported by the drastic decline of rice fields after 1969 as shown in Fig. 4.2.. The economic output is rather limited to view in this aspect.

4.3.3. Environmentally friendly ways of farming

The government statistics presented a monopoly of rice farming according to land use, where monoculture is generally considered as ecologically unsound. However some aged interviewees reflected an important picture from their childhood memory.

> *"Despite planting for rice, we had to help our parents feeding the pigs and poultry which were only slaughtered during festivals. Their faeces, of course including our own, became excellent fertilizers after treatment. The unsold parts of farm produce such as chaff of milled rice could be blended for pig feed." (Interviewee #1)*

Mixed farming was practiced instead of solely paddy rice to supplement daily living of the family. For instance, some patches of vegetables were farmed with poultries like ducks and chickens. This is favourable to the environment as the wastes can be recycled for food production. Serving to recycle waste and nutrients, the practice achieved a closed-loop of 'food-growing nutrient cycle' during pre-industrial revolution (Smit et al., 1996:13).

The farming practice was very much like the pre-industrial revolution practice that the rice fields were mostly ox-tilled. According to the retired officials, the farming practice did not incorporate much of chemical fertilizers:

> *"Chemical fertilizer wasn't so popular until the 1970's even promoted by the government for long, as the families were too poor and would rather farm on the cheaper night-soil. With the mixed farming and nutrient cycling, practically we had small expenditure from farming. What we feared most were extreme weathers which devastated the yield and plague that could kill hundreds of chicken in a single night." (Interviewee #10)*

The night-soil was applied as principle fertilizer in the early stage of this period (AFD, 1951), and stations were built to collect the manure from urban area of Hong Kong. Not only reducing the farming cost, this practice had another profound effect:

"Many of the agricultural soils [in Hong Kong] are light in texture with poor water holding capacity. They would benefit immensely by the annual incorporation of well-prepared compost with "boosting" by the addition of night-soil or small dressing of a complete fertilizer." (AFD, 1953:2)

The application of night-soil and compost also contributed to soil improvement and conservation. This could rectify the loss of soil organic matter which is a common consequence brought by conventional farming methods such as frequent tillage and removal of crop residues (FAO, 2005). However, with the increasing wage or night-soil delivery labours and the wider use of different sanitation system in new urban buildings, the application of night-soil was phased out at the end of this period.

To summarize the functions in this period, the function for food security was most emphasized, both for security in farmers' livelihood and political reason of the government. The farming system was ecologically sound with the application of night-soil and the produce was of cultural significance for Hong Kong. Although the economic output was not high for local consumption, it did contribute some to international trading for Hong Kong by exporting high quality produce.

4.4. Farming for economy: From early 1970's to early-1980's

Stepping into the 1970's, the fundamental function of local agriculture has changed from securing the food supply to the maximization on economic return of the industry.

4.4.1. Drastic decline of paddy rice farming

Unlike the postwar period when paddy rice dominated over other farmland areas, it lost more than 9,000 hectares of its land size in less than three decades according to official record. Many of the previously rice fields were cultivated for perishable vegetables and high-protein food like freshwater fish as signified by the prevalence of vegetables and fish ponds after late 1960's as shown in Fig. 4.2..

According to the findings of Hayes (2006) and Wong (1983) as well as the comments from several aged interviewees, the decline of paddy rice farming is resulted from several factors and phenomena as demonstrated in Fig. 4.3..

The colonial government decided to import rice from Thailand as the limited farmland in Hong Kong could not catch up with the booming demand for rice in the early 1960's (Zheng and Wong, 2005). Under the massive rice import, the local rice fields had lost their tactical purpose that the government had fewer motives to further invest on the research and development of the type of cultivation. This indirectly resulted in the lower competitiveness of local rice cultivation on both quality and quantity under the strong exporting countries like Thailand.

Particularly in the early 1960's, the severe draughts in Hong Kong had exacerbated the conflict on water demand between the rice fields and the expanding population (Hayes, 2005). Therefore the government tackled the water shortage with the construction of the two largest reservoirs, Plover Cove Reservoir and High Island Reservoir in the 1960's and 1970's (Wan & Li, 2011). Unfortunately, the construction of the reservoirs had flooded the river valleys in cultivation as well as disturbed the drainage pattern downstream (Hayes, 2006). In light of this phenomenon, the water security by urban citizens was partly built upon the sacrifice of farmers, who had lost their farmland and home for the reservoirs.

These pressures posed by urban development were "mutually reinforcing" with each other (Hayes, 2006:75) and induced the collapse of paddy rice farming which was not officially recorded anymore by mid-1980's. The factors of increasing demand for non-staple food, factory workers and the development of new towns will be discussed in coming sections.

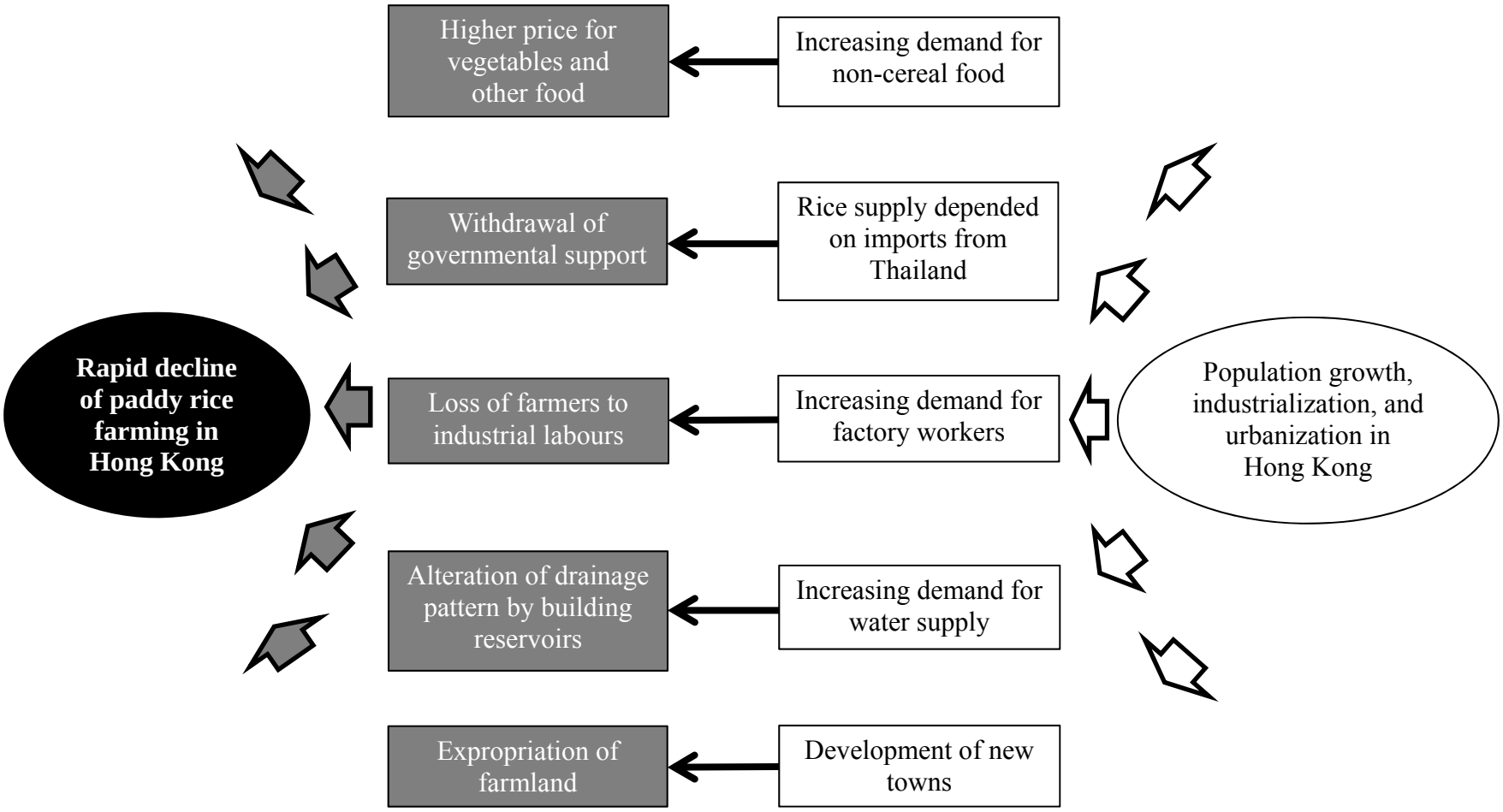


Figure 4.3. The effect of urban development upon the rapid decline of paddy rice farming in Hong Kong

4.4.2. The most prosperous period of Hong Kong agriculture

Most of the interviewees agree that from the early 1970's to early 1980's is the most prosperous for local agriculture. Echoed by official data, the agriculture value including crops, livestocks and poultries peaked in the early 1980's, achieving HKD1.55 billion in 1983. However, the total farmland area kept shrinking at the same time. Wong (1971) proposed seven factors to the prosperity of the industry, particularly on vegetable farming:

i. The increase in population increase by both natural increase and immigration from China;
ii. Greater purchasing power of the citizens and the improved living standard demanded for more fresh vegetables and flowers;
iii. Influx of skilled immigrant farmers that stimulated subsistence farming to intensive farming over the New Territories;
iv. Improvement on transportation which facilitated the trade of perishable food;
v. Improved technology particularly on fertilizer and irrigation was introduced by agricultural workers, government services, immigrant experts or improvised by farmers themselves;
vi. Greater profitability of vegetables and flowers won over others crop especially on paddy rice for higher market price and short maturation period which is more adapted to market fluctuations;
vii. Better government services were provided on research, extension, credit, education, advice, co-operatives and marketing.

These factors will be further studied to enrich the study by the agricultural development in the 1970's to early 1980's.

Quantitatively, the produce of vegetables increased in value by almost 3 folds, from HKD159,106,000 in 1970 to HKD468,100,000 in 1982. However the yield of produce was not so spectacular, recording a decrease from 181,558 tons in 1970 to 155,000 tons in 1982. This demonstrated the drastic increase in market price of vegetables.

The decrease in crop yield mainly resulted from the shrinkage of farmland, which declined by 32.4% from 1970 to 1982. The decrease in yield was relatively small for vegetable farming (only 14.6%) because the production per hectare was increased at the same time, from 47.78 metric tonnes per hectare in 1970 to 60.18 metric tonnes per hectare in 1982. This boost in yield per hectare can be accounted for the popularization of small machines like mechanical tiller, as well as the increased use of inorganic fertilizers and pesticides which shortened the growth period allowing more cropping and decreasing yield lost to pest consumption.

4.4.3. Development of reputed brands from various farming regions

Qualitatively, there was strengthened 'specialization' for produce in different regions. Unlike the dominance of paddy rice in the last period with less variation of produce, the vegetables had much wider varieties and species. Through the practice of seed selection and saving, the farmers gradually discovered the typical crops most suitable for the particular topography, hydrology and climate.

According to Produce Green Foundation (2012), a farmer cultivated the landrace of Hok Tau pak choi (鶴藪白菜) unintentionally. In the late 1960's, the farmer successfully cultivated the special variety from ordinary seeds called Jiangmen pak choi (江門白). The exceptional quality of Hok Tau pak choi brought high profit that the farmer could sell the produce at double amount of ordinary price.

The success was enjoyed many other farmers as well as they developed famous local brands that many of the interviewees are able to recall. Fig. 4.4. illustrates some of the outstanding brands in different farming areas in Hong Kong. This facilitated the branding of different native produce over the limited farmlands in Hong Kong. The famous brands are further collected from various interviewees, and listed in Table 4.2., with their respective location in Hong Kong marked in Fig. 4.4..

Other than the annotations from A to M in the map, the black round dots are places with market gardening, where clusters of dots are areas that nurture famous local brands.

Table 4.2. List of famous brands of local produce in 1970's
(Respective locations marked in the map of Fig. 4.4)

Code in map	Type of produce	Location
A	Cone-shaped bitter gourd (雷公鑿苦瓜)	Ta Kwu Ling (打鼓嶺)
B	Hok Tau pak choi (鶴藪白菜)	Hok Tau (鶴藪)
C	Choi sum (菜心)	Kwun Lam, Tuen Mun (管欖)
D	Welsh onion(水蔥)	Ma Shi Po (馬屎埔)
E	Chinese kale (芥蘭)	Wa Shan, Sheung Shui (華山)
F	Chinese radish (蘿蔔)	Shan Ha Tsuen (山下)/ Tong Yan San Tsuen (唐人新村)/ Ha Pak Nai (下白泥)
G	Watercress (西洋菜)	Chuen Lung in Tsuen Wan (荃灣川龍)/ Tsz Tin Tsuen in Tuen Mun(屯門紫田)
H	Water spinach (通菜)	Ping Shan (屏山)
I	Celery (西芹)	Hung Shui Kiu (洪水橋)
J	Red spring onion 紅頭蔥	Tung Chung (東涌)
K	Tomato (蕃茄)/ Angled luffa (絲瓜)/ Hairy gourd (節瓜)	Kam Tin (錦田)
L	Chinese wolfberry (枸杞)	Tsiu Keng (蕉徑)
M	Spinach (菠菜)/ Amaranth(莧菜)	Tai Kong Po in Pat Heung (八鄉大江埔)

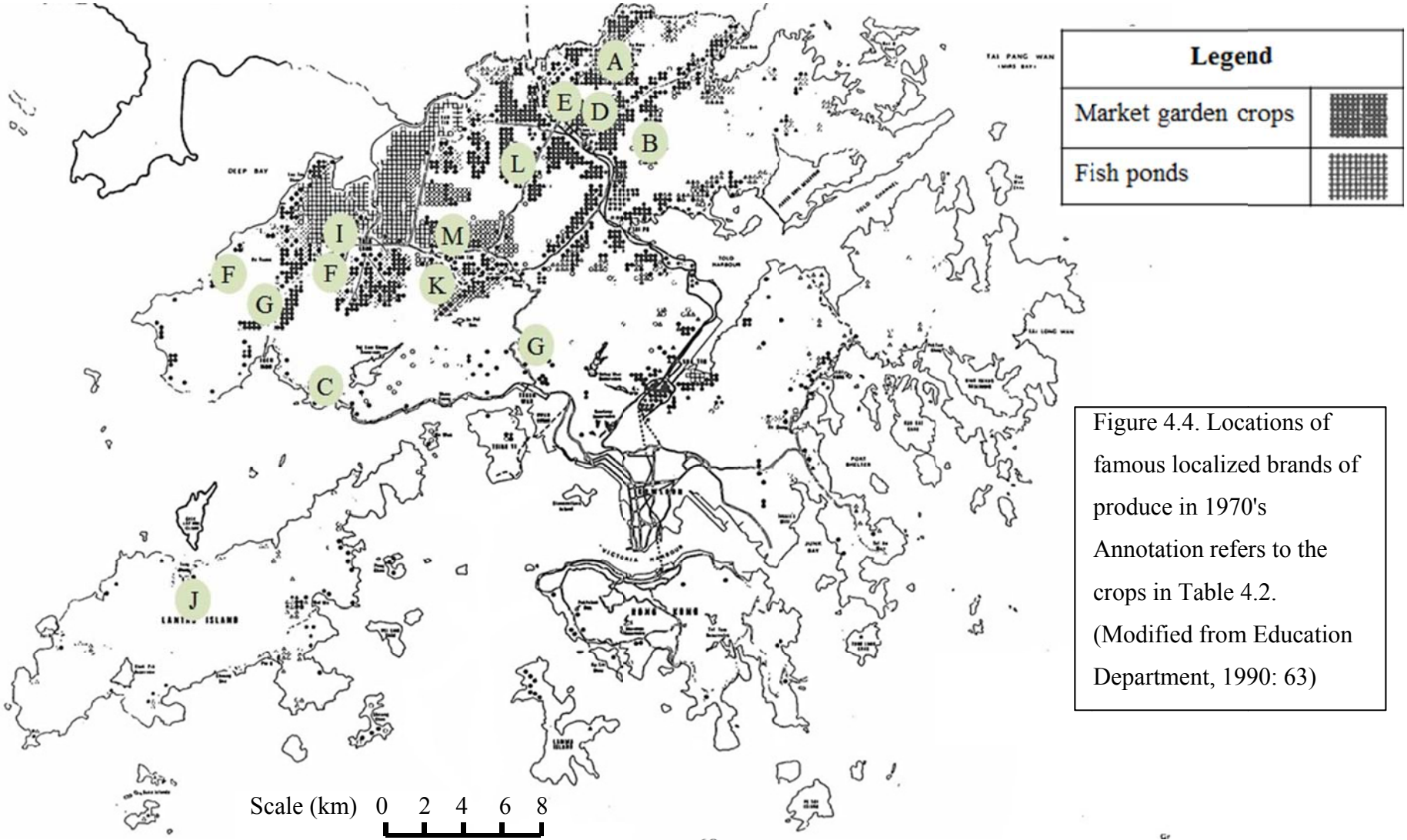


Figure 4.4. Locations of famous localized brands of produce in 1970's Annotation refers to the crops in Table 4.2. (Modified from Education Department, 1990: 63)

Besides specialization and improvement on quality and quantity of vegetable produce, the competitors were not performing well enough to threaten the local produce. As interviewee #9 recalled, the imported vegetables from Mainland were mostly durable, or 'hard to chew' (硬口) such as cabbage. The quality was not promising as well:

> *"How can you eat a Choi Sum over a foot long? Many of the farmers from the Mainland switched to grow cereal when Chairman Mao proposed 'Take Grain as the Key Link' (以糧為綱). They forgot how to grow tasty vegetables, causing dissatisfaction from the Hong Kong sellers as they had to spend a lot of time trimming the vegetables by half for suiting the preference of local market." (Interviewee #9)*

Obviously the Mainland import was incompetent and only served the more durable crop. The market of fresh, perishable crop was therefore dominated by local farmers.

4.4.4. Urban development and increased income of farmers

Another major factor of increasing the income of farmers was the rise in living standard, resulting in the increase in their purchasing power (Wong, 1971). This can be reflected by the rapid rise of Gross Domestic Products (GDP) per capita (at 2012 prices), which increased by almost five folds from HKD5,836 in 1970 to HKD28,366 in 1980 (Census and Statistics Department, 2012a). Livestock and poultry farming were both significantly benefitted from this because the citizens could afford chickens and pork, which was a luxury earlier in the 1960's. Comparing with the state of the industry of pigs and chickens in 1970, 1975, 1980 and 1983, we can see the positive trend of the quantity of animal farming in Fig. 4.5..

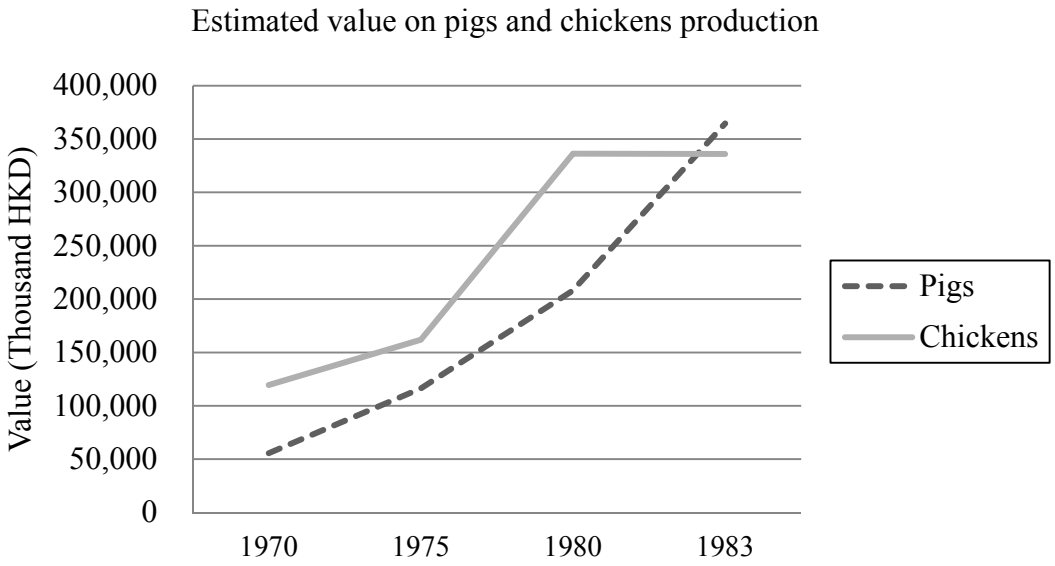


Figure 4.5. Estimated value on pigs and chickens production (Source from: AFD)

In summing up these factors, the farmers earned a good living and were able to afford children's higher education fees. According to interviewee #14, his family of nine children was sustained by farming by her father, earning around HKD200 per month. This is supported by Cheng's (2009) finding when the income of a farmer was higher than a factory worker. At that time, the agricultural production value peaked and the farmers were better off than the previous period when the produce were not sold at good price.

4.5. The down turn of agriculture

4.5.1. Decline in environmental functions

The farming practice became less environmentally friendly in this period of time. The practice of night-soil collection was discontinued due to the increased cost on delivery and the change of urban sanitation systems. At the same time, the replacement of vegetables farming over paddy rice also changed the pattern of fertilizer application because inorganic fertilizers were more preferred by the vegetable farmers for boosting the yield by growing more crops per year. The decline of rice farming implied the reduced demand of night-soil and other composts. The improved income of farmers, enabling them to purchase chemical fertilizers and pesticides which were considered as a luxury for the rice farmers who originally used cheaper night-soil.

