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STUDY ON THE ROLE OF URBAN AND PERI-URBAN AGRICULTURE: A CASE OF ZHENGZHOU, CHINA

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Abstract

Urban and peri-urban agriculture as a coping strategy for food security now has been recognized its multi-functionality, which also plays important role in mitigate poverty, create employment, social inclusive and public health, improve environmental performance and enhance ecological biodiversity. Zhengzhou city is starting to practice UPA with a well-designed plan for the city development. In this context, I want to assess the role that it plays or might play in the economic, social and environmental terms in sustainable urban development.

A case study in peri-urban of Zhengzhou is applied by using a method of semi-structured interview with 56 households. The main findings are: the geographic characteristic is not so determined and UPA in Zhengzhou city is market –orientation; the main producers involved in UPA are rural farmers; the contributions of UPA respect to food security, income generation and employment are more prefer the producer themselves; households do better in organic waste disposal and try to improve their living and producing environment but have less awareness on wastewater; also the constraints indicated is their vulnerability in communicating with market and less support from cooperatives.

For the sustainable urban development, the implications in this thesis are to promote the development of UPA in urban in order to embedded urban dwellers and encourage farmers' cooperatives as well as make farmers aware of the potential benefits by using wastewater and support wastewater use in UPA.

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List of Acronyms

FAO	Food and Agriculture Organization
IPCC	Intergovernmental Panel on Climate Change
RUAF	Resource Centres on Urban Agriculture & Food security
UNFCCC	United Nations Framework Convention on Climate Change
UPA	Urban and Peri-urban agriculture

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Chapter 1 Introduction

1.1 The Background of Study

The rapid urbanization progress goes associated with land use changes results in challenges, for example food insecurity, poverty, hazards to public health, pollutions, urban waste as well as environmental degradation, for city sustainable development (Baumgartner & Belevi 2001a; Kutiwa et al. 2010). At the same time, agriculture has become more industrialized that relay on incentive cultivation, chemical fertilizers and pesticides, and the mechanization of cultivation and processing. The intensification in production triggered by the maximum profit has affected the sustainable development of biodiversity in negative sense. Therefore, over the past decades, citizens, academic and governments, intuitive or intentional, are seeking coping strategies that can alleviate these problems and develop the sustainable cities.

Urban and peri-urban agriculture[1], which is practice of cultivating, processing and distributing a diversity of food and non-food products integrated in the urban economic, social and ecological system by using resources from urban areas, and in turn supplying resources, products and services largely to that same or broader area (Mougeot 2000a, p5). Consequently, urban and peri-urban agriculture with its multi-functionality is applied to achieve urban productivity and sustainability then spread quickly all over the world and according to the widely accepted estimate; about 200 million urban residents are involving in urban farming activities, providing some of their food to800 million people. Concerns of urban agriculture and interest in studying what is urban and peri-urban agriculture, how it develops and how it contributes to sustainability have gained importance throughout different disciplines.

There is a considerable body of literature which put much attention on the growing of basic food production in urban and peri-urban areas in recent years and its positive role is

[1] The terms “urban agriculture”, “peri-urban agriculture” and “urban and peri-urban agriculture” are often used synonymously in thesis.

highlighted. It shows that urban and peri-urban agriculture provides farmers with important foodstuffs and employment opportunities that would otherwise not be available in the urban context (Kutiwa et al. 2010; Tefera 2010; Corrigan 2011).However, its potential in terms of food utilization, dietary diversity and poverty alleviation sometimes are overemphasized and as its share in income and overall agricultural production is often quite limited (Kutiwa et al. 2010; Zezza & Tasciotti 2010).

Other less extensive literature raises concerns about its impact on public health and environment, a comparative analysis on reviewing these literatures is applied. Studies on urban parks or urban forestry confirm that the experience of nature in urban environment is source of positive feelings and beneficial services, which fulfil important immaterial and non-consumptive human needs (Chiesura 2004; Z. Yang et al. 2010).But also the problems derived from practicing agricultural activities in urban and peri-urban area are stressed. It's mainly focus on the risks of reusing urban waste and incentive-agriculture and its hazards to public health and environmental pollution in practicing urban and peri-urban agriculture (Huang et al. 2006; Mireri et al. 2007; Pasquini 2006; Rojas-Valencia et al. 2011).

Some other key issues like the threatens from land tenure and use, urban planning, policy gaps, the role of the city authorities, approaches that support urban and peri-urban agriculture also draw more attention (Appeaning Addo 2010; Aubry et al. 2012; Lynch et al. 2001; Smit & Nasr 1992; Siciliano 2012; Asomani-Boateng 2002; Page 2002; T. Shi & Gill 2005)

China, inevitable, also encounters challenges to feed its 1.3 billion populations with a per capita cultivated land far below the world average, the increasing risk of soil pollution, waste disposal and degradation of diversity. While the different story in China is that the implementation of urban and peri-urban agriculture is top-down activities which proposed by the urban authorities and planner learned from other countries' experiences combined with the cities' actual condition (Qiu et al. 2005). Government is making positive responses to the challenge of decreasing availability of cultivated land and

offering unremitting efforts towards the goal of resource-saving and environment-friendly society construction (Luo 2009).