The consequence of shifting fertilizer application was immense. The 'food-growing nutrient cycle' was disconnected that the urban area had to treat the reusable food waste by incineration and landfilling. For the rural setting of the less populated New Territories, the expanding industries of poultry and pigs also faced less demand for their increasing discharge. Many of them chose to discharge directly to rivers causing severe pollution in water bodies.

Moreover, the increased number of cropping over summer caused more severe pest problems in Hong Kong. To ensure better appearance of vegetables (i.e. without wormholes), the farmers applied pesticides more intensively. This however, decreased the biodiversity of the agro-ecosystem by killing the pests together with the soil fauna. This further disrupted the environmental function of agriculture and sowed the seeds for the hardship of agriculture in the next period.

4.5.2. Land competition with urban development

Despite the increased yield and value of agriculture, the total area for agriculture and the population of farmers decreased gradually. The farmlands were lost to satellite cities, or later called new towns scattered in the New Territories. Two phases of new towns were built in this period. The first phase in the early 1970's included Tsuen Wan, Tuen Mun and Sha Tin where 10,135 ha of land underwent urban development. The second phase included Tai Po, Yuen Long and Sheung Shui/ Fan Ling, where 4,227 ha of land was developed (Information Services Department, HKSAR, 2012). Alongside with this 14,362 ha of rural land that was planned and developed, the area of active farmland in Hong Kong reduced by 5,412 ha between 1970 and 1983, comprising 48.9% of the active farmland in the beginning of the period. At the same time, the abandoned farmland increased by 79.2% from 2,288 ha to 4,100 ha. These figures demonstrated the huge impact of urban development on the active farmland.

As witnessed by interviewees #14 and #18, large lots of farmland were expropriated by the government for new town development, and to construct the highways and road networks. Interviewees #1 and #10 pinpointed that some of the farmers who lost their land decided to use the compensation fee from the government to invest in farming in Mainland China, where the business environment improved after the Open-Door Policy (改革開放) began in 1978 following the Cultural Revolution.

This had essential effects on the local agriculture, which will be further discussed in the coming sections.

4.5.3. Obstacles for younger generation to farm

Industrialization was a two-sided blade for agriculture. It increased the purchasing power of urban population, thus supporting the vegetable price to rise. However, industrialization also attracted many of the farmers, especially their siblings not to follow farming as their parents did. It is deep-rooted in Hong Kong that farming is inferior job for those unable to achieve higher education. This contrasted with the image of farmers as the guardian of the rural landscape as proposed by Wilson, G.A. (2001) that the social status of farmers was higher in the Western world.

As reflected by many of the interviewees who spent their childhood in farming, their parents wished they could receive higher education, so as to get a more decent job, and thus enjoy a more 'successful' life. The experience of interviewee #9 was very dramatic, recalling that he worked in a rattan factory while growing up. His father did not want him to farm for life, but he eventually returned to farming after a quarrel with his father, "I just wanted to do what he didn't allow me, and I can do better than what he did!" (Interviewee #9). This case reflected the difficulty for the offspring of farmers to continue farming under the low social recognition towards farmers.

Besides social recognition, there was another barrier for the younger generation to enter fulltime farming even though they like the lifestyle. According to interviewee #17, he wanted to farm with his father when growing up.

> *'My dad didn't allow me to farm together when there were no vacant lands as all were farmed by him. Even though I liked farming, I had to work and wait in town until he got too old to manage all the fields.' (Interviewee #17)*

The limited land availability had stopped the younger generation from expanding their parents' farms, even when they could bear the low social recognition as a farmer. This caused a generation gap in the succession of farmers and broke the continuity of local agricultural development.

4.5.4. Productivist agriculture and weaker multifunctionality

Going through the declining environmental functions and constraints from various social factors, the threats towards agriculture are unveiled behind the prime economic achievements. This period of agriculture development follows the productivist pathway to a certain extent. The production method switched from ecologically sound ways to more destructive ones, such as using more inorganic fertilizers and pesticides for boosting yield.

Accounting for the multifunctionality of the period, the economic function was stronger than the last period in narrow sense because the production value and farmers' income peaked in the early 1980's. However the job opportunities provided by the sector actually decreased. Furthermore, the environmental function declined severely when urban wastes were no longer utilized in farming, together with the ecologically harmful cultivation methods. Therefore, the multifuncationality is weaker than earlier identified.

4.6. Chapter summary

This chapter first overviewed the general attributes of agriculture of Hong Kong. The first postwar period of agricultural development from the late 1940's to late 1960's was analyzed to serve majorly for food security of the colony. The major purpose of agriculture was on bottom-up and top-down security for the society. The environmentally friendly farming method of utilizing the urban waste was another benefit brought by local farming, together with economic contribution by exporting high quality food and cultural significance of local produce.

Stepping into the next period in early 1970's, a fundamental change of farming was accelerated by rapid urban development in Hong Kong. Paddy rice farming diminished while the cultivations of market gardening crops, mainly vegetables dominated the farmland in Hong Kong. Together with the drastic expansion of market for the protein-rich food such as freshwater fish, poultry and livestock, the production value peaked in the early 1980's that the decade is regarded as the golden period of agriculture in Hong Kong.

However, local farming had increasing incompatibility with the urban environment. For instance, large scale of farmland was consumed by new town development all over the New Territories for supporting the population growth. The social status of farmers was low, which was originated from both the productivist farming methods which did not protect the land (Marsden et al. 1993 in Wilson, G.A., 2001) and the traditional culture deep rooted in the Chinese society. This hindered the succession of farmers, and together with other social incompatibilities, the path towards the complete decline of agriculture was paved after early 1980's.

Chapter Five: The collapse and 'urbanization' of local agriculture from mid-1980's to early 2010's

After the golden period of local agriculture from early 1970's to early 1980's, the farming industry experienced a drastic shrinkage after mid-1980's. Walking through the adversity of local agriculture from the mid-1980's to mid-1990's, farming activities have been reconnected with the urban living in the new millennium. In form of urban agriculture, the agricultural sector is seemingly stepping out from the bottom of valley.

This chapter examines the significant transformations towards more 'urbanized' agriculture from mid-1980's to early 2010's. It will study the reasons and the implications behind the collapse of local agriculture in the mid-1980's to mid-1990's.The multifunctionality of UA currently will be assessed in the next chapter.

5.1. The collapse of productivist agriculture in Hong Kong: from mid-1980's to mid-1990's

From the mid-1980's, the agricultural value kept declining. The land area, farming population and food self-sufficiency all drooped to levels below those of the beginning of the post-war period, the time when most of Hong Kong's territories, especially the New Territories, was yet to be urbanized . One major cause is the increased food import from mainland.

5.1.1. Collapse of local farming by the suppression of market price

The pleasant living standard of farmers in the golden period of local agriculture did not last long. After the introduction of Open Door Policy by Beijing in 1978, the amount of imported food from Mainland China substantially increased. In the decade between 1978 and 1987, food import value from mainland increased from HKD3,923,000,000 to HKD10,920,000,000 (China Resources Trade Consultancy Co Ltd, 1988: 50), and the value of vegetables and fruit imported from Mainland grew more than double as in 1978. At the same time, the quantity of local food production, as represented vegetable production, decreased from 175,000 metric tonnes in 1978 to 141,000 metric tonnes in 1987, which was a drop of 19.4%.

The massive influx of vegetable from mainland was of much lower price, as a result of the low labour and land cost in China. This greatly suppressed the market price of local vegetables such that the farmers could earn far less than before even with same quantity and quality of yield. This seems to be a simple market crash from massive import. However, if we further our interrogation in other produce – especially fish – and behind the general figures, one can identify factors such as technical exchange and land use changes are also playing a part in driving the agricultural sector down.

5.1.2. Technical exchange with mainland farmers

According to interviewees #2 and #13, fish farming was still profitable up to the mid-1990's, a decade after the collapse of vegetable market. They expressed that the mainland fish farmers spent quite a period of time to learn fish farming to catch up with the technological backwardness created by the Cultural Revolution. It took longer time for them to learn from Hong Kong fish farmers compared with vegetable farming with lower requirements on infrastructure. After learning fishpond farming again for several years, the cheaper products from mainland could then finally meet the market standard in Hong Kong in the mid-1990's. This implies the importance of technology transfer from Hong Kong for the agricultural development in Guangdong Province after the Cultural Revolution in governing the relative importance of local and mainland producers in Hong Kong food market.

Meanwhile, this is highly plausible for the 'Go North' (北上) farmers to speed up the learning progress for mainland farmers to pick up the long lost skills on growing cash crops. Unfortunately, this resulted in the crash of local food production market. As the researcher asked the farmers about their friends investing in mainland, they looked quite uncomfortable and were unwilling to provide further information. Possibly they are quite frustrated to see their friends indirectly damaged the local farming industry. In Chan's (2007) research over the agrarian movement of Hong Kong, some cooperatives bearing the title of local farmers made use of the loopholes to invest in mainland and then imported the produce from mainland China to Hong Kong. Chan (2007) criticized this practice for digressing from the core mission of the Hong Kong farmer's cooperatives, which was to support local farmers but not to facilitate investment in overseas agri-businesses which may compete with and undermine local agriculture.

5.1.3. Local production shifted to target at niche markets

When the income of local farmers plummeted under the massive food import, interviewee #16 introduced the survival strategy for some local farmers in the early 1990's:

> *"As the most popular species and varieties of vegetables such as choi sum were massively grown and imported from the mainland for fair quality and very cheap price, we can hardly survive in direct competition for cultivating similar species. Therefore, we had to instead grow varieties in vogue and of irreplaceable quality. What I had grown at the time was water spinach (通菜), which was popular in the restaurants during the summer seasons of early 90's. This vegetable is tasty, delicate and very perishable, and its freshness could hardly be preserved by the transport technology if it travels to Hong Kong from Guangdong at that time. This strategy brought me a fortune, however this ended when large tracts of my farm land were expropriated for construction of the West Rail Line in late 1990's." (Interviewee #16)*

The price he could sell for each catty of water spinach in the 1990's was HKD12, which is very high when compared to the low figure of HKD1.4 per catty for half a month in early August, 2005 (Vegetable Marketing Organization [VMO], 2008). The profitable price at that time reflects how farmers could change their crop grown to cope with the harsh competition from imported food. They could make a living by focusing on certain trendy varieties and more perishable food which the competitors could not serve. The unfortunate experience which interviewee #16 lost part of his farmland in the late 1990's revealed another significant factor on the down turn of agriculture, the availability of farm land.

5.1.4. Farm land no longer for farming

The loss of farmland was rapid in the 1970's for the development of new towns. Actually, two major driving force also took place at the same time where farmland was converted into container storage fields and New Territories Exempted Houses, more commonly known as 'Small Houses' (丁屋).

Under the policy on Small Houses that originated in 1972, all male indigenous villagers (原居民) aged 18 or above enjoy the right to build a small house on village land without the need to pay for land premiums (Lands Department, 2005). The conversion from agricultural land to residences was further accelerated after a controversial court case that was very influential towards land use policy, known as the 'Melhado Case' (生發案) (Jim, 1997). After the court case, landowners could convert farmland with loose restriction, resulting in a surge of farmland abandonment and conversion to car parks and container storages. This was regarded as the 'Melhado Fiasco' by Jim (1997: 274), when the government lost control over farmland. The consequence was so immense that even up to now, the container storages and scrapyards are still covering a significant proportion of Kam Tin, San Tin and Ping Che along the main roads.

The land use changes in Kam Tin, one of the largest farming regions of Hong Kong, is well-studied by Tang (2002). Through quantitative methodology, Tang (2002) proved that the conversion of farmland to other uses was significant in the period. The land uses like container storage and vehicle repairing centres are incompatible with farming as water pollution they produced is devastating towards agriculture.

Not only polluting the farmland nearby, the land use conversions also significantly altered the hydrology of the cultivated soils. Interviewees #17 & #20 are the farm keepers of a farm next to Luen Wo Market, Fanling. When the Luen Wo Market expanded and consumed half of the original village in the 1990's, interviewees #17 & #20 recalled that the land was covered by a thick layer of constructional materials for the foundation works of the buildings. This elevated the land by more than two meters higher than the original farmland. Consequently, the active farmland bordering the built up area suffered more severe flooding in rainstorm than the time before urban encroachment. After the completion of the 30-storeys high residential buildings nearby, the sunlight was severely blocked that some sun-loving vegetables such as choi sum could no longer grow on the farmland.

These damages to the farmland revealed how agriculture was sacrificed again after the construction of reservoirs for water supply before the 1980's. This time was

because of urban demand for housing like the Luen Wo Market, and the development of logistics industry as in Kam Tin.

5.1.5. Confrontation with environmental protection

The incompatibility of the agricultural activities with the environment greatly increased starting from the early 1970's when inorganic fertilizers and pesticides became popular. One of the first major tasks of the Environmental Protection Department (EPD) was to tackle the water pollution caused by sewage discharge from poultry and pig farms in accordance with the *Waste Disposal (Livestock Waste) Regulations* set in 1988. Septic tanks were required for the farms to treat the waste discharge before reaching the rivers. As pinpointed by interviewee #18, this greatly increased the operational cost and eliminated many small pigs and poultry farms who found it unaffordable.

Nevertheless, some large-scale farms could afford the required installations and expanded in size, taking advantage of the reduced number of competitors. To make the industry more environmentally friendly, Lam (1993) suggested a sustainable measure by making use of sawdust to compost the pig farming wastes. Unfortunately this method was not widely practiced, likely due to the decline of vegetable farming which resulted in decreased demand for organic fertilizers.

Together with the changes from small-scale pigs and poultry farms to large-scale ones, a milestone event of local agriculture took place in 1989, when the first sizable organic farm called Produce Green Hok Tau Organic Farm was established in Hong Kong. The farm was set up to promote organic farming, not using inorganic fertilizers and pesticides for the sake of human health and the ecology. After the confrontation for two decades when conventional farming became destructive to the environment, the development of organic farming began to forge local reconciliation between agriculture and environmental protection. Moreover, the farm organized some training courses on organic farming that enlightened many farmers.

However in the 1990's, conventional farming as practiced by interviewee #16, was still dominant in the local agriculture. According to interviewee #22, organic farming was not really accepted by the fulltime farmers at that time:

'The organic farming classes were popular among two groups of citizens. These were surprisingly the teachers and the middle class who wanted to learn how to farm in their backyards after migrating to Canada. Conventional farmers rarely took the course and we admitted that what we taught (them at that time) was inadequate for equipping a fulltime farmer (to make a living). The conventional farmers would ask the official organizations and departments for practical measures on being organic, so as to help them sell the organic produce.' (Interviewee #22)

This reflected that the cooperation of green groups and agricultural practitioners was not yet successful under the development of organic farming, especially when the market was too small for the farmers to survive. The organic market was finally initiated a decade later in the new millennium, when concrete cases of cooperation between farmers and environmental conservationists took place of larger scale.

5.1.6. The halt of seed saving when farmers left farming

Late 1980's was a hard time for vegetable farming, when the market was crashed by mainland import. Almost all interviewees who farmed for more than 20 years stopped full-time farming and decided to work in factories for a living in the period. Even interviewee #16 who could survive in the early 1990's was a part-time renovation worker in the late 1980's. The only exception was interviewee #24, who moved to farm in the very remote Ping Che with his wife, after being tired of the repetitive work, narrow space and less freedom as a factory worker. While other farmers were struggling in sustaining income from farming, he chose to spend less by simplistic living with his wife and enjoyed as long as he could continue to farm.

The consequences of farmers leaving agriculture were discussed at a meeting about organic seed-saving on 8 March 2011. Seed-saving is a critical practice for traditional farming where the farmers can select the varieties with better performance for plantation in the next season. Without this practice, the farmers lose the control over the genes of the seeds as they have to purchase seeds from retailers without knowing exactly the attributes of the variety. Interviewee #17 reaffirmed this in a powerful statement on the meeting:

'Only farmer saving seeds themselves can be regarded as a genuine farmer!' (Interviewee #17)

As suggested by interviewee #18, the saved seeds have limited shelf lives of mostly around 2 to 3 years. The years during the departure of farmers were a fundamental obstacle to seed-saving that many famous brands of varieties were lost in this period. The quality, the taste, the fans, and the memories built up from the decades of Hong Kong citizens enjoying local varieties faded away inevitably. Falling into the 'food from nowhere' characteristic of the Third Food Regime (Campbell, 2009), local agriculture lost its major advantage over the competitors. This further aggravated the demise of local agriculture, as the difference of the quality of produce between those from the mainland and Hong Kong narrowed.

5.2. Diminishing functions of local agriculture

5.2.1. Environmental functions

The industrialized production method of pigs and poultry farming resulted in severe pollution when the vegetable farming shrunk and no longer used farm manure as fertilizers. The weakness on environmental function could not yet be rectified by the more eco-friendly organic farming which was practiced mainly in small scale. The environmental function of local agriculture is considerably low in this period.

5.2.2. Economic functions

The economic function was obviously weakening. Local vegetable farming suffered a hard hit when the market share of major cash crop (e.g. choi sum and pak choi) was dominated by the mainland China. Local farmers could only grow more perishable and 'trendy' crops to survive by targeting at niche market. The collapse of the production value of fish pond farming was delayed by the higher technological requirement of the industry, and local practitioners maintained the upper hand until the mid-1990's. Contrasting with the golden years in the 1970's, the economic value and function of this period of time was much inferior.

The hardship of local farming resulted in further loss of farmland when the economic return from residential development and container storage was much higher than

farming. Vast area of farm land was abandoned, and even concretized. This further limited the scale of local production and thus weakening the economic functions.

5.2.3. Social functions

With regards to the social functions, local agriculture no longer played a crucial role in local food security as there was a cheaper and stable alternative, i.e. imports from mainland China. The villagers needed not to rely on farming to make a living, since even the under-privileged population was protected by the improved social security system. It was not an appealing policy to providing the underprivileged a piece of farmland and encouraging them to enter the sunset industry.

Moreover, the cultural importance of farming to Hong Kong reached a minimum, when the livelihood of Hong Kong citizens became very detached from farming. The urban citizens would appreciate spending a weekend in the country parks more than walking along the messy abandoned fields. Even with neat rows of fresh vegetables, it would not be a pleasure to see the old farmers spraying pesticides with pungent smell. This phenomenon echoes with the findings from Lowe *et al.* (1993) where they reported that urban-rural migrants (i.e. urban dweller migrating into suburb communities) were discontented with agricultural practices in the neighbourhood.

The education on agriculture and food was very limited for the generation spending their childhood in the 1990's. In the primary school education, there was little chance to get to know how to grow food, whereas gardening for flowers in pots was introduced depending on the hobby of the teacher. In junior formal education, the most common words on local farmland was something like 'Hong Kong has very scarce land resource with massive population', 'Farming in Hong Kong is already a sunset industry'. This contrasts with the experience of the elder generations where a farmer from Choi Yuen Tsuen shared her childhood experience in the 70's: basic farming skills were taught in the primary school at the time that the kids could assist their family for farming. For the 'post-80's'[2], the chance to even see how a head of choi sum is grown from soil was minimal.

[2] 'Post-80's' (八十後) is a popular word used on calling the generation born in 1980's.

To summarize, during the 1980s, Hong Kong people witnessed the rapid collapse of local agriculture. The multiple functions became weak on all the social, environmental and economic aspects, particularly when agriculture was detached from urban living.

5.3. The dawn of multifunctional urban agriculture: From late 1990's to now

The beginning of this period is certainly at the low ebb of agricultural development, especially in term of economic significance. As the current and future potential functions will be further assessed in Chapter 6, this section will focus on the major incidents affecting local agriculture.

5.3.1. Further decline of productivist agriculture for public health concern

Sustaining the trend since the last period, when poultry and pig farming was discouraged as a result of environmental concern, the agricultural sector further collapsed under successive outbreaks of diseases. Regarding the experience of interviewee #8 who used to operate a pig farm before transforming into an orchard, animal diseases have never been away from animal farming under the hot and humid climate of Hong Kong. However, in the new period of agricultural evolution, the government's response was very different from before with respect to the emphasis on public health.

During the outbreak of avian flu on several occasions after the handover of Hong Kong in 1997, the government took prompt action in exterminating all chickens available in the market and inside the farms. The very first incident took place during 1997 and 1998, with a death toll of five Hong Kong citizens and 1.5 million birds in Hong Kong (AFCD, 1998). Unfortunately, the threat of a potential plague did not disappear. In 2001, fresh poultry market was halted for a month to stop the disease from spreading. This resulted in some mature chickens in the farms to be killed as well when they could not be sold. This resulted in the death of almost 951,500 chickens (AFCD, 2002). Consequently, the government proposed a buyout scheme for poultry and pig farms in which farmers were asked to give up their farming licenses in return for monetary compensation.

With reference to the population of chicken in Hong Kong (Fig. 5.1.), the impact of episodes of territory-wide poultry slaughtering did not suppress the poultry industry, which immediately resumed its pre-outbreak production level. This is possibly due to the high market demand for fresh poultry products by the Hong Kong citizens (Liu, 2008). However, the buyout of farming licenses has created substantial impact on the industry – as the number of farms reduced, the annual production of chickens in Hong Kong has gradually dropped to about one third of its peak level in 2006. At the same time, keeping backyard poultry, a common practice of farm and villages, was prohibited in 2006. The severe consequence upon the multifunctionality of urban farms in Hong Kong will be discussed in the next chapter.

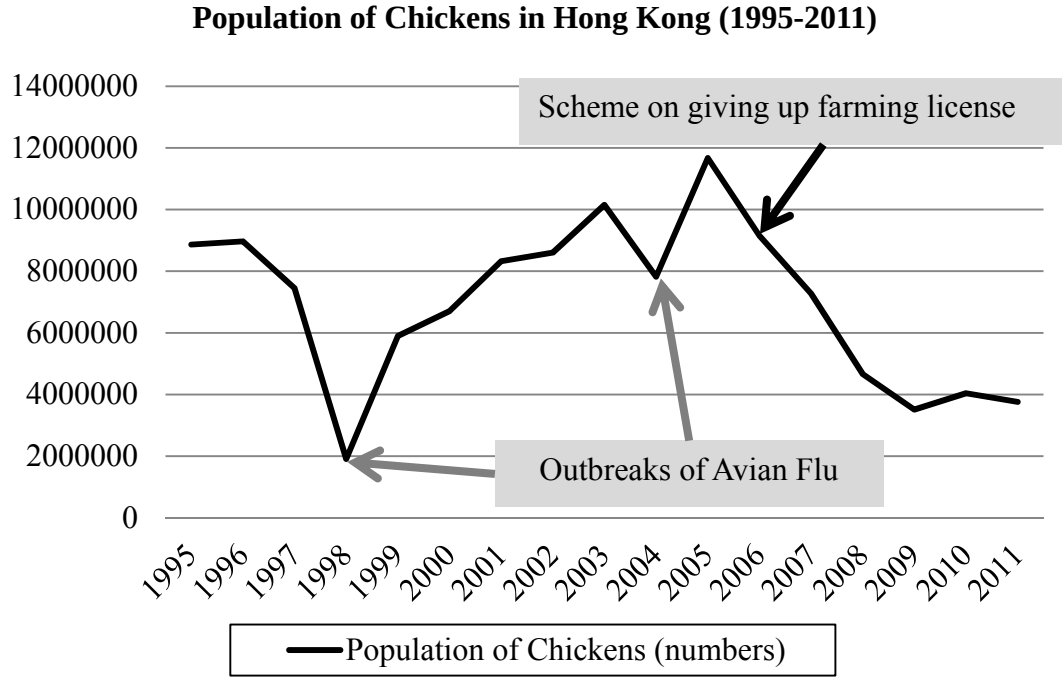


Figure 5.1. Population of chickens in Hong Kong from 1995 to 2011 (Data source: AFCD)

These measures and reactions clearly contrast with the scene in the 1960's, during which hygiene was put at much lower level than food security as discussed in Section 4.2.1. This is understandable as concern on public hygiene rises alongside with urbanization (Vlahov and Galea, 2002). The functions of poultry and pig farming diminished in Hong Kong when the government decided to depend on imported food to meet local demand since the mid-1980's. When the social importance of the agricultural sector declines, it is reasonable for the policy makers

adopted a 'zero-tolerance' approach on avian flu whereby the potentially infected chickens have to be executed for the sake of losing large quantity of food.

Putting the administrative and urban development factors aside, the change of policy was likely influenced by an epochal incident in 2003 – the SARS Outbreak. The outbreak of SARS caused devastating effect on the local economy (Siu & Wong, 2004), for example, the visit of tourists halved for a few months, and 50 restaurants were temporarily closed because Hong Kong citizens were afraid to stay on the street for the risk of being infected. Schools were suspended and everyone had to wear a mask on the street. This probably brought about the change in mindset leading the citizens to support the government's action on reducing the size of poultry farming.

Together with the shrinkage of poultry farming, centralized slaughtering of chickens was once proposed for further minimizing the spread of avian flu[3]. However, the action was debatable because of the cultural emphasis on the freshness of food. This plan was finally on halt but the buyout scheme as well as the prohibition of household poultry rearing continued. It was an inconsistent policy to suppress the food production sector but allowing customers to contact live poultry in the market. Chan (2010) even criticized on the action as sacrificing the potential of urban agriculture for the convenience of bureaucrats.

Analyzing these incidents, it is clear that the concern of public health in urbanized area seems to be incompatible with the urban agriculture in Hong Kong. However, it applied mainly on industrialized, productivist agriculture where chickens and pigs were kept in high density. The situation of other facets of local agriculture in Hong Kong is another story.

5.3.2. Development of organic food production

Ironically, the rising concern on health is also an opportunity to the farming sector through stimulating the development of organic farming. Organic farming gains its reputation among the health-conscious population for it minimizes the risk of food poisoning and thus promoting food safety. Another important benefit from

[3] Discussion over the central slaughtering the Legislative Council on 4 June 2004 can be assessed from: http://www.legco.gov.hk/yr03-04/english/panels/fseh/minutes/fs040604.pdf

prohibiting inorganic pesticides and other harmful substances is the promotion environmental ethics and the enhancement on biodiversity of farmland. After a decade of promotion and education by the green groups, notably the Produce Green Foundation, another organization focusing on organic farming was founded in 1999, namely Hong Kong Organic Farming Association (HOFA)[4]. Cheng (2009) studied the development of the community and the market for organic vegetables in detail, witnessing high integration of UA with the surrounding communities.

The organizations were devoted not only to educating the farmers, but also the customers. To secure the sales channels for new produce, conventional farmers would cooperate with the officials more than with the green groups for more practical recommendations. In response to the increasing demand for local organic food, the AFCD started the scheme on supporting organic farming by means of technical support. An AFCD officer (Interviewee #10) who took charge of promoting organic farming methods to farmers from 1999 recalled that his duty was no easy task, as some of the farmers were not willing to change their habits or reaction when pests appear. He had to inspect whether the farmers had cheated them by secretly spraying inorganic pesticides for convenience or reducing expenditure. Frequent inspection was required for ensuring the integrity of farmers, an essence repeatedly emphasized by interviewee #10 to be one of the keys to the development of organic farming. This was further safeguarded by the establishment of quantitative standards over organic food in 2004 by a certifying organizations, the Hong Kong Organic Resource Centre.

Under the concerted effort from the government and the NGOs, the number of organic farms grew from around 10 in the late-1990's to about 451 in 2012 (AFCD, 2013c). However the official data on value and sales of local organic vegetables is not available up to now, which hinders us from holistically evaluating the magnitude of the function served to Hong Kong.

According to the observation by the author among the low-income neighbourhood, the average price for certified organic food is rather high for most families in Hong

[4] The organization is currently renamed as Sustainable Ecological Ethical Development Foundation (SEED).

Kong. This is particularly obvious when the certified organic vegetables such as choi sum is sold at about HKD 30 to HKD 40 per catty, but the conventional imported one from mainland costs less than HKD 10 per catty. Due to the high price difference, it is inevitable for the market to lean towards the middle to high class customers. This limits the potential contribution of organic farming to improve the livelihood of the underprivileged sector, which is rather different from the function in the 1950's to 1960's.

Despite the relatively high price of organic food, the affordable citizens are very willing to purchase local produce under the fear on food safety from mainland food imports. Most of the interviewees concur with the findings from Cheng (2009) where the distrust is intense from the bottom of Hong Kong customers' hearts. The peculiar relationship between the food safety in mainland and Hong Kong will be further discussed in the Chapter Six.

5.3.3. Emergence of leisure farming

Another irony which we can observe during this period is how the expansion of urban living has eventually promoted, rather than undermined, agriculture, through stimulating the growth of leisure farming. The definition of leisure farming is rather diverse in the context of Hong Kong, including hobby farming, educational farming, farming experience such as fruit-picking, and workshops. It is more appropriate to understand it as the income and structural diversification of farm, where the farms not only invest on fertilizers for production, but also designate areas for gathering visitors. In return they earn not only from selling produce but also from farm tours or other on-farm activities. This is considered as a phenomenon when the farm steps from weak multifunctionality to a moderate one (Wilson, G.A., 2007).

According to interviewee #22, there are more and more urban dwellers wishing to enjoy an alternative lifestyle as hobby farmers by renting a small lot in one of the farms in the New Territories. They would only visit their lots during holidays and weekends and the daily caretaking of their produce is performed by full-time farmers on their respective farms, who earn additional charges on top of simply land rent. Some other urban dwellers would even engage in part-time farming to participate in more physically demanding farm work as well. Urban dwellers may participate

farming in different levels with respect to the lifestyle they wish to enjoy, and one example is a farm in Hok Tau, Fanling. The farmer switched from full-time designer to part-time basis and spent most of his time in the fields.

Cheng (2009:7) described this phenomenon on newcomers into agriculture as "their ways to find happiness, love and enjoyment apart from the money-oriented life goal". This trend manifested itself after the financial crisis in 1998 when Hong Kong citizens started to pursue goals in life other than simply earning more money. This is further enriched by the experience of operating one of the oldest educational farms in Hong Kong by interviewee #22:

> *'The SARS Outbreak in 2003 was a turning point for the local agriculture in Hong Kong. The unbearable atmosphere under the phobia of infection pushed people out of the urban areas. They could only take away their masks in the green space instead of the suffocating concrete forest. The number of visitors to our farm actually doubled during the period of outbreak. Especially for students, they were amazed by how food is grown in harmony with the nature.' (Interviewee #22)*

The above quote reflects how the farmland attracted the urban population at the time, especially farms with adequate facilities for visitors to participate in farm work or possessing rich agricultural knowledge to share.

Apart from the SARS Outbreak which changed the urban dwellers' perception towards farming, the introduction of new species also promoted leisure farming, Under the introduction of localized variety of strawberry at around 2004, many local farms changed to grow strawberry and provided self-picking service (interviewee #10). By providing the harvesting experience with entrance fee, the farmer could earn more than simply selling the produce with comparatively low wholesale price. This became very popular as many strawberry farms appeared all over the New Territories in the late 2000's. In the guidebook on leisure farming in 2013, out of the 120 registered leisure farms, 94 (78.3%) of them provide self-picking services[5]. This

[5] A search engine for leisure farms is provided by the Federation of Vegetable Marketing Co-operative Societies, Ltd.: http://www.fedvmcs.org/farm_list.php

is reasonable as self-picking is one form of structural diversification which demands for least capital and space. Only trays, cleaner lanes and simple guidance are required for this practice, while others require vast space and investment to install equipment.

5.3.4. The rise of intra-urban agriculture

For most of the farming activities mentioned above, they took place in the surroundings of the urban area, acting as facets of peri-urban agriculture. While previous development and transition mostly took place in rural or peri-urban area, farming activities emerged inside the urban environment in this period, taking the form of community gardens, with different purposes and target population groups.

A major type of community gardens is those in private housing estates. As one of the pioneers in promoting it in Hong Kong (interviewee #23) highlighted, the major goals of community garden are food education and community solidarity. The 'gardeners' are mostly housewives and retired elderly people, who often bring kids with them during the holidays, while youngsters are rare visitors to the gardens.

Apart from the bottom-up effort from the public, the government also promoted UA at the same time. Each of the 18 districts in Hong Kong has at least one public community garden operated by the government or green groups, comprising of 21 gardens in total[6]. According to information gathered from conversation with a participant of farming class, the programmes for public community gardens are so popular that the quota of application of each phase per four months is fulfilled within 15 minutes. In the community gardens operated by the government, the participants are satisfied with their farming experience in the gardens, notably due to the hands-on knowledge they have gained about food production and environmental protection (Yu, 2012).

While the community gardens mentioned above are located in the empty lots of the urban area, some are looking for above-ground farming opportunities. In the early 2010's, some city farmers began experimenting rooftop farming in the city's urban

[6] Locations of the 21 community gardens are listed in http://www.lcsd.gov.hk/green/garden/en/loc.html

area. The Eco-MaMa farm in Quarry Bay is a notable pioneer in holding regular farming classes to attract the families from the eastern Hong Kong Island to the rooftop of an industrial building (Eco-MaMa, 2012). On the other side of the Victoria Harbour, an urban farming campaign called Project GROW took place above the Film Culture Centre in To Kwa Wan. A spectacular blend of movie sharing, guided farm tour and cookery workshops took place all within an industrial building (Film Culture Centre, Hong Kong, 2013), a sharp contrast with the shabby perception of the general public in Hong Kong about city's industrial areas.

Moreover, there is crossover between industries under the setting of urban agriculture. On the top of a cafe in Wan Chai, the chef was also the farmer growing vegetables such as salad rocket, or *Eruca sativa* (火箭菜), at the rooftop of the tenement house (SLOW Experience, 2012). Other than vegetable farming, there is a bold attempt in the industrial estate of Ngau Tau Kok. HK Honey successfully established a bee farm on the rooftop of its industrial complex making use of the urban flora, such as the flowers in urban parks and road side plantations, supplemented with fruiting vegetables grown nearby (HK Honey, 2013). The harvested bee hives are further processed into bee wax candles, and workshops are organized for teaching the craftsmanship to participants. The functions served and the interaction with the urban environment will be further studied in Chapter Six.

5.3.5. Strengthened cooperation with green movements

The UA in Hong Kong were playing a greater role in promoting sustainable livelihood with their effort in ecological conservation, besides experimenting organic food production.

Long Valley, a site of long farming history in Hong Kong, was not yet the concern of environmental protection before 2000. The place quickly became the hotspot for green groups when the proposed route of Lok Ma Chau Spur Line threatened the local wildlife in Long Valley (Ho, 2010). The successful campaign by green groups not only protects the birds and other faunas in the area, but shed lights on the possibilities on how farm land can be a place for ecological conservation as well. The government supported the campaign by introducing Management Agreement to the area, where green groups received certain funding for projects involving the local

communities to live in harmony with the wildlife (Ho, 2010). The 'Action Model on Sustainable Development in Long Valley' was a comprehensive campaign starting from 2005. Activities included ecological rehabilitation, modification of agricultural practices, historical conservation and educational activities (Conservancy Association, undated-a). The campaign is considered as successful by Ho (2010) for linking up the local communities to ecological conversation and to appreciate the historical value of their livelihood.

The success is achieved by the availability of farmland which presents a venue of human-nature interaction, as well as the farming activities which are most vital in keeping the campaign moving. The Long Valley Eco-paddy Club was launched in 2011, so as to sustain the paddy rice farming by the concerted efforts from experienced village farmers and volunteers. Families and individuals are encouraged to join the scheme with certain membership fee. Thereafter, the club members could join a series of farm work such as plantation of rice seedlings, receive an amount of the rice after harvesting, as well as harvesting festivals of water chestnuts and arrowheads (Conservancy Association, undated-b). This is a mixture of leisure farming and community supported agriculture which the potentials of peri-urban agriculture in Hong Kong can be discovered.

Green movement cooperated with UA again in a fish-farming area under the threat of real estate development. On the fishponds and reed beds in Nam Sang Wai, 500 citizens were provoked to protect the farming landscape from the threat of large scale private residential development on 12 December 2010 (Apple Daily, 2010). A key campaigner (interviewee #4) mentioned that Nam Sang Wai is a place signifying the collective memory of Hong Kong citizens about fishponds since 1960's, and also a biodiversity hotspot for bird watching. The synergies between fish farming, ecological conservation and tourism could be destroyed when the landlord turn the area into private housing estate. The campaign is still on-going with thousands of citizens trying to preserve the current situation of harmony and public usage. This incident earmarked how environmental protection was further connected to social movement for protecting the peri-urban farmland from residential development in Hong Kong.

5.3.6. Agricultural livelihood under spotlight again

While the SARS Outbreak in 2003 revived primitive attention among the Hong Kong public about local farming, it was however not until the 'Choi Yuen Tsuen (菜園村) incident' in 2008 which drew people across the territory into serious reconsideration of the livelihood of local farmers and, perhaps more importantly, the future of local agriculture. The Choi Yuen Tsuen incident began as a series of demonstrations for more democratic planning of the construction of the Express Rail Link, which would run through Choi Yuen Tsuen, a village whose majority of inhabitants made a living on their farming practices (Ip, 2011). The villagers insisted not moving away even with compensation by the government. Unfortunately, the construction continued at last that the villagers had to rebuild their village elsewhere, so as to continue their way of living which is irreplaceable by urban settlement.

The Choi Yuen Tsuen Livelihood Place (菜園村生活館) has been seeking for other ways of sustainable living. Lo (2012) studied that Lifestyle Movement is where some youngsters were living as Half-Farmer-Half-X (半農半 X). They make a living as part-time farmers and created community economy by means of community supported agriculture (CSA), in the meantime having other part-time jobs. This can be an extension to the organic movement in the early 2000's and deepened the movement further towards social dimensions.

Another threat of development devouring much larger scale of farmland and population heated up at the end of 2000's, namely The Northeast New Territories New Development Areas (NENTNDA). The development covers three regions; they are Kwu Tung North, Fanling North and Ping Che/ Ta Ku Ling (Arup, 2012). According to the joint-statement by several local green groups and farms[7], 98 hectares of farmland will be lost from the development, accounting for 13.35% of the active farmland (734 hectares excluding fish ponds as in 2011). The organizations affirmed the multiple functions served by agriculture in Hong Kong, urged to stop further urban encroachment over farmland and demanded for more holistic agricultural policy by the government. To review from the past, this joint-action

[7] Joint statement available in *http://www.greeners-action.org/gsc/public/others/20120816_Mapopo_nentnda/20120816_MaPoPo_nentnda_statement.pdf*

between the green groups and farmers is probably the most substantial round of cooperation between agriculture and environmental protection in Hong Kong after the years of conflict from the 1980's to 1990's.

There was also a special farm established to demonstrate another option of development proposal besides the government-led one. In one of the affected areas, Fanling North, Mapopo Community Farm (馬寶寶社區農場) situates right over the boundary between the urban area of Luen Wo Market (聯和墟) and the village of Ma Shi Po (馬屎埔) (Fig.5.2.). The farm explores the possibilities of interactions between the urban and rural livelihood. Farming classes, farmer's market, cookery workshops, and guided tours are held for linking up the local community with the farmers (Mapopo Community Farm, 2013). Moreover, they collect the kitchen waste from the restaurants in the Luen Wo Market for making compost as fertilizers.

Figure 5.2. The Ma Shi Po Village situates right next to the urban fringe

5.3.7. The transformation to multifunctional agriculture

As mentioned in Sections from 5.3.1. to 5.3.6., the productivist way of farming no longer suits the development of Hong Kong. The shrinkage of poultry and pig

farming, and the growth of organic food production is solid evidence on how food safety and public health is emphasized by the policy-makers and the general public. The rise of leisure farming presents how the farms are seeking sources of income other than simply food production. Diversification of structure and income is required for the peri-urban farms to meet with the need of urban citizens. The emergence of intra-urban farms further reflects the demand for farming experience and food education via the community gardens in residential area and schools.

Obviously, the agriculture is becoming more multifunctional with tightening relationship to the urban development of Hong Kong. The series of incidents and movement of local agriculture is still on-going and of growing intensity towards the beginning of 2010's. There are more attempts on testifying how agriculture can fit in the local context and contribute to more sustainable living of Hong Kong citizens.

5.4. Chapter summary

This chapter elaborated the major changes of local agriculture in three recent decades. The contribution of local agriculture towards the urbanities of Hong Kong has been declining when the majority of food demand was satisfied by massive import of cheap price. Together with the intensifying conflict with the mindset of environmental protection propagated from the 1980's, local agriculture was diminished by the loss of farmers and farmland. One fundamental change was the introduction of organic farming in the late 1980's, however it was not yet up to scale until the early 2000's.

Stepping into the fourth period from later 1990's to early 2010's, the productivist farming types such as chicken farms were further suppressed by the avian flu under the rising concern on public health. However, the outbreak of SARS also promoted leisure farming by pushing the urban citizens to explore the agricultural landscape and farm activities. There are more intra-urban farms such as rooftop gardens sprouting in the compacted urban environment. Particularly on ecological conservation, agriculture joined hands with environmental protection after the decades of confrontation where the farmland can also be a paradise for wildlife. The land use conflicts in Choi Yuen Tsuen and NENTNDA had brought the farming lifestyle back to the public eyes after the broken connection since the mid-1980's.

The new farms no longer cultivate in productivist methods that different farm activities are performed, one notable example is the composting of food waste collected from the neighbourhood.

Under the growing interaction of local agriculture with the urban livelihood, the farms are becoming more multifunctional. The multifunctionality will be assessed in the next chapter.

Chapter Six: Exploring potential functions of urban agriculture

The previous chapters provided a better understanding on the unique context of agriculture in Hong Kong through the changes over the six decades after the WWII as well as the factors underlying the evolution. This chapter will first analyze the current state of agriculture, and then explore the potential functions for recommending suitable directions on future development of UA.

6.1. Current situation of local agriculture

This section first analyzes the current situation of agriculture in Hong Kong by geographical attributes including the spatial distribution as well as the number and size of farms. Then the demography of agriculture is analyzed in terms of gender and age of farmers, followed by a classification of vegetable farmers. Finally the operation of farms is investigated by the land ownership, sales channels, sources of income and biodiversity in the farms.

6.1.1. Farming in Hong Kong: a geographical profile

Spatial distribution of farms

The distribution patterns of the vegetable farms in Hong Kong are captured in an annotated map provided by the AFCD and VMO in Fig. 6.1.. These farms spread over mostly in the northeastern, northern and northwestern part of the New Territories. Major farming regions are indicated by where most concentrated dots can be found. There are Fanling, Kam Tin, Pat Heung, Ping Che and Sheung Shui. The spatial pattern is quite similar to the major farming regions in the past. The dots in different colours represent three types of registration system on the vegetable farms in Hong Kong as at 30 Sep 2011. The yellow dots are the 163 farms practicing the organic methods under the organic certification system, and received the technical support from the official departments. In blue dots are the 245 accredited farms which practice conventional farming but at the same time reduce the input of chemical pesticides to minimize the potential threat to human health. The red dots are the farms registered with the government, and are neither under any certification or accreditation related to organic farming practices.

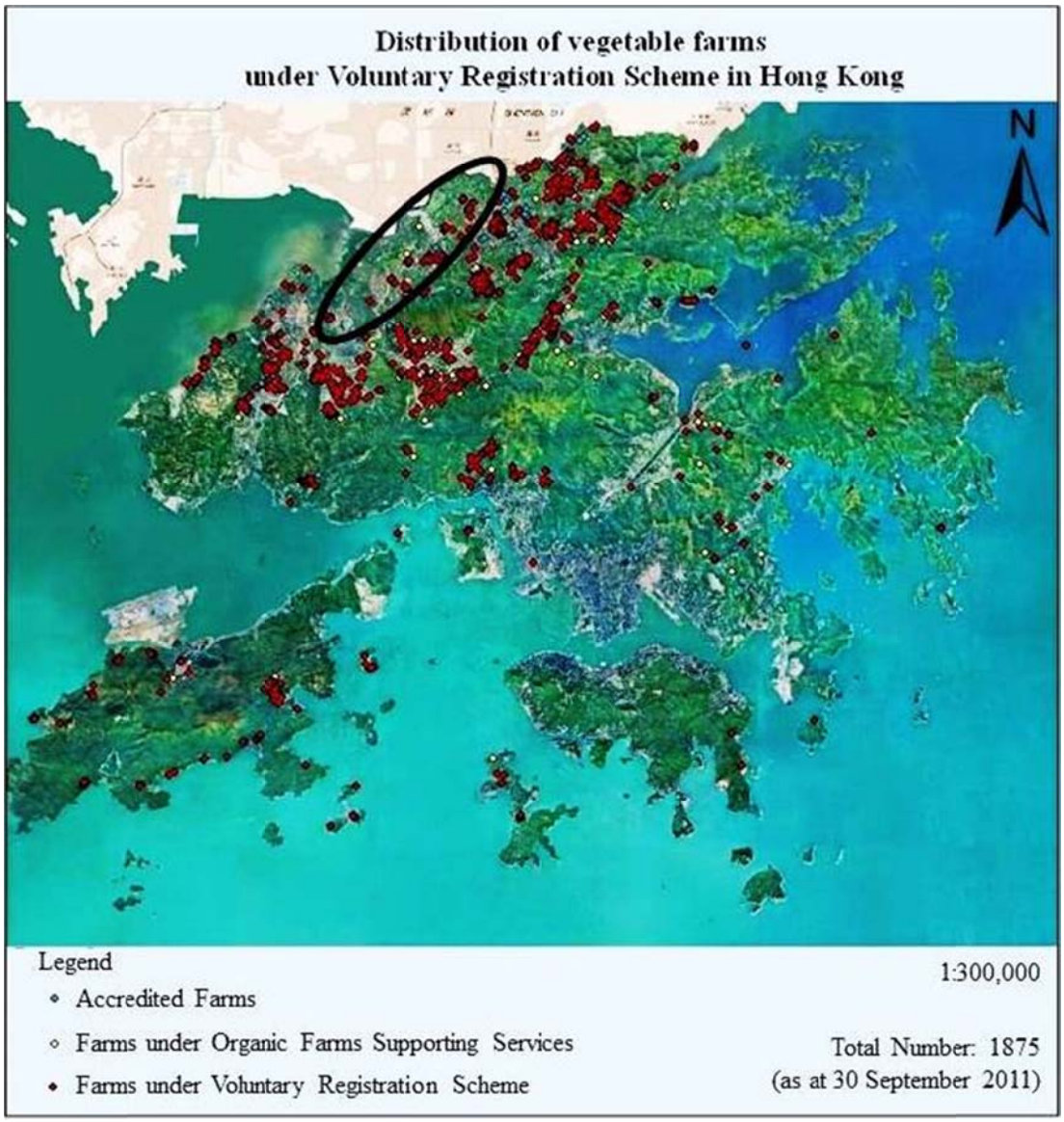


Figure 6.1. Distribution of vegetable farms as at 30 September 2011 (Modified from: AFCD and VMO)

The black oval in Fig. 6.1. covers the region of most fish ponds in Hong Kong, including sites such as San Tin (新田), Mai Po (米埔), Fung Lok Wai (豐樂圍) and Nam Sang Wai (南生圍). Other than these two types of farming, there are also orchards, flower farms, Chinese herbal medicine farms, chicken farms, pig farms, and bee farms scattered over the New Territories.

On the poultry and pigs farms in Hong Kong, there are 43 pig farms and 30 poultry farms from 2009 to 2012 as provided by the AFCD. There are several clusters of their locations, such as Shap Pat Heung (十八鄉) in Southern Yuen Long, Kam Tin, the Southern part of San Tin (新田) and Ta Kwu Ling (打鼓嶺). The locations are

quite similar to the distribution of vegetables, which can be the result of the requirement of being close to water bodies for cleaning and feeding of the animals. Meanwhile, water is also essential for irrigating vegetables. However when comparing with vegetable farms, they are much further away from any town centres in the New Territories. This is likely because of the risk of avian flu and swine flu that is not compatible with living environment of higher density which facilitates the spread of diseases.

Apart from the farms in peri-urban region as shown in Fig. 6.1, there are also farms in the intra-urban areas such as school farms, community gardens as well as rooftop farms. However, exact locations of the intra-urban farms are not available. Roughly speaking, the number of school garden and community gardens are much larger in quantity than rooftop farms, where the rooftops in crowded urban areas have only been utilized since the late 2000's. Meanwhile, as mentioned previously, the community gardens in private housing estates started in early 2000's, followed by the community gardens managed by the government in the 18 districts of Hong Kong.

Number and size of farms

According to the information provided on 31 October 2011, there are 1,879 registered farms in total. To judge what size of farm is large or small, interviewee #18 agrees on the classification, according to his breadth of knowledge of the general operation of farms in Hong Kong:

i. Farm size below 2 d.c.[8] (or 0.135 ha) is small,
ii. between 2.01 d.c. to 5 d.c. (0.135 ha to 0.337 ha) is medium, and
iii. above 5.01 d.c. (or 0.337 ha) is large.

This is classified under the characteristics of farming practice in Hong Kong as low mechanization that an ordinary farmer can take care of a relatively small area.

The proportions of different farm sizes are illustrated in Fig. 6.2.. The majority of the farms are of small size (54%). A farm too small in size is hardly able to sustain full-time farming, as the profit from selling produce is limited. This implies most of the

[8] Dau Chung (斗種, abbreviated as d.c.) is a traditional unit for measuring the size of farm in Hong Kong, where 1 d.c. equals to 7,260 sq. ft. or 0.0674 ha.

farms are cultivated not for commercial use or the farmer has other sources of income. Moreover, the shrinkage in farming labour due to ageing of farmers is also a plausible reason. The actual situation of the age of farmer will be discussed in latter sections.

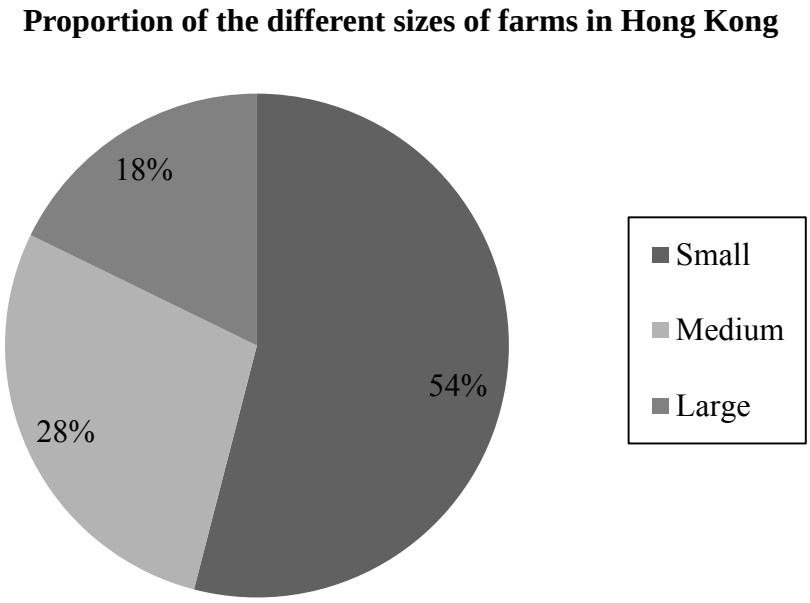


Figure 6.2. Proportions of the different sizes of farms in Hong Kong

6.1.2. Demographic information of agriculture

Gender and age of the farmers

Among the 1,511 registered farmers who reported their age as at 31 October, 2011, over half of them (923 out of 1,511) are already beyond 60 years old. As shown in Figure 6.3., only 3% of the farmers are below 40 years old, and 39% of them are between 41 to 60 years old.

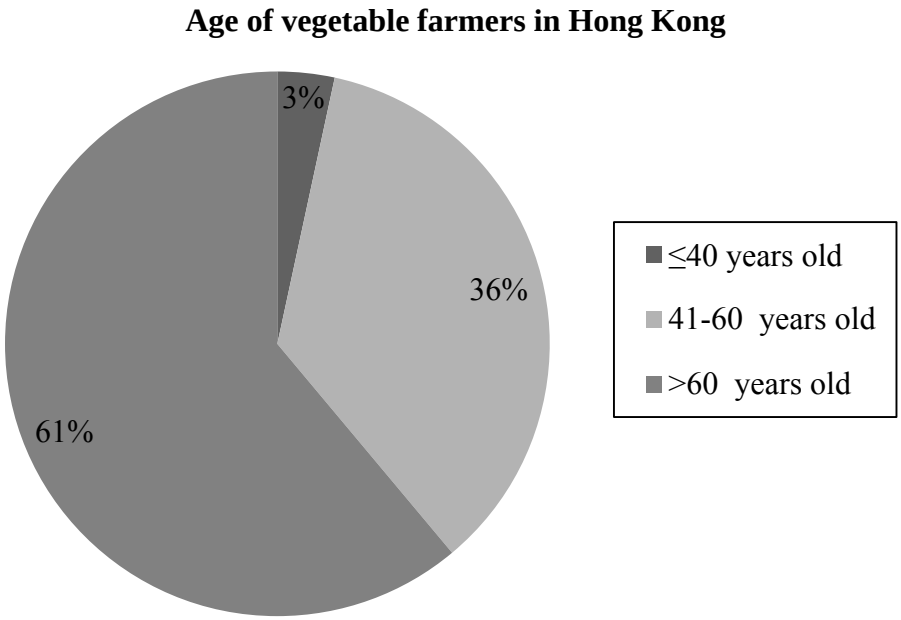
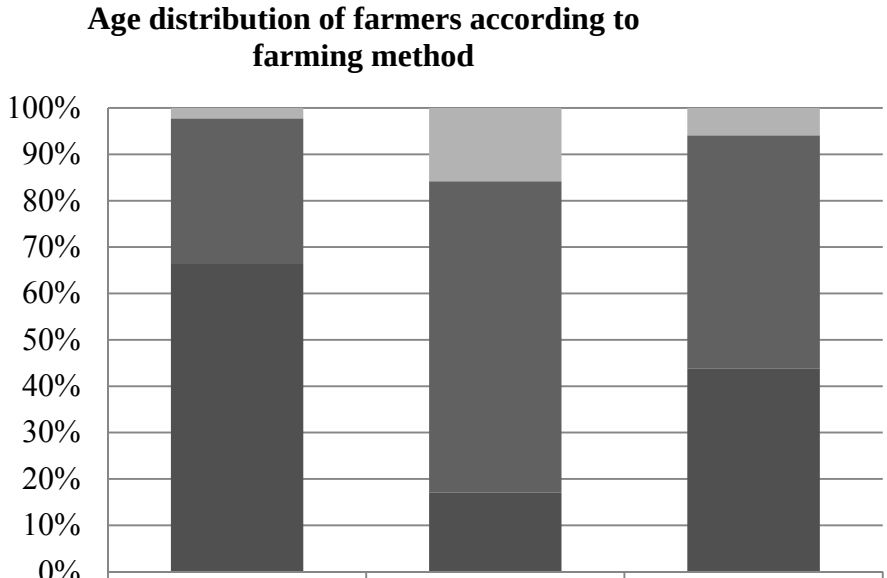


Figure 6.3. Age of vegetable farmers in Hong Kong as in 31 October, 2011

This reveals a severe ageing problem of agriculture in Hong Kong especially when the ratio of the younger generation (≤40 years old) to the older (>60 years old) is less than 1:18. The industry will seriously shrink when the older generation becomes too old to carry on farming.

Some interesting trends are also observed when one looks into the age distribution of farmers in the following three types of farms:

i. The traditional farms, including the accredited farms and other conventional farms;
ii. Self-claimed organic farms; and
iii. Farms under the Organic Farm Support Scheme (OFSS) which aim to acquire certification on organic farming.



	Traditonal Farm	Farm Under OFSS	Self-claimed Organic
≤40 years old	28	12	11
41-60 years old	392	51	94
>60 years old	828	13	82

Figure 6.4. Age distribution of farmers according to farming method

As shown in Fig.6.4., the majority of the farms in operation in Hong Kong are traditional farms, most of which are cultivated by old farmers aged beyond 60 years old. The proportion of middle-aged (41-60 years old) and young (≤40 years old) farmers are higher for self-claimed organic, and especially farms under the OFSS. This indicates that younger farmers are more interested in organic farming, while the older generation of farmers continue to employ conventional methods which they have been using since the popularization of inorganic fertilizers in the early 1970's.

The ageing problem of farmers also exists among the pigs and poultry farms. According to the data provided by the AFCD as at 31 October 2011, the average age of pig farmers is 56 years old, and that for chicken farmers is 57 years old in 2011. This is likely the result of voluntary surrender scheme for pig farmers proposed by the government since 2006 and the government's refusal to issue new licenses up to present.

Classifying the vegetable farmers

According to the observation by the researcher, vegetable farmers in Hong Kong can basically be classified into three types as listed in Table 6.1.. The classification is not rigid with some exceptions, but the types represent the majority of the different groups of farmers.

Table 6.1. Types of farmers of Hong Kong

Types of farmers	A	B	C
Age	>60	41-60	≤40
Farming method	Conventional	Certified organic	Permaculture/ Organic
Time spent on farming	Full-time	Full-time to part-time	Mostly part-time
Main language spoken	Dialects such as Hakka and Chaozhou	Cantonese	Cantonese
Willingness to talk to strangers	Low	Moderate	Moderately high
Way of learning farming techniques	Learnt from family in Hong Kong or Guangdong	Learnt from family in Hong Kong	Attended farming classes
Education	Primary to secondary level	Secondary schools to bachelor degree	Bachelor degrees or higher

Type A represents the elder farmers, who have been farming for many years since they or their parents moved to Hong Kong in the post-war period. They mostly came from different regions in Guangdong Province. One notable example is an area

known as Nan Pan Shun (南番順), which is the combination of three regions, Nanhai (南海), Panyu (番禺) and Shunde (順德) next to the city Foshan (佛山). Some of them speak Cantonese, but with accents different from what is spoken in Hong Kong. Some other old farmers coming from Chaozhou (潮州) or Fujian Province cannot speak Cantonese. Even for the indigenous inhabitants who came to Hong Kong before 1898, the older generation does not speak Cantonese. Hakka (客家) farmers speak the Hakka dialect (客家話) and Punti (本地) farmers speak the Wai Tau dialect (圍頭話). This created a language barrier for them to communicate with ordinary Hong Kong citizens who do not know how to speak regional dialects besides Cantonese. This is likely a reason for most of the old farmers in Type A to be reluctant to speak to strangers and did not welcome the author for interview. Moreover, as an Chinese saying goes, "farmers communicate with the nature more than the people." This may be another reason for them to be relatively introversive and less talkative than other types of farmers.

Type A farmers still rely on conventional input such as inorganic fertilizers, and their practice is predominantly labour intensive due to the low level of mechanization. They farm for a living and the area they occupy reduces when the farmers become too old and less capable to manage large fields.

Type B farmers are mostly the offspring of the generation of Type A. Many of them assisted farm work in family during childhood, but went to downtown for work after attaining higher education levels than their parents. Some returned to farmland in the 1990's, and in larger numbers in 2000's with certain amount of savings. After learning more about organic farming through the farming classes by the NGOs, they invested in the infrastructures such as greenhouses to build the organic farms.

Besides being full-time farmers, some of the Type B farmers continued their previous jobs such as design and programming in order to earn more for living. For the more economically capable ones, they may even hire some workers to do the routine farm work. This enables them to live on a semi-retired lifestyle and enjoy the greenery of the farms in pursuit of a healthier life.

Type C represents the youngest generation of farmers in Hong Kong. They acquire the highest level of education than the Types A and B. Not many of them have experienced farming since childhood because they were born around the 1980's, when Hong Kong became more urbanized. Therefore they had to learn farming from the basics in the farming classes held by various NGOs.

Similar to Type B farmers, Type C farmers also practice organic farming for environmental concerns, but they pay more consideration on how to utilize the resources from urban area for their agricultural practice as well. One notable example is that they acquire kitchen waste from nearby urban communities for composting to produce fertilizers and soil conditioners. This can be due to the smaller amount of capital they possess than Type B farmers, such that they are pushed to think of alternative pathways with less expenditure. Another possible reason is that they were born in the period when urban area faced aggravating problems, such as the threat of saturated landfills in the 2000's. Growing up in this atmosphere encouraged Type C farmers to be more aware of how agriculture can operate in harmony with the urban settings, an idea which is emphasized in permaculture[9]. Type C farmers mostly have part-time or freelance jobs in addition to farming. The background of farmers has immense effect on the future development of UA in Hong Kong as the operation of farms can be very dependent on the characteristics of the farmer.

6.1.3. Conditions on the operation of farms

The following analyses are undertaken based on the data acquired from a questionnaire survey conducted during a leisure farming seminar in Hong Kong on 26 August, 2011. Among the farmers interested in newer forms of agriculture, 92 farmers responded to the survey, whose questions are detailed in Appendices I and II.

[9] Principles of permaculture can be viewed in: *http://permaculturepriciples.com/*

Land ownership of farms

The information of the land ownership of the farms is listed in Table 6.2.:

Table 6.2. Land ownership of farms in Hong Kong

Land ownership of farm	Purchased	Rented	Others	Mixed
Percentage (Number)	6.5% (6)	78.3% (72)	8.7% (8)	6.5% (6)

Among the sample, the majority of the farmers (78.3%) cultivate on rented land, implying low freedom of decision making particularly when the terms of lease is too short for farmers to invest on infrastructure. According to interviewee #18, the term of lease in recent years has reduced from 10 years to only 2-3 years. Only a few of the farmers (6.5%) possess full ownership of the land. The category of 'Others' include company owned land, land collectively owned by the clan of indigenous inhabitant[10], and even land which are farmed without the consent of landowners. Another 6.5% of the farmers faced mixed ownership of the farmland, for instance, different parcels of land within a farm are owned by unrelated parties. One notable example is the farm operated by interviewee #24, whose farming area is owned by one indigenous inhabitant, but the parcel containing the irrigation well was owned by another villager. This can result in a frustrating situation when the well-owner no longer rent the parcel to interviewee #24, making it impossible to continue cultivation on the remaining land without irrigation water.

Sales channels of farms

With regards to the sales channels of the farmers, not all the farmers sell their produce. Quite a proportion (29.3% or 27 out of 92) of them grow food not for sales, but only for their own consumption or donation to charity. 33 farmers choose multiple sales channels, which is about half (50.8%) of the 65 farmers who sell the harvest for income.

Traditionally, the produce of farmers is collected for wholesaling by the Vegetable Marketing Organization (VMO). However, only one farmer surveyed relies totally on VMO, and 15 farmers include selling to VMO as part of their marketing strategy.

[10] Commonly known as Cho Tong (祖堂).

The proportion served by the VMO is rather low (24.6%). Another sales channel is the farmer's markets held by several organizations to gather farmers from various regions. Up to 2013, there are seven large scale farmers' markets in Hong Kong operating at least once per week. There are four farmer's markets in the New Territories: Fanling, Lam Tsuen, Tai Wo and Tuen Mun. Only one in Mei Foo, Kowloon, and two on the Hong Kong Island: Central and Quarry Bay.

Among the 65 farmers making a profit from farming, only 13 of them (20%) sell their produce in the farmer's markets. The relatively small participation implies a mismatch for newer forms of agriculture to the sales channels provided by the government and supporting organizations.

Instead of going through the farmers' markets and the wholesaling channels of VMO, more farmers choose to sell directly to the customers. 25 farmers (38.5%) sell the produce to farm visitors or outside of farms as hawkers in the urban communities. More popularly, farmers are harvesting upon customers' orders and send to the customers concerned directly (32 farmers or 49.2% choose the option). Apart from inhabitants in surrounding communities, some farms have even come into supply agreement with hotels and restaurants for satisfying the high demand of fresh and quality produce.

Sources of income of farms

Among the 92 farmers, 45 (48.9%) of them have no other sources of income besides selling produce. 20 farmers (21.7%) chose both "grow food for self-consumption or donation" as well as "no other sources of income", so they can be classified into non-commercial farmers. The sample size for investigating sources of income among commercial farmers is thus reduced to 72 farmers.

Among these 72 farmers, 25 of them (34.7%) do not have income sources other than selling produces. Meanwhile, only 7 of them (9.7%) do not sell their produce, but earn income by other means such as farm tours. 22 of the commercial farmers (30.6%) chose mixed income sources. The most popular income sources are to rent out small plots for holiday farmers, and open their farms for farm leisure and tourism (both chosen by 26 farmers, or 36.1%). Fewer farmers prepare and sell food for visitors (12 or 16.7%). 12 farmers (16.7%) adopt other ways such as organizing

farming workshop and other tourism-related activities to earn a living. As reflected by the data, there are still a number of the farmers who do not undergo income diversification and thus attaining lower multifunctionality.

Biodiversity within the farms

Mixed farming was a common practice before the 1990's such that many vegetables and paddy rice farmers in Hong Kong would also raise chickens and pigs at a small scale. The farm is benefitted by both the higher income as well as more efficient resource usage – when the crop residue can be utilized as animal feed, and in turn the animal waste can be used as fertilizers for the crop. Therefore, the sustainability can be enhanced by having higher biodiversity, and this serves as an indicator for assessing the sustainability of UA.

Out of the 91 respondents, a large proportion (64 or 69.6%) does not raise animals in farms. There are two major reasons for not raising animals among them:

i. Insufficient time, space and knowledge for managing the animals; and
ii. Restrictions imposed by government policies.

The first reason is more about the personal decision of the farmers but the second one is uncontrollable for farm operators. The key reason behind is the prohibition on household poultry-keeping of chickens, ducks, geese, pigeons, turkey and quails since 2006 for the fear of avian flu.

Among the 27 farmers who raise animals in farm, over half of them (15 or 55.6%) raise a variety of animals. The most commonly raised animals are goats (20 or 74.1%) and cattle (13 or 48.1%), followed by rabbits (8 or 29.6%), fish (5 or 18.5%) and tortoises (4 or 14.8%). In the local culture of Hong Kong, rabbits and tortoises are seldom considered for eating but more commonly for exhibition purposes, i.e. as domesticated animals which can be fed by pleasure-seeking farm visitors. Only a few of the farmers sell the animals for consumption because raising a scale large enough for selling would require vast space and lots of time for caretaking. According to a full-time goat-herder in Ma Shi Po Village, the goats reared are sold at high prices for religious ceremonies during Muslim festivals, and he can make use of the vast area of abandoned farmland nearby for the goats to forage over the years.

6.2. Functions served by the urban agriculture in Hong Kong in present

After understanding the general condition of UA in Hong Kong, this section attempts to summarize the functions of UA with respect to peri-urban and intra-urban forms of agriculture. The functions will be classified into environmental, social and economic aspects in order to connect with sustainability more precisely. Factors affecting the performance are also discussed.

6.2.1. Economic functions of UA

This section investigates the performance and potential of UA in the following economic functions:

i. Economic value
ii. Job opportunities provided
iii. Widening economic structure and creating industries
iv. Land use economics

Economic value of UA

The share of Hong Kong's gross domestic product (GDP) contributed by the local agricultural sector, measured by the market value of all crops, livestock and poultry, is only 0.04% as in 2011. However, the GDP generated by sectors whose services are purchased by the agricultural sector, such as logistics, food processing, wholesaling and retailing, are not included in the official statistics. Moreover, higher value of local agriculture in Hong Kong can be realized when the environmental functions (Yoshida, 2001) and social functions of the agricultural sector are, like in the multifunctional perspective, taken into full account.

One way of enhancing economic output is agro-tourism. As revealed by the questionnaire survey done by Yau (2012), leisure farms in Hong Kong attracted a fairly large proportion (54.7%) of visitors whose monthly income were between HKD 10,001 and HKD 40,000. Most of the visitors (67.4%) were willing to spend more than HKD 50 during their visit. This provides a sizable amount of income for the farms, especially when organic produce is of around HKD 36 per catty and the

individuals seldom purchase more than a catty. Therefore, the potential income of agriculture is higher when incorporating other functions of the farms.

Job opportunities provided by UA

One of the biggest questions over the jobs provided by the farms is the salary. The monthly expenditure of a commercial farm on hiring a farm worker is about HKD 10,000 per head (interviewee #10). But often they had to hire foreign workers who possess better farming skills, in which half of the expenditure goes into the registration fee, insurance, meals and accommodation, causing the actual salary received by the foreign farm worker to be around HKD 5,000. If local farmers are hired, the direct salary can be around HKD 10,000, however skilled farmers are limited in Hong Kong. This is similar to the findings from interviewee #17 and #20, whose multifunctional farms also hire administrative staff for managing the farm activities at about HKD 10,000 per month. This salary may not be very appealing to youngsters as it is lower than the median monthly income of Hong Kong, which is $12,000 as in 2011 (Census and Statistics Department, 2012b). This also implies a lack of economic incentives for the new generations to enter agriculture.

As reflected by three young classmates who learned farming together with the researcher, another major obstacle for youngsters to take part in farming is the lifestyle. Farmers have to work in the daytime as it is unfeasible to work outdoor at night. For full-time farmers to take care of a larger size farm, they are required to wake up at sunrise. As shared by an experienced farmer, some delicate farm work must be done in the morning to take advantage of the more humid and cooler atmosphere during that time. These imply that the youngsters have to adjust a lot in lifestyle, such as to sleep earlier at night when most of their peers are still out for nightlife or online. But all of them perceived this change to be a pattern of life healthier than that of the normally late-sleeping urban dweller.

Widening economic structure and creating industries

Official statistics are also insufficient in exploring for the functions of widening economic structure and promoting new and creative industries, for example, the general income of farmers or the amount of seed-fund to start a farm. Qualitatively, there is a notable example on the synergies between UA and social enterprise.

Greenshop (土作坊)[11] is a social enterprise founded in 2007. It targets at supporting the underprivileged citizens in the neighbourhood of Wan Chai. Before the Mid-Autumn Festival each year, members of Greenshop cooperate with the lotus farmers in Long Valley and Nam Chung in northeastern New Territories to harvest the lotus seeds. The lotus seeds collected are then processed by housewives and the elderly in the Wan Chai so that they can earn credits for purchasing organic food and commodity for daily usage. The lotus seeds are processed into lotus seed paste, the essential ingredient for making moon cakes, and then the organic moon cakes are sold to the public in Hong Kong.

At the lotus farm in Nam Chung, the farmers receive economic return from harvesting the seeds, while Greenshop also sells organic rice freshly milled by a rice husker next to the lotus pond. As shown in the lower part of Fig. 6.5., the rice husks are piled up next to the lotus pond, which will become soil conditioner for the lotus and feed the aqua fauna in the pond.

These interdependent activities do not necessarily generate income, but the efficient resource utilization can be beneficial to both industries. This is a practical example of how the urban resources like market and manpower can serve the peri-urban farms and in turn provide quality food to the urban dwellers, as well as support a better living of the underprivileged who usually find local organic food too expensive.

Other than Greenshop, there are other social enterprises cooperating with local farms. For example, the Food Recycling Scheme (食德好)[12] in Tai Po makes use of the Chinese radish from local farms in Fanling to produce organic turnip cakes (蘿蔔糕)[13]. Turnip cake is a traditional delicacy for Chinese New Year Festival. The Scheme also provides food waste collected from urban area for the farms in Fanling to make composts as fertilizers, thus saving the cost of cultivation by the farmers.

[11] The Greenshop can be reached via: *http://greenshop.sjs.org.hk/catalog/*

[12] The Food Recycling Scheme can be reached via: *http://foodrecyclinghk.wordpress.com/*

[13] To be more accurate, Chinese radish cake or Daikon cake should be used instead. However turnip cake is frequently used in tradition already in Hong Kong.

Figure 6.5. Rice husks for enriching soils of the lotus pond

Land use economics

The performance on economic use over the land in Hong Kong is dimmed in terms of abandoned farmland in the peri-urban areas. By 2011, the abandoned/ fallowed land occupies 69.2% of the total farmland surveyed by AFCD (2012). The low utilization rate implies the poor performance of farming over this function of land use economics. This is due to the high land price derived from the possibility to build

a residential estate, and the landlord just abandon the land before turning it into houses. This phenomenon is common in many highly urbanized cities in the world. This is more intensive in Hong Kong when the major farming areas are situated between two central business districts of Shenzhen and Hong Kong (Yiu, 2011).

The phenomenon on land abandonment is signified by the Agricultural Land Rehabilitation Scheme, a matching platform for farmers and land owners. From 2007 to 2011, the total number of farmers applying to the scheme is 219, but there were only 73 successful cases (33.3%) involving 11.2 hectares of farmland. Furthermore, the waiting list for the scheme has reached over 250 farmers by 21 March, 2013. Given the same success rate, the total demand on farmland will be 38.2 ha, or 0.94% of the total abandoned farmland if all the applicants succeed. This implies that many more farmers are required for revitalizing the idled land all over the New Territories. Calculations and estimations will be performed in the next chapter about policy recommendation for further promoting UA.

Meanwhile in the intra-urban settings, a community garden run by the government in Tin Shui Wai was visited. The hobby farming classes are so popular that the housewives complained the online registration system is full after 15 minutes from the opening at 8 am. In the new town of Ma On Shan, the newly opened community garden has attracted over 2,000 applications for 300 available lots (U-Beat Magazine, 2011). Some unsuccessful applicants had to wait for two years for the next available round. The huge demand reflects high potential for developing community gardens in the underutilized spaces in the city.

Recently the government has been investigating to grow vegetables in vacant industrial buildings by means of Controlled Environment Hydroponic technology (AFCD, 2013b). However, the availability of vacant industrial building is limited, where the vacancy ratio of private flatted factories is only 5% in 2012[14], which is very low when compared with the vacancy ratio of 69.2% of farmland as in 2011.

[14] More information about vacancy of industrial buildings can be accessed via Hong Kong Property Review 2013 in http://www.rvd.gov.hk/en/publications/hkpr.html

Summary of economic functions of UA

Generally, the economic functions of UA are not realized effectively for the current context of Hong Kong. The lack of farmers is an obstacle especially when it takes major changes on lifestyle with limited salary for newcomers to participate in farming. The landowners can receive very little from farming and prefer to abandon the land. Other than the unattractive income from UA, a common nature on cost-reduction can be summarized. The expenditure can be decreased for both the operation of the farm and the livelihood of citizens when the following scenarios are further developed in Hong Kong:

i. Excess manpower in neighbourhood are utilized via social enterprise and community economy;
ii. Wastes in urban areas are turned into resources for peri-urban farms;
iii. Turning maintenance-intensive gardens and turf into social gathering grounds by means of community gardens.

The potentials of the economic functions of UA can be concluded by a speech by a renowned scholar on 1 April, 2011 in Choi Yuen Tsuen, about his experience of promoting UA in Beijing:

> *'Urban agriculture can be perceived as "Anti-GDP". The demand for Logistics and transportation services are reduced from growing healthy food within the city and recycling of waste; you can pay the doctor less when devouring fewer pollutants from organic food. The GDP must be lower when UA prevails, but what kind of living is more sustainable?'*

6.2.2. Environmental functions of UA

Environmental functions served by UA can be:

i. Improvement on microclimate
ii. Enrichment on biodiversity
iii. Reduction of food mile
iv. Facilitation on waste and nutrients recycling

The following discussion will assess their performance and their potential of realization in Hong Kong.

Improvement on microclimate

In recent years, the urban area of Hong Kong has been experiencing urban heat island effect, i.e. temperature of urban area is higher than its surroundings and remains high at nighttime (Giridharan, Ganesan & Lau, 2004). Less than 30 kilometres away from the territory, Shenzhen also faces intensified urban heat island effect caused by rapid reclamation and development of fishponds (Chen, Zhao, Li & Yin, 2006).

In-between the urban cores of Hong Kong and Shenzhen, the remaining fishponds over the northwest New Territories and the belt of farmland in northeast New Territories serves strong potential functions in regulating the climate (Conservancy Association, 2011). Despite the lack of academic research in Hong Kong, this function is proven to be significant on wet-bed farming (Yokohari, Brown, Kato and Moriyama, 1997). The paddy fields surrounding the urban area of Tokyo significantly regulated the temperature in summertime. Furthermore, the closer the paddy fields are to the urban core, the better cooling effect they bring.

Other than the peri-urban farming areas, the rooftop farms also provide certain cooling effect to the city. A pilot study site has been set by Hui (2011) for testing the possibilities of combining UA and green roof in the context of Hong Kong. The major constraints in the high-density urban area of Hong Kong are listed by Hui (2011) as:

i. Low availability of suitable land and space
ii. Unfavourable building regulations, and control over land use
iii. Extreme microclimate conditions
iv. Urban dwellers are detached from the community in daily living
v. Low price of imported food, which discourage citizens to grow food by themselves

Despite the constraints above, the latter two can actually be overcome by the social functions of UA. In reality, farming in primary and secondary schools are increasing

in popularity in Hong Kong. Meanwhile, there are an increasing number of community gardens over the roof tops. They take place mostly on industrial buildings for the fewer constraints of land use but higher load limit of the rooftops.

Enrichment on biodiversity

Other than temperature regulation, the fishponds in the Northwest New Territories have significant contributions towards preserving biodiversity, especially with traditional practices of mixed fish-farming (Cheung, 2008) and regular dredging (Conservancy Association, undated-c). They are particularly important for the migratory birds flying through Hong Kong (Cheung, 2011; World Wild Fund, Hong Kong, undated). As suggested by interviewee #4, the 'semi-abandoned' situation of the fishponds in Nam Sang Wai has enriched the area's ecological value. For instance, the reed beds grown after abandonment at the south is a breeding ground and shelter for creatures, and the birds can forage on the active fishponds at the north. Interviewee #4 emphasized the consideration between ecological conservation and agricultural development:

> *'The ecology will be devastated if the reed beds at the south are cleared and dredged for fish farming. The ecological value of abandoned farmland has to be carefully assessed before resuming to agricultural use. Of course, putting concrete and building houses on would bring an even bigger disaster. This is a key reason bringing the green groups and farmers together.' (Interviewee #4)*

Apart from the fishponds, the 'Nature Conservation Management in Long Valley' campaign has achieved fruitful results with wet-bed farming such as paddy rice, watercress, and water chestnut. With reference to an on-going research provided by the Conservancy Association and Hong Kong Bird Watching Society, the average number of birds recorded monthly has increased by 64.8% from 2006 to 2012 in the core part of Long Valley. The setting of farm land favours the biodiversity as amphibians like frogs prefer to reside in different habitat. Interestingly, the concretized pond for washing the harvest is preferred by *Microhyla pulchra* (Marbled pigmy frog, 花姬蛙) as breeding site.

The community farm in Ma Shi Po also extended their functions from farming to conservation. After practicing permaculture, which minimizes the use of even organic pesticides, they started a conservation project for bringing back fireflies to the agro-ecology[15]. The larvae of the fireflies can predate on the African snail, an invasive pest in Hong Kong which its predators were eliminated by pesticides. Combining with sustainable farming practices, the reintroduction of native species back into the farmland can facilitate the rehabilitation of agro-ecosystem after the destructions by conventional practices.

Besides vegetable farming, bee farming has significant contribution to the enhancement of the natural ecosystem nearby. For example, the bee boxes actually act as shelter for wild bees under extreme weather in winter or attack from predators like wasps, which can eliminate a whole box of bees in a few days (interviewee #5). Enjoying the protection of bee farmers, the bees can better assist pollination of wild plants on surrounding hills.

The intra-urban bee farms can also improve urban ecology. Currently in Hong Kong, bee hives found in urban area are often treated as pests and are killed by the government or pest control companies out of the fear of urban dwellers. Interviewee #3 not only runs a bee farm on the top of the industrial building as shown in Fig. 6.6., but also provides service of collecting urban bee hives[16]. This enhances the pollination to urban plantations by preserving the population of urban bees. The fruits so produced can nurture birds and other animals in urban area.

[15] More detail on the project can be found in: *http://mapopo.wordpress.com/2012/01/06/ecoclass4/*

[16] For further information of the urban bee farm, please visit *http://www.hkhoney.org/community.html*

Figure 6.6. A rooftop bee farm in an industrial estate, with coloured bee boxes

Reduction of food mile

As one of the most direct functions of local agriculture, the reduction of food mile is particularly important for Hong Kong. Unfortunately, only 2.3% of vegetables were grown locally in 2011. Moreover, the origins of imported food are of increasing distance from Hong Kong. This is because the former major food supplier, Guangdong Province, has also undergone rapid urbanization. The increased internal

demand for food as well as declined food production resulted from the loss of farmland decreased the capacity to export to Hong Kong. Therefore the sources of vegetables from further regions are selected. This can be verified by the expansion of the Accredited Farm Scheme in 2011 from Guangdong Province to the Ningxia Autonomous Region, a provincial unit more than 1,800 kilometers away from Hong Kong.

Apart from vegetables, only 7.1% of live pigs and 4.5% of freshwater fish are produced locally as of 2011. The proportion of live poultry is apparently high (56.9%). However, this is resulted from the change of eating imported chilled poultry[17] since the outbreak of avian flu in the late 1990's, that the actual population able to enjoy local fresh poultry should be highly over-estimated. With more than 90% of food imported from afar, the food mile to Hong Kong is no doubt enormous and UA has limited contributions to reducing energy wastage on food delivery.

Facilitation on waste and nutrients recycling

The function on recycling food water is particularly essential under the context of Hong Kong. Currently, food wastes are produced at 3,584 tons every day in 2012, and account for 40% of total solid waste (Environmental Protection Department, 2012). This imposes a major challenge to Hong Kong when the landfills are expected to be saturated soon.

Incorporating animal rearing in vegetable farms and orchards facilitates waste and nutrient recycling, as observed in two local farms (as operated by interviewee #8 and #19). Fig. 6.7. is a capture of the farm of interviewee# 8 in Lok Ma Chau, where large scale dragon fruit trees, some patches of vegetables, goats, bees and some other animals are raised. As annotated in the white circle, the farmer collects the faeces of the goats (the bean-like substance in black) and put them around the crops such as beetroot in Fig. 6.7.. This provides both mulching effect as well as nutrient source for the plants to grow.

[17] Technically speaking, chilled poultry (冰鮮雞) is different from frozen poultry (雪藏雞) for the different treatment methods. Chilled poultry is more preferred by Hong Kong citizens for the fresher taste. More detailed differentiation can be viewed in *http://www.legco.gov.hk/yr00-01/english/panels/fseh/papers/e1846-04.pdf*

Figure 6.7. Goat faeces for cultivation

Another example of sustainable farm with animals is witnessed in the farm in Ma On Shan owned by interviewee #19. The interviewee harvested some Chinese radish (蘿蔔) of which the root is usually consumed instead of the leaves and stems. The leaves and stems were poured into a fish pond as shown in the black circle in Figure 6.8.. The water of the bottom of fish pond was then collected for irrigation as such water was enriched by the excretions of the edible and ornamental fishes.

Figure 6.8. Vegetable residue as fish feed

These two cases demonstrate the synergy related to raising different animals in a farm. However, as the survey results in Section 6.1.3. shows, the practice of raising animals is restricted since 2006. Household keeping of chickens could reduce the workload of vegetable farmers as reflected in various short interviews by Chan H.L. (2010) and experience from interviewee #11. As the chickens feed themselves on the larvae of pests hidden in the farm, they were simultaneously ploughing the fields as they dug out the larvae. Thus the input of farmers on ploughing and pesticides is reduced.

The function of household poultry-keeping was not limited to vegetable farms. For example, raising chickens was beneficial for the operation of longan (龍眼) orchard as emphasized by an orchard farmer in Ma Shi Po. When longan fruits are overripe, they fall onto the ground and become unsuitable for harvest. The rotten fruits would attract fruit flies that could devastate the yield of other fruit trees. The chickens were important as they could consume and 'clean' the rotten fruits on the floor, and their faeces serve as nutrients for the longan trees, thus completing the nutrient cycle and preventing the breeding of pests. Unfortunately, these sustainable practices stopped after the prohibition of household poultry-keeping in 2006, thus hindering UA's performance in reducing and recycling waste in Hong Kong.

Summary on environmental functions of UA

The fishponds and farmlands over the peri-urban area can significantly alleviate the urban heat island effect by the, and meanwhile, the rooftop farms in intra-urban area can potentially lower the urban temperature. Well-managed farms are ecologically resourceful and can be beneficial to surrounding biodiversity. Apart from fishponds and paddy rice farming in Hong Kong, both of whose benefits are well documented, bee farming can enrich the biodiversity in both peri-urban and intra-urban settings.

Problem on heavy food mile is aggravating in Hong Kong as Guangdong Province, the nearest food source, is now losing farmland to rapid urbanization. However, the ability of UA to reduce food mileage is limited as the quantity of local production is low. There are notable examples on how waste and nutrient recycling can be achieved through raising animals in farm, but such practice was restricted by the absence of poultry in the peri-urban farms since the mid-2000's.

6.2.3. Social functions of UA

The performance of UA on these five functions will be assessed in this section:

i. Food security
ii. Food safety
iii. Social solidarity
iv. Health improvement
v. Food education

Food security

As aforementioned, FAO (2009) identified four pillars of food security: availability, access, utilization and stability. In the context of Hong Kong where clean water is secured for food utilization, food availability, access and stability will be emphasized in this study.

In concern of food availability, an assessment on regional level is required when the major food source is actually the mainland China. Currently, a relatively stable amount of food is guaranteed by political relationship between Hong Kong and the mainland China. However, an indication of potential food insecurity is discovered through the recent changes over the Accredited Farm Scheme.

The Accredited Farm Scheme was expanded to farms from mainland for importing safer vegetables by monitoring the source of food production outside Hong Kong. The number of Mainland farms and the respective annual production of food serving Hong Kong are compared in Fig. 6.9. below:

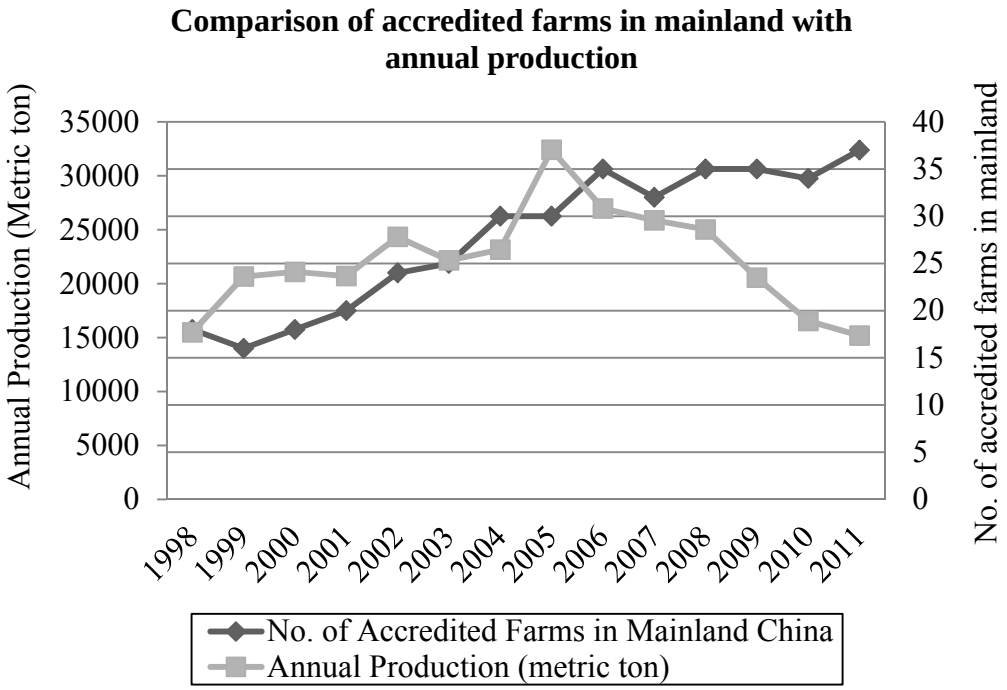


Figure 6.9. Comparison of accredited farms in mainland with their annual production (Source: AFCD)

The number of accredited farms in Mainland China increased by double from 18 farms in 1998 to 37 farms in 2011. Geographically, the scheme outreached from Guangdong Province to Ningxia Hui Autonomous Region. However, the annual production declined from 2005, supplying only 15,191 metric tons in 2011, which is even lower than the beginning of the scheme (15,490 metric tons) in 1998. This can be resulted from two reasons:

i. Decreased productivity of farms, limiting the yield to reach Hong Kong.
ii. Assuming the farms to have similar productivity, not all the harvest is marketed to Hong Kong.

The first reason can be the deterioration of arable soil in China, where 20% of total arable soil has been heavy polluted and becomes no longer suitable for cultivation (Ministry of Land and Resources of the People's Republic of China, 2010). Meanwhile, climatic change can also decline the farm productivity as China is projected to lose up to 10% of crop productivity by 2030 under the increasing extreme weather events and changing climatic pattern (The China Council for International Cooperation on Environment and Development, 2007).

The second reason is likely due to the rapid development of cities in China. This stimulated the purchasing power of Chinese citizens that the farms in mainland China would rationally choose to sell nearby with similarly good price and less transportation cost, comparing with marketing to Hong Kong. This is highly plausible when Shenzhen, the bordering city to Hong Kong, also has increasing demand for imported food as it suffers low food self-sufficiency after the rapid industrialization and urbanization since the 1990's (Lang & Miao, 2013). This is a warning signal to the food availability of Hong Kong in the future, when the hinterland for food source is also facing immense challenge on feeding themselves.

About food access, local food is actually not easy to reach by citizens. The supermarkets seldom sell local produce, however, most of the vegetables in the wet market are labeled as 'locally produced in New Territories' (本地菜/ 新界菜). According to majority of the interviewees, most of the self-claimed local vegetables are disguised by mainland import. This can be testified by the data from the VMO (2012), the ratio of local produce in the total quantity marketed is only 2.1% in 2011/ 2012, such that the low quantity from wholesaling is impossible to support the 'local vegetables' all around the wet markets.

Even if the food is truly grown local, it has to be affordable for citizens in order to enhance in food access. For vegetables, such as choi sum, the most popular vegetables in Hong Kong, the normal market price is roughly HKD 8 per catty for conventional mainland import, much lower than its average price in the farmers' market of around HKD 36 per catty. The local food, no matter in the high class restaurants or farmers' market, is not so affordable and thus their accessibility to the underprivileged is limited.

With regards to the stability of food supply, local production in Hong Kong was once encouraged to stabilize local food price when the level of import is unstable (Lam, 1993). However, the current local production is too low to achieve food self-sufficiency. Lam (1993) recorded that Hong Kong's self-sufficiency for vegetables is 55%, while it is 17% for live pigs and 65% for live poultry. Considering the major food source, incidents of severe food price fluctuation occurred during episodes of natural disasters in mainland, such as the snowstorm in 2008 covering central to northern China, and the wide spread drought in southwestern China in 2012.

During the two incidents, the wholesale price of choi sum (Table 6.3) rose by a significant proportion, thus affecting the lives of citizens, especially the grass root families. The staggering two-fold increment in spring 2012 suggests that Hong Kong's food stability is increasingly fragile as the government kept seeking new sources of vegetables from even farther parts of the mainland China.

Table 6.3. Disasters in China affecting food price of Hong Kong

Type of disasters	Snowstorm in 2008 Winter	Drought in 2012 Spring
Peak wholesale price of choi sum at the period	7.5 HKD per catty (30 Jan, 2008)	20.6 HKD per catty (12 Mar, 2012)
Yearly average wholesale price of choi sum in respective year	5.82 HKD per catty (2008)	6.14 HKD per catty (2012)
Fluctuation of wholesale price	+ 33.5%	+ 235.7%

These phenomena of food insecurity reveal that the current mindset of total dependence on imported food is questionable. Despite the contribution of local agriculture to food security is limited, revitalizing the vast abandoned farmland can probably contribute to a significant proportion of food. This can be beneficial to both Hong Kong and the mainland China by easing their aggravating stress on feeding the largest population on earth.

Food safety

Food safety in Hong Kong is currently safeguarded by inspection of imported vegetable samples by the Centre for Food Safety. Nevertheless, this system has been recently challenged by food scandals related to mainland-imported vegetables, which were found to possess excessive heavy metals (Ming Pao, 2011). The residual pesticides remain a problem of mainland-imported vegetables from mid-1980's to recent years (Greenpeace, 2012). This can be a reason for the local wet markets to disguise the mainland vegetables into local produce as mentioned above.

The public perception to imported food from mainland has been declining since the repeated food scandals in the mid-2000's. Major incidents include the freshwater fish illegally fed with malachite green (孔雀石綠), poultry eggs with Sudan dyes (蘇丹

紅) in 2006, and the world wide fear on milk powder contaminated with melamine (三聚氰胺) that damaged the kidney of infants in 2008. Under the threat from these incidents, the appeal of produce from Hong Kong is not only about freshness as in other regions, but also a more trusted food source than the mainland China.

Moreover, mainland produce is not only distrusted by Hong Kong citizens, but also citizens in mainland. Interviewee #12 has been requested to sell his organic vegetables to mainland customers. The price sold in Mainland is very high, for instance, CNY 100 per catty of vegetables. However interviewee #12 rejected the request for the concern on increasing food miles and the belief on Hong Kong citizens should enjoy safe local produce.

In reality, the local produce may not be always safe when the container storages, and scrapyards all over the New Territories are potential pollution sources to contaminate the surrounding vegetable fields. However the local inspection system earns far more trust than mainland one among the local citizens. Upon the issue of pesticides and inorganic fertilizers, a local practitioner of conventional farming (interviewee #16) pinpoints that the usage of inorganic fertilizers have declined in recent years due to increased cost of the imported fertilizers. In addition, the living lifestyle of local farmers as residing in a hut next to the field, actually limits the usage of pesticides as the farmer chooses to minimize the pesticide application that he can breathe in less harmful substance in daily living.

In terms of food safety, the Hong Kong citizens believe in the integrity of local farmers and inspection system upon organic farming, while doubting the quality of massive food import from mainland. This is one of the key reasons behind the local support for further development UA.

Social solidarity

UA has very strong function on consolidating communities. For peri-urban areas, interviewee #21 recalls the change of attitude of surrounding villages in Long Valley:

> *'When we started the farmland rehabilitation programme in early 2000's, the villagers nearby were quite hostile to us. They perceived the green groups were those who hinder them from building houses on*

farmland, thus reducing their potential income. However this changed after we planted paddy rice on the fields. The elderly were amazed by the recurrence of golden fields for harvest which they haven't seen for decades. They started to contact us and even taught us the dos and don'ts on growing paddy rice.' (Interviewee #21).

Not restricted to farming, the villagers are recruited to be tour guides, telling their living stories of cultural heritages and the farming life in harmony with the nature.

In Fanling, the Mapopo Community Farm (馬寶寶社區農場) in Ma Shi Po Village attempts to reconnect rural living with urban dwellers. The farm and invited artists facilitated the repainting of weary houses in the village (Fig. 6.10.), where the environment of a farming village is itself an excellent inspiration for artwork. This empowered the villagers to carry on the daily life of farming, as well as inviting the visitors from the urban areas to appreciate farming more. The support on the village is vital especially under the threat of urbanization by the planning of North East New Territories New Development Areas (NENTNDAs).

Figure 6.10. Farm houses repainted by voluntary artists

Within the intra-urban area, community gardens are originally targeted at consolidating the surrounding communities. According to a pioneer founder of community gardens in Hong Kong, cultivation is actually the means to it, not the goal (interviewee #23). A private housing estate, Castello (帝堡城) succeeded by 'train the trainers' system which strengthened the community (Yu, 2012). Residents in Castello who participated and learnt farming in the previous year are obliged to become tutors in the next year, thus creating more interaction between residents instead of simply attending lessons by an instructor hired from elsewhere.

However, according to the observation by interviewee #23 and the author, the participants are mostly children, middle-aged and the elderly. The absence of teenagers in community gardening is now being investigated by a group of university students who recently founded the Agricultural Development Group of The Chinese University of Hong Kong (CUAGRO). The group organized a farming course in the campus and achieved fruitful results. Besides have fun, the university students would appreciate more on the social significance of the action done, such as utilizing food waste from a canteen nearby for composting into fertilizers (Fig. 6.11.). This can be accounted for the wider knowledge the university students possess, facilitating them to relate farming to other social issues such as waste management and food justice.

Figure 6.11. University students turning food waste into compost

Health improvement

The function on rehabilitating patients of mental illnesses has been realized by The New Life Farm (新生農場) operated by New Life Psychiatric Rehabilitation Association for decades. According to the representative from New Life Farm (interviewee #15), a farm setting and related industries can assist the patients at different stages of rehabilitation. For example, patients are well suited as a farmer if they love green environment and does not mind to contact strangers who are the visitors. For those who prefer solitary more, they can work in food processing, such as workshop for drying herbs and packaging of the harvested vegetable. The patients who are more willing to communicate with strangers can even work in café or farm shops selling the agricultural produce. Under this green and diversified environment brought by the UA, patients' rehabilitation progress is better than those who worked in the conventional sheltered workshops (interviewee #15). Fig. 6.12. depicts the landscape where fields and workshops are situated together.

Figure 6.12. An overview on part of the New Life Farm. The white oval indicates the food processing workshops.

Food Education

Food education is especially important for the youngsters who did not experience the society having more interactions with agriculture before 1980's. Apart from the intra-urban community gardens where the farmers would bring their children to, there are various farming activities held by the peri-urban farms. According to interviewee #22, the Produce Green Farm (綠田園農場) receives many young visitors to the farm by liaising with primary and secondary schools, accounting for about 70% of the total visitors. The farm designs several farm experience tours and camps for students to learn about how food is grown from the soil[18]. Fig. 6.13. illustrates the pits built for teaching the children how to use a hoe to plough the soil.

Figure 6.13. Pits for teaching children how to plough the farm soil

Besides the Produce Green Farm, which promoted of organic farming for more than two decades, there are more farms providing educational activities in the new millennium. Remarkable examples are the workshops on understanding bakery and rice held by the Mapopo Community Farm in Fanling, and the rice seedling planting, rice harvesting and festival held by the Eco-paddy Club in Long Valley.

[18] Activities held by the Produce Green Farm can be found in http://www.producegreen.org.hk/activity_02.htm

By participating in a rice seedling and harvesting planting event held in Long Valley, the author observed the extra happiness brought by participants joining with their family members to the event. It was a mixture of sweat and laughter during the planting activity. The change of public perception towards farmers was captured in a memorable moment among the family member and an Indonesian domestic helper. When everyone was struggling to plant neatly and to balance in the muddy rice field, the Indonesian planted as fast as the farm instructor. The families were amazed by her skill and appreciated her background as a former inhabitant of a farming village in Indonesia. The participants not only learnt how rice is grown from mud, but also understood that farming was another profession. Farming is not just an unpromising job for the undereducated, the farmers deserve more respect. Figure 6.14. is a picture on how the families work together for planting the rice seedlings in Long Valley.

Figure 6.14. Families working together in planting the rice seedlings in Long Valley

Education even went beyond agriculture the in the field. A girl was rather passive at stepping into muddy field at first, but later on enjoyed very much the rice planting despite the dirt. They can take part in not only physically demanding farm work, but also drawings about agriculture that widens their imaginations (Figure 6.15.).

Figure 6.15. Children's drawing about the farm, and interestingly panda is related.

One more dimension of UA's contribution towards food education was observed in the farming classes. After understanding the hardship of growing food, the participants changed their diet to have less rice served for preventing wastage. This is particularly important in local context where treatment for food waste is a major urban problem. Meanwhile, less wastage on food also promotes food availability by reducing excessive demand, which enhances the potential contribution of UA towards food security.

However there are drawbacks from having diverse age groups of participants in the farming activities. As an organizer there mentioned, there must be laughter having kids around, but in turn efficiency would decline by half. This implies the productivity of the farm may not be compatible with the educational function served.

Summary of the social functions

In local context, food security now relies on food import from mainland where faces increasing burden of meeting food self-sufficiency. Food safety is particularly important owing to the disputed quality of food import from mainland. However, their current performances are both hindered by the low quantity of local production in Hong Kong, yet, the potential contribution should not be overlooked as there are still vast farmland to be revitalized.

There is immense potential for UA to offer functions like social solidarity improvement, health improvement and education. Some of them are actually intertwined and cannot be discussed in discrete terms, for example, the community

gardens can consolidate the surrounding community and also educate visiting children on how food is grown.

According to a pioneer on promoting UA in Taiwan, some farm activities which are boring to the farmers are actually very interesting for urban dwellers. This sheds light to how UA can enhance the livelihood for both villagers and urban dwellers.

6.3. Overview of the multiple functions of UA in Hong Kong

This chapter attempted to assess the multiple functions of UA of three pillars, economic, social and environmental in both intra-urban and peri-urban settings. The economic function is weak considering monetary output alone, but the potential of strengthening and widening economic structure should not be overlooked.

The environmental function is moderately strong being compatible with ecological conservation with organic and permacultural practices, as well as recycling the urban wastes such as food wastes. However the functions are restricted by tight control over farm animals, and the function on reducing food mile is hindered by low quantity of local output.

The social function is currently moderate. The performance is actually promising on linking up communities with different lifestyles, no matter rural or urban. There are outstanding examples of promoting food education and improving mental health, yet, the functions over supporting food security and safety are limited by small scale of local production.

In conclusion, the scale of contribution by UA towards sustainable living is generally small in scale and the population reached is limited. However, the potential contributions should not be underestimated, and the functions can be much stronger when local agriculture is developed with careful planning. The future directions for development will be proposed in the next chapter.

Chapter Seven: Future directions for developing multifunctional UA

This chapter first analyzes how well the theories of the evolution of agriculture and multifunctionality of UA can explain the situation of Hong Kong. Not limited to theories, practical recommendations for further development of UA will be proposed upon specific themes derived from the previous chapters on the local context.

7.1. Development of theories on the local context of UA

7.1.1. Theoretical development on the evolution of agriculture

As developed by Wilson, G.A. (2007: 303), the multifunctionality of agriculture in case of Western Europe was high before the industrialization of farming method. It reached a trough after the Green Revolution in the 1950's when the productivist way of farming boosted the yield but sacrificed the environment. It is now regaining higher multifunctionality since the 1980's, similar to the Third Food Regime or post-productivist era as reviewed in Section 2.2..

For the case of Hong Kong, agriculture was highly multifunctional straight after the WWII especially for the strong social and environmental functions (see Chapter Four). Under the conventional farming methods and abandonment of using urban waste as night-soil by early 1970's, the multifunctionality declined along with the in more productivist way of farming. The crash of local food market under the massive import cheap food from mainland has diminished all three dimensions of functions of UA, reaching a minimum degree of multifunctionality in 1990's (see Chapter Five). Stepping into the new millennium, the multifunctionality rebounded with the development of organic farming and multifunctional agriculture in both peri-urban and intra-urban settings. Such U-shaped temporal shift in multifunctionality is generally similar to Western Europe proposed by Wilson, G.A. (2007) as in Fig. 2.1..

7.1.2. Interactions between different functions of UA

As discussed in Chapter Six, most functions can co-exist in no conflicts with each other, and some even gain mutual benefits. Vegetable farms can benefit from additional income if they also engage in raising animals, which can be fed at little cost on sub-quality farm produce, facilitating the recycling of food-related resources. Another notable example is to grow wet-bed paddy rice by organic method, which

can conserve the habitat for fauna, alleviate the urban heat island effect nearby as well as educating visitors via farm activities such as planting rice seedlings. In return, the farmer can brand the rice produce for selling at high price for its multiple contributions to the society. Moreover, some physically demanding farm work such as rice harvesting can be done by a group of visitors, such that the farmer can spare time for other farm work requiring more skills.

However, as suggested by the interviewees, some particular functions are not compatible with each other. For instance, while agro-tourism brings more off-farm income, food production may be scarified and result in loss. Fish pond is a very popular tourist spot for Hong Kong, especially for bird watching. Interviewee #2 dislikes visitors walking around his fish ponds in fear of the possible spread of germs by the dirt in the sole of visitors' shoes, particularly during July and August which is the peak season for fish diseases. Fortunately, there has not been serious conflict with the tourists because the bird watching season is in winter, and the visitors seldom step on the slope of pond bunds.

Another case of incompatibility is observed in large leisure farms. To accommodate more visitors for higher entrance fee income, large leisure farms are usually designed to have wider footpaths and sheltered sitting areas. Some foot paths may even be concretized to enable the visitors walk in rainy seasons without getting themselves muddy. To further explain the effect of footpath design upon productivity, we can consider some simple calculations. For a traditional production farm in Hong Kong, the footpaths between fields are around 20 cm in width, barely enough for farmers to walk through and squat to undertake farm work. However, for visitors to walk comfortably, leisure farms will widen the footpath to around 40 cm in width. Usually, the growing space for a head of choi sum is about 20 cm in diameter. Therefore, a whole column of choi sum is sacrificed, accounting for 20% of the crops in a lot. While the leisure farm may receive more entrance free by this design, the yield of crop is reduced and thereby undermining the farm's functions on promoting food safety and security. The negative impact on food production can be even worse if is the plots are extensively converted into lawn or cemented ground for the pleasure of visitors (Fig. 7.1.).

Figure 7.1. A corner of a large leisure farm in Sheung Shui

7.1.3. Multifunctionality of different types of local farms

The possibilities on levels of multifunctionality of a farm are confined by a range of enabling factors, for instance, types of land ownership and resources possessed by the farmers. This idea is illustrated in a funnel-shaped diagram (Wilson, G.A., 2007:273) such that for farms under similar enabling factors, the level of multifunctionality performed is further determined by the productivist tendency of the farm. To further elaborate, when a tenant farmer has few labour and financial resources, he can hardly plan for expanding his production with the uncertainty of how long he can continue farming. Therefore, he can only opt for operating 'small, economically marginal farms' or hobby farms, on which he cannot practice full-time farming and has to seek other sources of income. On the other hand, landlords with sufficient capital can invest on agri-business maximizing produce by mechanization, research or to development large, economically buoyant farms in which they invest on diverse farm structures to support the development of agri-tourism.

With the inspiration from this model, a tailor-made model (Fig. 7.2.) is proposed with three key modifications for fitting into the context of Hong Kong.

The first modification is to elaborate and classify the enabling factors into two categories in Table 7.1., in order to differentiate the types of farms more precisely.

Table 7.1. Enabling factors for multifunctional UA in local context

Tangible enabling factors	Intangible enabling factors
Capital for farm investment	Reputation among citizens
Land ownership	Voluntary support from outsiders
Terrain and soil fertility	Technology on urban waste utilization
Manpower within the farm	

The second modification is to incorporate the utilization of urban resources into the parameter of productivist tendency of the farms, so as to fit into the highly urbanized context of Hong Kong. As demonstrated by the performance of different functions of UA in Chapter Six, it can be concluded that non-productivist ways of farming often utilize urban resources. One notable example is how food wastes can be treated by UA instead becoming an urban problem. In this sense, strong multifunctionality of UA in Hong Kong is contributed by both non-productivist tendency and high utilization of urban resources. Meanwhile, weak multifunctionality is comprised of productivist tendency and low utilization of urban resources.

The third modification is to enrich the context on levels of multifunctionalty with the actual functions served to Hong Kong. For instance, farms are regarded as strongly multifunctional with strong social and environmental function, while the farms with only high economic return and weak social and environmental functions will be regarded as weak in multifunctionality.

Each type of farms in Figure 7.2. will be explained one by one, starting from the right hand side with least enabling factors to the left hand side with most enabling factors.

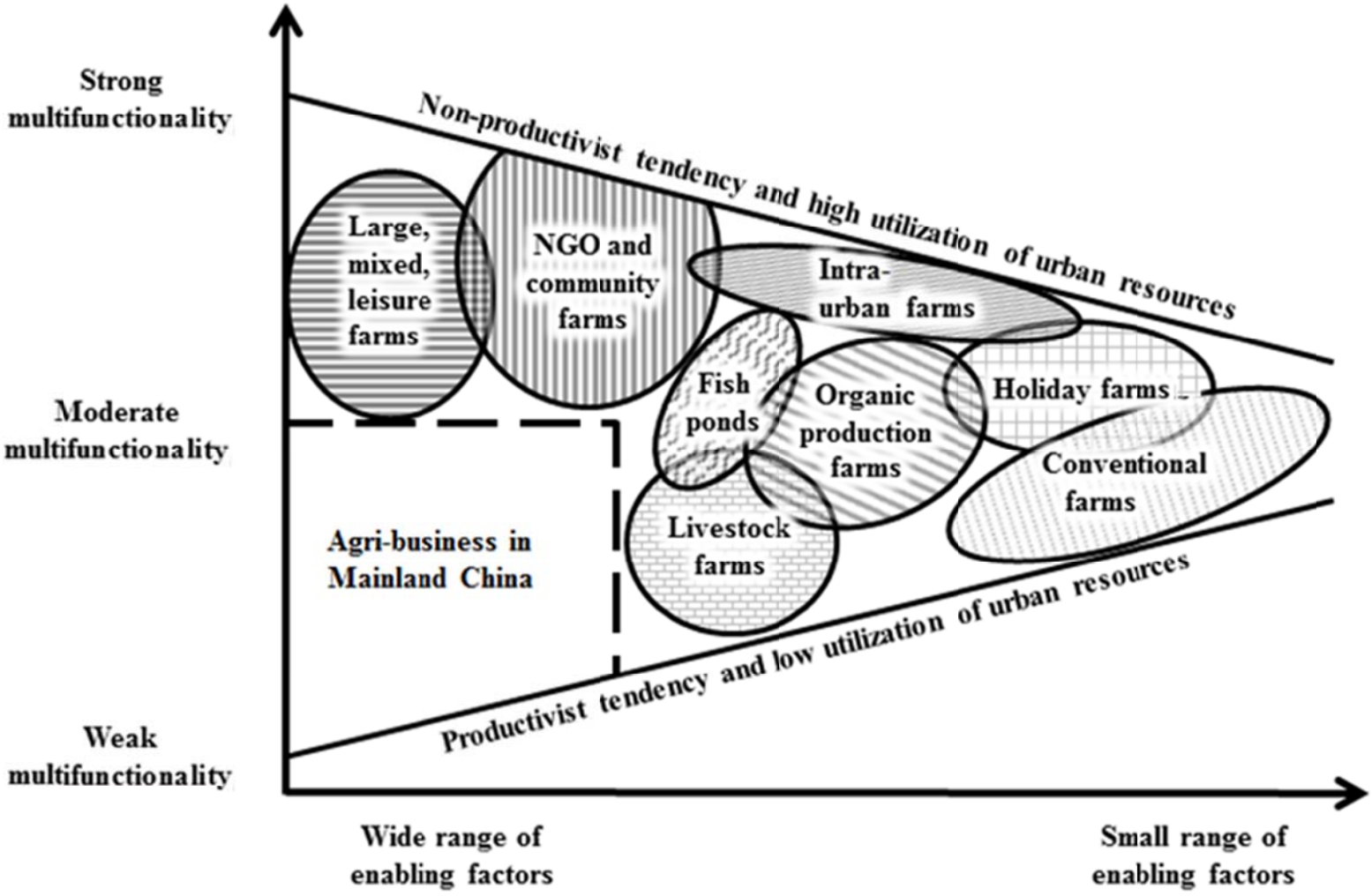


Figure 7.2. Model on different types of farms in Hong Kong with respect to multifunctionality (Modified from Wilson, G.A., 2007:273)

Conventional farms are still of majority in numbers, which use pesticides and inorganic fertilizers for growing vegetables and flowers. They are mostly aged farmers practicing the old style of cultivation, who would continue farming as long as they are physically capable. Large machinery is seldom possessed by farmers with less enabling factors in terms of small farm size and unstable land ownership, thus reducing their productivist tendency. In reality, the farmers have increased in using organic fertilizers such as peanut cake because the inorganic ones are becoming more expensive in recent years. This is beneficial to the environment as the organic fertilizers can replenish the soil organic matter. In combinations of these factors, the level of multifunctionality is from moderately weak to moderate for conventional farms.

The holiday farms refer to small lots cultivated by hobby farmers who only visit during the holidays, while the daily farm work is performed by full-time farmers or instructors. It is situated to the right hand side of Figure 7.2. due to the limited time and manpower devoted by holiday farmers. The multifunctionality can be enhanced when holiday farmers, usually residing in the suburbs, utilize their resources such as food waste for composting. However, the multifunctionality can also be limited if full-time farmers preferred convenience over food education. For instance, sometimes the farmer may decide to replant some unhealthy crops to ensure the 'beautiful and successful' experience of the holiday farmers, which can generate a wrong perception of food being easy to grow. Some of the natural soils may have to be paved to prevent dirt to the participants. These measures decrease the functions on food education and ecological conservation, thus lowering the multifunctionality.

Next to the holiday farms are the organic production farms situated mostly in peri-urban area. They farm for high-quality produce with organic certification, and a small proportion also farm on bees fruit trees. Their farming method is more environmentally friendly than conventional one and they usually sell the produce directly to customers, not via traditional wholesale markets. Multifunctionality is relatively higher because the farming practice is more sustainable. However, the multifunctionality may decline when the farmers install greenhouses or other measures isolating the ecology with the surroundings for the sake of higher production.

Intra-urban farms are strongly multifunctional intrinsically for the geographic advantages to utilize urban resources more efficiently, meanwhile serving multiple functions to the community. Notable examples include the school gardens of high contribution to food education, the community gardens consolidating the communities, as well as roof top farms facilitating more effective land usage. By The way, the range of enabling factors vary widely for different locations, i.e. school gardens enjoys more enabling factors under the proactive support by the government, meanwhile the rooftop farms are constrained by unfavourable building regulations.

The fish pond farms are essential for ecological conservation in Hong Kong, especially for feeding the migratory birds. The fish farming practice can result in striking difference in multifunctionality. For the less capital-intensive fish ponds, traditional ways of fish farming such as regular pond dredging, feeding with urban food wastes and raising mixed species of fish are very environmentally sustainable. However, some capital-intensive fish farms practice monoculture of high-price fishes and use organic fish feed imported from overseas. Plastic membranes are placed over the pond bunds to reduce the vegetation and protect the fish from diseases, at the same time preventing the birds to rest on. This reduces the environmental functions and declines the multifunctionality for gaining higher monetary return.

Livestock farms situate at the productivist end with very dense living environment for the chickens or pigs. The enabling factors possessed are strong as the farmers can afford very high startup cost because of the infrastructures especially the septic tanks. They can be moderately multifuntional despite being productivist, some farms also utilize urban resources such as burn wood blocks from construction wastes to fuel the process of cooking urban food waste into swill as pig feed.

Farms operated by NGOs and communities are highly diverse on purpose, types of produce and location. They may not have a large amount of capital for operation, but they are appealing to urban citizens that many of them are willing to assist voluntarily on farm works. The utilization of human resource in urban setting enables the farms to contribute to social and environmental functions and at the same time educating the participants about food. The missions of NGOs usually enrich the farms with particular functions. For example, some community gardens have developed for specific target audience such as the elderly in ‘Farm of Healthy Elderly’

(健康長者農場) held by the Hong Kong Young Women's Christian Association in Tan Chuk Hang, Fanling (HKYWCA, 2012). Surrounded by flyovers in Choi Hung, a sensory garden with special design on utilizing different herbs and activities has been developed by the Christian Family Service Centre. Outstanding therapeutic power has been testified towards depressed elderly in the Serene Oasis (心靈綠洲) (Christian Family Service Centre, 2013).

Community farms are special types of farms operating like cooperatives among villagers who share not only the channel of sales, but also other elements of living such as village's culture. An example is the Mapopo Community Farm, being one of the most multifunctional farms in Hong Kong with thanks to the concerted effort by villagers and urban dwellers. This type of farm can be regarded as the 'model farm' in Hong Kong for the maximum function contributed with relatively low requirement on tangible enabling factors.

Currently, the largest farms in Hong Kong are mostly for leisure purposes. They have very diverse activities such as farm experience, barbecuing, exhibition of animals and even horse riding. The farm owners have the most of tangible enabling factors in terms of land ownership, capital and thus able to hire more labour on farm work. Despite the high level of diversification of activities and infrastructures for more monetary return from agro-tourism, the actual functions served are limited in social and environmental aspects. This is because of the high degree of exhibitive nature that often romanticizes the process of farming and limits the educational function, i.e. visitors only experience harvesting which is only one aspect of the farming activities. Some of the farms may be considered as 'beyond agriculture' for over-focusing on recreational activities such as barbequing and even golf.

For other developed regions, there is agri-business at the lower-left corner of the model. However this type of large area, highly mechanized and mass-production type of farms is absent in Hong Kong. This pattern is due to the 'Go North' phenomenon of rich local farmers who invested in Guangdong Province in the 1980's. Agri-business could not root in Hong Kong because of the limited availability of land and higher salary cost compared to Guangdong Province.

This model illustrates the pattern of different farm types in Hong Kong. The level of multifunctionality is extended from a transitional perspective to the actual contributions to the sustainability of Hong Kong. Generally, we can see the multifunctionality of farms ranging from moderately weak to moderately strong in Hong Kong. With this understanding on multifunctionality of UA, practical recommendations over the future development of UA in Hong Kong will be made in the next section.

7.2. Directions for development of multifunctional UA

The future direction of UA should be strongly multifunctional for the whole agricultural sector, but this need not to be achieved by individual farms being strongly multifunctional. There can be farms utilizing different components of agriculture to attract visitors, meanwhile there should also be production farms concentrating on high and stable yield. The model in Fig. 7.3. illustrates the directions for development for different types of farms in Hong Kong.

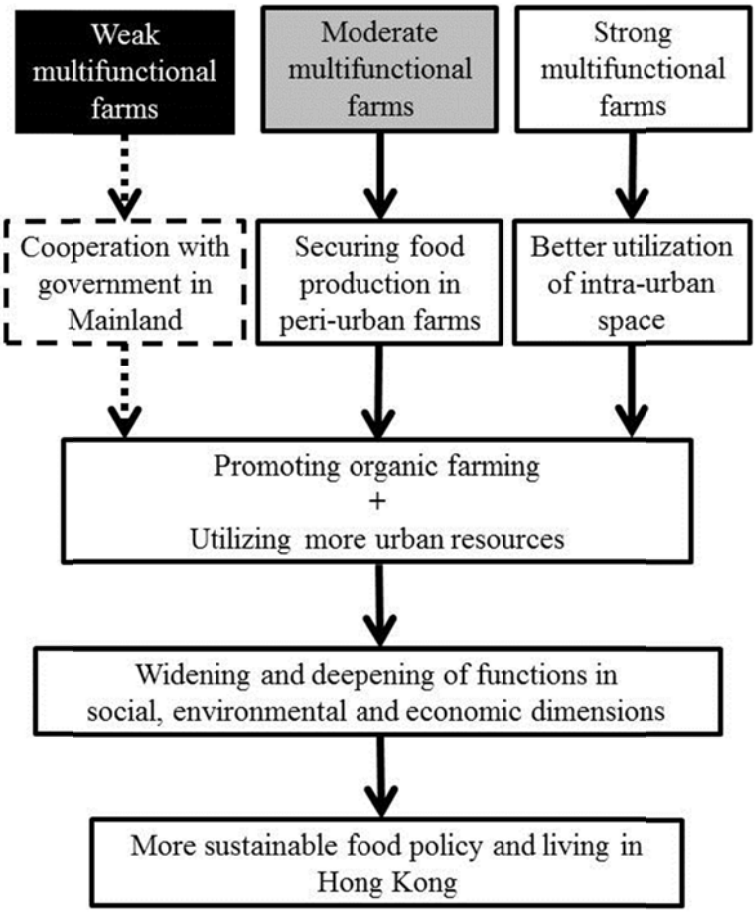


Figure 7.3. Model on directions of policy making for UA

Most of the large scale and highly mechanized farms of weak multifuctionality are actually not located in Hong Kong, but in Mainland China as previously explained in Fig. 7.2.. Therefore the Hong Kong government has to cooperate with the related officials in the mainland to ensure the quality and quantity of imported food by monitoring the source, so as to promote food security and safety.

There are plenty of moderately multifunctional farms in the peri-urban area, including the fishpond farms, organic production farms, holiday farms and a proportion of the livestock farms and conventional farms. Their multifunctionality is not the highest but they serve essential purposes on maintaining the unique agricultural landscape over the New Territories and backing up the production of high quality food in Hong Kong. In accordance with the incompatibility of leisurization with food production, these farms should avoid having too many structural changes for entertaining visitors at the expense of reduced food production.

Strongly multifunctional farms in Hong Kong include the large leisure farms with mixed produce, NGO and community farms, as well as the school garden and community gardens in intra-urban area. The NGO and community farms should be preserved and promoted as they are already making the best use of their resources and the support from urban citizens. The urban space such as rooftops and vacant land should be further utilized by UA. Community garden is a desirable type of farms to spread in urban settings as is flexible in farm size, and it serves vital functions of education and social solidarity.

There are two fundamental criteria for all the farms to fulfill:

i. Continue to promote organic farming, so as to prevent the devastation of the environment as in 1980's. At the same time, this increases the sustainability of UA, both on physical aspect for soil fertility and human aspect from the support of the society.
ii. Utilize more urban resources, especially food waste. This can reconnect the food-growing nutrient cycle of the city which was broken since the end of night-soil collection since early 1970's. Processing into compost or animal feed is of high potential in utilizing the abandoned farmland as well as relieving the urgent problem of waste treatment.

The spectrum of farms with different levels of multifunctionality and location will contribute to the functions not limited to those assessed in Chapter Six. One vital implication from this research is while UA can contribute in a wide range of functions, many of the functions, e.g. food safety, food security and job opportunities, require an agricultural sector of larger scale and higher quantity of production to realize. Therefore the policymakers have to carefully plan over food production and other activities to foster a more sustainable food policy and livelihood in Hong Kong.

7.3. Policy recommendations for the development of UA

This section provides five recommendations on policies to further develop UA:

i. Goal setting on food self-sufficiency
ii. Measures to secure farmland for food production
iii. Vocational training for farming and related jobs for multifunctional UA
iv. Technology and mechanism to better utilize urban resources
v. Urban waste management

7.3.1. Goal setting on food self-sufficiency

The rationale behind promoting food self-sufficiency to measure the size farmland required in relation with the city's demand of food, particularly when the performance on many functions of UA is difficult to be quantified for policy making.

Priority setting is essential for policymaking which one type of produce has to be selected for promotion. Vegetable is the most suitable produce because vegetable is perishable, highly demanded in market and highly flexible on land use in terms of the size and shape of farmland, as well as duration of land usage for the relatively short growing period of around two to three months per cropping. In comparison, rice can be stored efficiently and not as marketable as other produces. Fresh water fish species have increasing local demand (interviewees #2 & #13), the local consumption has increased by 68.9% from 2005 to 2011 as officially recorded. However, the market can be limited as Hong Kong citizens prefer less boney seawater fishes (interviewee #6). Moreover, fishponds require clayey soil that is limited to estuarial land in Hong Kong. Pig and poultry farms are difficult to expand

as a result of the concern of public health. For orchards and field crops, no data on self-sufficiency is available and the market is limited.

After designating vegetable self-sufficiency as the goal to be met, the following attempts to calculate the land required for achieving the different levels of vegetable self-sufficiency (VSS) in Hong Kong. The VSS calculated by dividing local production by the consumption of the corresponding year. In 2011, VSS at 2.26% was satisfied in 292 ha of farmland. The projection bases on the assumption of same vegetable productivity per area of farmland in the future. This may overestimate the farmland required for levels of VSS because the productivity per area is now undermined by the decreasing physical capability of aged farmers, as well as high proportion of farmland not utilized for food production, particularly in leisure farms. The land required – or to put alternatively, the area of farmland to be protected and rehabilitated – for reaching a particularly level of VSS, as summarized by Table 7.2, can be calculated by the formula below:

*Farmland required = Current area of farmland *(Target ratio of VSS / Current VSS)*
*e.g. Farmland required in achieving 10% of VSS =292ha *(10% / 2.26%) = 1,001ha*

Table 7.2. Targets of vegetable self-sufficiency and farmland required in hectares

Target VSS (%)	10%	20%	30%	33.7%
Farmland required further (ha)	1,001	2,294	3,587	4,071

According to AFCD, there are 4,071 ha of abandoned farmland in Hong Kong by 2011, whose complete rehabilitation can allow us to achieve 33.7% of VSS. This is a high figure comparing with other major cities such as Singapore where aims at achieving 10% of VSS (Agri-Food & Veterinary Authority of Singapore, 2011). This presents a high potential for further development of UA in Hong Kong, even we have such a small amount of existing farmland. After understanding the area of farmland needed, different measures are required better secure the land from potential destructions.

7.3.2. Measures to secure farmland for future development

The following actions must be taken to preserve adequate farmland for future development of UA:

i. To designate agricultural areas which prohibit land use conversion from farming to other forms of development.
ii. To review the land use planning in peri-urban area and intra-urban spaces. As criticized by a speaker at the Hong Kong Agricultural Forum on 27 January, 2013, there are about 2,000 ha of farmland without statutory protection of land use zoning.
iii. To introduce tax on land abandonment, so as to provide incentives for landowner to promote farming instead of speculation (interviewee #22).
iv. To promote leisure farming with better plan and regulation. Some farms install too much recreational facilities which diminish the food producing and educational functions, and concretization can even harm the ecology such that ecotourism is hindered to develop. We may learn from the lesson of Taiwan, whose government mandated that at least 90% of the land in a leisure farm is used for cultivation[19]. By attaining a suitable balance between food production and infrastructures for tourists, the agricultural landscape can become more attractive to promote agri-tourism and also ecotourism with environmentally friendly practices for farming.

7.3.3. Vocational training for farming and related jobs

Farming classes have been emphasizing on how to grow your own food and to attain a healthy lifestyle. This is insufficient for new farmers to operate a farm especially when most of them did not assist in family farming in their childhood. The government can provide vocational training for farm operation and management. This is particularly useful when internship for graduates from farming classes can be organized to provide sufficient experience for newcomers.

Moreover, the rise of intra-urban community gardens will raise the demand for farm instructors. Apart from classes currently taught by NGOs, the government can play an active role in training capable farmers to become instructors. Therefore some of the aged farmers can carry on contributing in UA without worry for declining physical ability. Moreover, the field can be taken over by young newcomers so that the outflow of skilled farmers in the early 1980's will not repeat.

[19] Article 10, Regulation for Counseling and Governance of Recreation Agriculture. Please refer to http://law.coa.gov.tw/glrsnewsout/EngLawContent.aspx?id=112 for complete regulation.

To estimate on the number of job opportunities provided by developing UA, the number of farmers needed can be calculated with respect to target of vegetable self-sufficiency. As in 2011, VSS of 2.26% was supported by about 2,100 vegetable farmers. The job opportunities created by achieving different levels of VSS is projected by applying the following equation:

*Farmers required = Current number of farmers * (Target ratio of VSS / Current VSS)*
*e.g. Farmers required in achieving 10% of VSS =2,100 *(10% / 2.26%) = 7,199.*

Table 7.3 summarizes results at several key VSS levels. Note that the highest VSS is capped at 33.7%, the level attained when all abandoned farmland in Hong Kong resumes production. Again, this likely underestimates the job creation by promoting UA as many kinds of jobs can be created as well, such as farm instructors, tour guides for farm tourism and retailers to assist farmers to sell the harvest.

Table 7.3. Estimation on jobs created as farmers under different level of VSS targets

Targeted VSS	10%	20%	30%	33.7%
Jobs created as farmers	7,199	16,497	25,796	29,236

7.3.4. Technology and mechanism to better utilize urban resources

Organic farmers have opted for direct sales channels to secure higher economic return (see Section 6.1.3.). For instance, interviewee #12 invented a mobile phone application (often known as 'apps') for his customers to place orders by smart phones[20]. This greatly enhanced the convenience of urban customers to learn the harvest available on a particular day. Moreover, this gradually educates the customers to further understand the local produce more and appreciate the rationale behind eating seasonally according to local climate.

At the same time, community supported agriculture (CSA) has been developed since the early 2000's in Hong Kong to facilitate the interactions between farmers and the urban community. Several NGOs have devoted to support the farmers by inviting urban citizens to perform voluntary farm work in return for sweat, joy, and knowledge of how food is grown.

[20] The 'app' is available via
https://play.google.com/store/apps/details?id=com.C000933A1&hl=zh_TW

Food harvested from peri-urban farms can benefit the urban dwellers through the mechanisms of food processing work and time coupon systems, such as those operated by Greenshop and Food Recycling Scheme mentioned in Section 6.2.1.. By participating in the non-physically demanding work, the underprivileged can earn credits to purchase fresh organic produce at affordable price. This time coupon system enables local agriculture to serve the poor and adding value to their harvest by processing.

7.3.5. Urban waste management

Mapopo Community Farm in Fanling has utilized urban resources nearby effectively, making good use of the locational advantage of situating right between Luen Wo Market and the peri-urban farms. Customers are invited to bring along their domestic food wastes when visiting the farm and the market. The farmers composted the food wastes from the visitors as well as the restaurants in the neighbourhood. On the medium-sized farm of 0.201 ha or 3 d.c. in area, 2,483 kg of food waste was treated and utilized in a month[21]. If this practice can be promoted at other farms in Hong Kong, each hectare of arable soil can digest 398.5 kg of food waste every day. In the most optimistic condition, if the 4,071 ha of abandoned farm land is revitalized in Hong Kong, a significant amount (1,622 tons), or 45.3% of daily food waste production in 2012 (3,584 tons) can be reused.

As testified by the mixed farms, fishpond farms and pig farms visited, animal husbandry also has tremendous potential on facilitating the assimilation of food wastes. Household poultry keeping by the peri-urban farms should be reviewed to assess if the health risk is significant enough to justify such costs as lower resource utilization capacity and poorer farmer's livelihood. Although the new organic fishpond farms do not use local fish feed with urban food wastes like the traditional fishponds do, a technological breakthrough can bridge the food recycling loop by the recently introduced technology of incubating black soldier flies (BSF). A larva of BSF can consume 0.1 gram of food waste every day. Afterwards, the larvae become protein rich feed for fish, and the excrements of the larvae can be used for fertilizing

[21] Data provided by the Mapopo Community Farm for their food wastes collection from 1 October, 2012 to 31 October 2012.

the vegetables. The possibilities of the combination of the vegetable and fish farming have been tested through aquaponics by E-farm (川上農莊) in Hok Tau, Fanling[22].

As suggested by a pioneer in promoting the technology in Hong Kong, a commercial BSF farm sizing about 50 m^2 can raise about ten million larvae which consume up to a ton of food wastes every day. Not only reducing the pressure on landfills by food wastes, the larvae can feed more than 16,000 kg of fish per year. A new testing site for this system of sustainable agriculture in Hong Kong will be established in the campus of the Chinese University of Hong Kong in 2014.

Manpower and food wastes are the urban resources that can be efficiently utilized by UA under careful planning and introduction of supporting policies. Concerted effort by the NGOs and farmers has explored wide possibilities and the government should take action to promote sustainable living of Hong Kong.

7.4. Chapter Summary

This chapter has expanded the theories on agricultural transitions in local context, and modelled the functional distribution of different types of farms in Hong Kong. The actual functions of UA towards a developed city have been incorporated in the broad theory on multifunctional agriculture which has been emphasizing on agricultural transitions.

After analyzing the sustainability of food policy in Hong Kong and the regions nearby, directions for future development on UA have been proposed according to the capacity of different types of farms. While the diversity of farms in Hong Kong now contributes in wide functions towards the city, we have to expand the scale and realize the multiple functions in greater depth by increasing the quality and quantity of local food production.

Lastly, five policy recommendations are proposed to relate the demand for UA with area of farmland required, protect the farmland for different forms of UA such as leisure farming to develop, introduce the youth to farm after adequate training,

[22] More information of the application of aquaponics in Hong Kong can be found in *http://blog.yahoo.com/_F3VUSKXB7YBE6OKKFZQYJ5RDXY/articles/1193749*

develop technology and systems for enhancing the functions of UA, as well as make us of UA as a tool to alleviate urban food waste.

To realize more sustainable living by developing multifunctional UA, it would require the farmers and NGOs to continue their effort and the government to prepare a more sustainable food policy by developing local agriculture again in Hong Kong.

Chapter Eight: Conclusion

This chapter concludes the study by a summary of findings, implications and limitations of this research and finally to suggest the opportunities for future research of UA.

8.1. Summary of findings

Chapters Four and Five have delineated the evolution of agriculture in Hong Kong in four periods undergoing major functional changes, in order to answer the first and second research sub-questions of the study, "How has the urban agriculture (UA) in Hong Kong evolved in terms of functions?" and "What are the major factors dictating the functional transformation and adaptation to urban development?". In all of the four periods, close interaction between farming and urban living is witnessed. From late 1940's to late 1960's, food security was put at the top priority for both the governance by the colonial government and the social security of the citizens as a result of the massive influx of refugee from the newly established communist China.

The transition from the dominance of paddy rice farming to vegetable farming signified the change in key function of local agriculture in the second era, from early 1970's to early 1980's. In response to the rising demand from growing population with higher purchasing power that benefited from industrialization, agriculture became completely market-oriented and vegetables, poultry, pig and fishpond farming developed rapidly.

Under the massive food import from Mainland China by the mid-1980's, local agricultural sector passed its heyday and collapsed, signaled by significant shrinkage in output quantities. The local agriculture lost its social functions under the productivist tendency, and turned out to be of low priority under evolving land use planning. The development of such other land uses as Small Houses and container storages quickly consumed the farmland. Moreover, conventional farming and industrialized livestock farming caused environmental damages and went into conflict with green groups. This can be regarded as the 'productivist trough' (Wilson, G.A., 2007) in the context of Hong Kong. Meanwhile, a fundamental change of local agriculture was at dawn because of the emergence of organic farming in Hong Kong in the late 1980's.

Entering the fourth period (i.e. late 1990's to early 2010's), the agriculture in Hong Kong faced further changes when the public concern on health further suppressed the industrialized production of pigs and chicken. In addition, the higher emphasis on food safety promoted organic farming. In 2003, the urban livelihood was heavily affected by SARS Outbreak, which inspired the citizens to appreciate nature. Together with the increased recognition after the depression of food education and farmer's image for a decade, intra-urban agriculture appeared in different spaces such as school gardens and roof-top gardens. The uprising of Choi Yuen Tsuen in 2008 raised public concern over peri-urban agricultural zones and brought citizens to look at the potential contributions of urban agriculture to the sustainable livelihood of Hong Kong.

Chapter Six answers the third sub-question of "How multifunctional is the current UA in Hong Kong?". An in-depth research was performed over 12 specific functions under three categories as economic, environmental and social functions. The economic functions of UA are weak considering the low share of GDP, but the potential contribution to widening economic structure should be emphasized. The UA served moderately strong environmental functions. Upon social functions, the performance is moderate because the contributions on food security and food safety were constrained by the low quantity of local production. The key implication of this assessment is that the current contribution of UA is limited owing to the small scale and cover of food production. Nonetheless, the high potential of UA over a wide range of functions sheds lights to the need on revitalizing local agriculture, particularly to alleviate the aggravating urban problems.

Chapter Seven proposes recommendations with respect to the final sub-question, 'Basing on the local context on multifunctional UA, what should be done for the UA to further contribute to sustainability in Hong Kong?'. The theories of UA and multifunctionality are further elaborated as some functions are not compatible as certain sacrifice has to be made when putting multifunctional farms in practice. Different types of farms are positioned into different levels of multifunctionality in a considering the tangible and intangible enabling factors, as well as the productivist tendency and utilization of urban resources (Fig. 7.2.). For the diverse types of farms to contribute more by multifunctionality, the holistic direction of farm development is to be moderately multifunctional for peri-urban farms to secure the quantity of

food production, and strongly multifunctional for intra-urban farms to optimize the breadth of functions served to the urban community nearby. Finally, five measures are recommended in detail for UA to contribute better for more sustainable living of Hong Kong.

8.2. Implications of the study

This research can contribute in diverse ways for different stakeholders:

i. For the academia, this study has applied the concept of multifunctional urban agriculture to a developed city in Asia. Moreover, a functional approach is utilized on delineating the evolution of agriculture alongside with urban development in Chapter Four and Chapter Five. This can enrich the transitional theory to UA that currently focuses on the western world.

ii. For the government, the policy recommendations in Chapter Six have summarized the suggestions from different expertise. Practical policies for meeting the needs from the society can be made with reference to the projection of area and farmers required for achieving different levels of vegetable self-sufficiency.

iii. For the farmers and NGOs promoting UA, this study has shown the key changes of agriculture in the past, which facilitates more holistic understanding of different farm types in Hong Kong. The strengths and weaknesses of UA assessed in Chapter Six are essential for the organizations to promote UA more suitable for local context.

iv. For the general public, this study contributes to the education of both the history and current significance of local food production in Hong Kong, which is currently of minor proportion in formal education. After the decades of ignorance on food, this study wishes to provoke discussion on more sustainable food policy and development.

8.3. Limitations of the study

This study is based on both secondary and primary resources. However secondary data related studies are rather limited in the third period of agricultural transition, starting from the mid-1980's to the mid-1990's. The extent of research is further

limited when some official investigation reports within this period could not be retrieved.

The primary data are mainly collected by in-depth interview among stakeholders with sufficient experience on the functions of farming in the past, which can be more holistic by including active government officers and landlords. As the time span is more than 60 years, it is not realistic to expect the memory of the aged interviewees to be precise. An expert in seed-saving (interviewee #25) sighed with frustration when the author enquired about the landraces and famous brands of vegetables in Hong Kong:

> *'Studying the landraces and local brands is crucial for the development of agriculture in Hong Kong. Unfortunately, I'm afraid this research direction can only be accomplished 30 years ago, when the seeds were still saved and traceable.' (Interviewee #25)*

Another major limitation of the study is the insufficiency of quantitative data for measuring the performance of each functions served. For instance, the function served on providing job opportunities cannot be holistically assessed without knowing the average income of the farmers in Hong Kong, but the related data are not provided by the officials. Furthermore, in the questionnaire survey revealing the farmers' situation in Section 6.1.3., the sample population was restricted to new farmers interested in leisure farming because the survey took place in a seminar about leisure farming. The majority of conventional farmers were not reached as they did not attend the seminar with a lack of interest.

In addition, some functions served by UA are intrinsically difficult to quantify. For example, the social functions particularly social solidarity cannot be measured without detailed survey among the community.

8.4. Suggestions for future research

The discipline of UA is a relatively new topic in Hong Kong. Upon the foundation of this study with wide coverage, there are opportunities for further research:

i. Previous studies on each farm type had been focused on economic functions. Multifunctionality is a meaningful perspective to understand the

contributions by different farm types, particularly by fishponds, flower and orchards which are of significant proportion of local agriculture. The bee farming has shown remarkable potential for both peri-urban and intra-urban setting, which is yet to be studied in the context of Hong Kong.

ii. Quantitative survey can be expanded to reach a larger proportion of local farmers, so as to understand the income and livelihood of more farmers including the conventional ones who seldom attend public events. This can supplement the accuracy and breadth of official data which is currently limited by the resource of the respective departments to carry out more holistic surveys.

iii. The food productivity should be studied in comparing the leisure farms and production farms. Therefore practical guidelines can be set accordingly in ensuring the quantity of food production in leisure farms.

iv. More functions of UA can be assessed with longer time span, for example, the landscaping value and cultural importance. Valuation on the different functions of UA can be a method for producing more accurate measurement for policy making, particularly under keen land use competition from other land uses such as residential land use.

v. Lastly, the concepts of multifunctional UA has not yet been included in land use planning process in Hong Kong. Conceptual development towards urban planning is vital for advancing the sustainability in the future.

Finally, agriculture is not limited to cultivation or food production. It is a component of a city that UA should be further developed in both intra-urban and peri-urban livelihood, in order to construct a truly sustainable home of Hong Kong.

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Appendices

Appendix I: Sample of questionnaire distributed (In Chinese)

您好! 我是香港中文大學地理與資源管理學系的哲學碩士研究生，

現正研究香港農業的變遷，希望閣下能撥出數分鐘時間做以下簡短問卷，不勝感激!

一切個人資料絕對保密，研究資料只用作學術用途。

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1. 請問您耕田耕了多少年？ _____年
2. 請問您的耕地面積有多大？ _____斗種 / _____平方呎
3. 請問您的耕地是自己買地還是租田？

   □自己買地 □租田 □其他，請註明：_____
4. 請問您的農莊是否有機？ □常規 □有機，有認證 □有機，沒有認證
5. 請問您的農莊主要經哪些途徑賣菜？

   □自用而不作售賣 □菜統處批發 □於農墟售賣 □小販式售賣

   □有顧客預訂 □其他，請註明：_____
6. 請問您的農莊除了賣菜還有其他收入來源嗎？ 如有，請問是什麼途徑？

   □沒有 □租田給有興趣者耕作 □開放農場作觀光

   □提供食品 □其他，請註明：

   _____
7. 請問您的農莊有沒有飼養或散養禽畜？如有，是什麼禽畜？

   □沒有 □家禽 (雞鴨鵝等) □豬 □牛 □羊 □其他，請註明：_____
8. 承上題，為什麼養或不養？ _____
9. 請問您認為香港要發展農業，當前最逼切的問題是什麼？

多謝農友回答問卷! 如閣下希望接受進一步訪問研究，可以留下聯絡方法

(姓名:_____電話:_____電郵:_____)

或向本人劉同學聯絡! (電話：XXXXXXXX 電郵：XXXXXXXXX)

Appendix II: English version of questionnaire as in Appendix I

Hello! I am an MPhil student from the Department of Geography and Resource Management, the Chinese University of Hong Kong. The research topic is about the situation of local agriculture in Hong Kong. Would you please spare me a few minutes for the short questionnaire about the condition of your farm? The data will be for academic purpose only. Thanks a million!

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1. How many years have you been farming in Hong Kong? _____years
2. What is the size of your farm ? _____hectare / _____sq.ft.
3. About the land ownership of your farm, are you the owner of the farmland or the tenant ?
   □Landowner □Tenant □Others, please specify:_____
4. Is your farm an organic one ? □Conventional □Organic with Certification
   □Organic without Certification
5. How is your produce sold ?
   □For self-consumption □To wholesale by VMO
   □To sell in farmer's market □To sell yourself in stall or as a hawker
   □Ordered by customers □Others, please specify:_____
6. Does your farm have other sources of income besides selling produce ?
   If yes, what is the source ?
   □No other sources □Renting smaller plots to others
   □Open the farm for leisure and tourism □Providing food for visitors
   □Others, please specify:_____
7. Do you raise any animals in your farm ?
   □No animals □Poultry □Pigs □Cattles □Lambs
   □Others, please specify:_____
8. What is the reason to whether raise them or not ?
   _____
9. In your opinion, what is the major obstacle(s) for agriculture to be developed in Hong Kong nowadays ?
   _____

Thank you very much for your help! If you would like to express your views further through interviews for the research, please leave your contacts here (Name:_____ Phone number:_____Email address:_____)
Or contact Johnny Lau! (Phone：XXXXXXXX Email：XXXXXXXXX)

Appendix III: Sample of questions asked in in-depth interview

A. Basic questions:

1. Why did you start farming? How did your family and friend react?

2. Why did the farmer have to farm? What was the key function of agriculture in different periods of time, e.g. 1950's/ 1960's/ 1970's/ 1980's/ 1990's/ 2000's to present?

3. What were the major incidents happening to local agriculture over the years? How did they affect farming?

4. Who or what organizations did you receive support about farming?

5. How did you acquire the skill for farming?

6. How did the agricultural policy changed over the years? Were the changes beneficial or harmful to the industry?

7. How would you describe the relationship between agriculture, urban setting and Hong Kong citizens? How different is it from the past?

8. What did/ do you use as fertilizers? Are there any changes in price in the expenditure on operating a farm?

9. What are the goals you wish to achieve through farming nowadays?

10. What are the key significance and enabling factors of local agriculture of Hong Kong?

11. What is the major obstacle for the development of local agriculture in Hong Kong nowadays?

12. How should the agriculture develop in the future?

B. Examples of follow-up questions regarding to the expertise of interviewees

1. (For a conservation manager of NGO) Why did you choose to plant rice in Long Valley instead of more profitable vegetables?

2. (For a bee farmer) Will there be competition for food between tamed bees with wild bees?

3. (For a bee farmer in intra-urban area) Will the air quality in the industrial area affect the quality of the honey harvest? How do you react to it?

4. (For a retired officer) As one of the practitioners, were there any changes between the government's mentality over the development of local agriculture?

5. (For a farm instructor in community gardens) Is the quality and quantity of food harvested different between community gardens and production farms?

6. (For a farmer left farming in the 1980's) Why did you leave farming during the 1980's? What was the atmosphere among the farmers?

7. (For a farmer started farming in the 1980's) Why did you start farming when most farmers were in frustration? How did you make a living under the keen competition from massive food import from Mainland China?

8. (For a scholar in fish pond culture) Why do the Hong Kong citizens prefer seawater fish over freshwater fish?

9. (For a fish pond farmer) Would the migratory birds consume much of your harvest? How do you react when the green groups are trying hard to protect the birds?

10. (For a seed saving expert) What is the relationship between the variety of vegetables in Hong Kong and those in the Guangdong region?

11. (For an experienced flower farmer) Why did Hong Kong citizens buy flowers in the 1970's? How was the sales pattern change throughout the years?

12. (For a campaigner from green group) How will you respond when the abandoned farmland are turn back into cultivation, not for residential develop?

Appendix VI: Background and coding of interviewees

Code	Background	Stakeholder type	Years of agro-experience	Location
1	A retired senior officer of an official organization	Former officer	>20	N/A
2	A fish farmer	Farmer (fish pond)	>20	Lut Chau
3	A bee farmer in industrial area	Farmer + community builder	<10	Ngau Tau Kok
4	A campaign manager of a green group	NGO	N/A	Nam Sang Wai
5	A senior bee farmer and instructor	Farmer and instructor(bee)	>20	Shatin
6	A professor studying on local foodways and fish ponds	Academia	N/A	N/A
7	A flower farmer and instructor	Farmer and instructor(flower)	>20	Tai Po
8	A self-claimed organic fruit and vegetable farmer	Farmer (orchard)	>20	Lok Ma Chau
9	A certified organic vegetable farmer	Farmer (vegetable)	>20	Kam Tin
10	A retired officer of a government department and a farmer	Former officer and farmer (vegetable)	>20	Kam Tin
11	A certified organic farmer, salesman and chef for the produce	Farmer (vegetable)	>20	Kam Tin
12	A certified organic vegetable and fruit farmer	Farmer (vegetable)	>20	Kam Tin
13	A certified organic fish farmer	Farmer (Fish pond)	>20	Mai Po
14	A farm instructor on vegetable	Farmer (vegetable)	>20	Tai Po
15	A representative from a rehabilitation farm	NGO	>20	Tuen Mun
16	A conventional vegetable and rice farmer	Farmer (vegetable and Rice)	>20	Kam Tin
17	A self-claimed organic vegetable farmer	Farmer (vegetable)	>20	Ma Shi Po
18	An instructor and farmer on permaculture	Farmer and instructor(vegetable)	>20	Ma Shi Po

19	A self-claimed organic mixed farmer	Farmer (mixed)	>20	Ma On Shan
20	A self-claimed organic farmer and community builder	Farm administrator + community builder	<10	Ma Shi Po
21	A conservation manager of a green group	NGO	<10	Long Valley
22	A representative from a green group	NGO	>20	Hok Tau
23	A representative from an institute about permaculture	Farmer + instructor	>10	Sha Tin
24	A certified organic farmer	Farmer (vegetable)	>20	Ping Che
25	A representative from a seed-producing company	Seed producer and researcher	>20	Aberdeen