In the context of China, UPA generally refers to the agricultural activities in the periphery of city; make use of the resources in and around city, operate by the citizens and rural farmers, serve the city's social, economic, ecological and cultural needs by agricultural production. While, the main challenges urban and peri-urban agriculture faces in China is that sometimes even the authorities or the participants realizes the benefits, but they still hold the opinion that the development of agriculture in urban areas goes against the progress of modern city and government or try to maximize their short-term profits. Besides, the weakness in established land tenure system, well qualified participants, sufficient investment and communicated with markets etc., are all the constraints that influence the development of urban and peri-urban agriculture (Wu & Yu 2010).

1.2 Problem Statement

With the evidences that urban and peri-urban agriculture adopted by both developed and developing countries, it is said that a range of unique potential benefits and synergies are offered with overall urban design and also potential conflicts between urban and peri-urban agriculture and other factors for cities sustainable development. It is, therefore, better to work in whether and how much the urban and peri-urban agriculture contribute to cities and their inhabitants as multifunctional strategy to overcome the problems. There are numerous studies on the UPA in different views, but no standard method system has been established to assess its sustainability. Therefore, there is a necessary to work on it to assess the benefits and challenges of UPA.

Studies of urban and peri-urban agriculture in China are limited, and focus on distinguish concepts of urban agriculture and peri-urban agriculture, functions and global experiences as well as the development trend (Qiu et al. 2005; Wu & Zhang 2008; Wu & Yu 2010; Yang 2011; Zhao et al. 2011) , more attention are put on specific urban agriculture cases , such as recreational agriculture and home gardens (Duan 2011; Wu & Shen 2010; Yang et al. 2010), Even less of them focus on assessing the role that it plays

or might play in the economic, social and environmental terms in sustainable urban development.

The main research question is whether and how much the urban and peri-urban agriculture contribute to cities' sustainable development and what are the main challenges in the local context.

1.3 Study Objectives

Even the producers of urban agriculture are urban dwellers; there are more than a quarter practicing market-oriented agricultural activities on undeveloped peri-urban spaces. And this thesis focuses on the latter group which is characterized by small-scale farming as the main household livelihood strategy.

According to the Baumgartner and Belevi (2001b) the main contribution of urban and peri-urban agriculture can be categorized as food security, income generation, public health and the sustainable use of natural resources. In this thesis, I attempt to get an overall understanding about urban and peri-urban agriculture and address the multifunctional role of urban and peri-urban agriculture by illustrate its social, economic and environmental aspects of Zhengzhou city in China. Due to limits on time, financial and resource availability, the study focus on the activities and perceptions at household level as well as the perceptible and visible outcome and impacts refer to urban and peri-urban agriculture to achieve the above objective.

The sub-objectives of the study are following:

(1) Collect both primary and second-hand, quantitative and qualitative data on urban and peri-urban agriculture in Zhengzhou city;
(2) Analysis key issues of food security, income generation, Agricultural systems and communications with market, the state of cooperatives and producer's awareness and behaviours towards environmental and health risks;

(3) Conclude contributions and problems that encountered in practicing urban agriculture and constraints in achieving the sustainable urban development.

1.4 Structure of Thesis

The thesis is organized as follows: Chapter 2 consists of a literature review that first how urban and peri-urban agriculture is conceptualized and elaborates the main characters of urban and peri-urban agriculture. Secondly, the benefits of urban and peri-urban agriculture are illustrated in three categories, social, economic and environmental. Finally, problems and constraints are summarized. In Chapter 3 a brief description of research area and the research methodology in each stage for the case study is outlined, it also includes details in the information collection, and the main questions used in the case study interviews. Results analysis of the case study are then presented and discussed in Chapter 4. Finally, concluding remarks and a brief recommendation are provided for the sustainable development of urban agriculture in Zhengzhou city.

Chapter 2 Literature Review

Urban and peri-urban agriculture (UPA) is a phenomenon as old as cities themselves and exists in various forms, from small plot in balcony or on rooftop, household backyard garden to extensive farm in city periphery, from household subsistence activities to large commercial enterprises. The differentials due to not only agricultural or geographic factors, but also the context it's rooted in waved by social economic and historical variations in the urban and peri-urban areas. In this chapter, I would like to draw an overall picture how urban and peri-urban agriculture looks like and the connection between the sustainability, both positive and negative aspects will be mentioned by reviewing the relevant literatures.

2.1 The concept of UPA

UPA is observed in varying perspectives as well as defined in various ways respect to the way it makes effective use of available resources and opportunities, and also the purposes of researches conducted. Consequently, there is no a general organized notion prevails in the literature applicable to all the countries worldwide due the specific context that urban and peri-urban agriculture emerged and developed.

The concept of urban and peri-urban agriculture remains in development. Meanwhile studies all over the world about UPA ask different questions and analysing different activities in Asia than in other regions of the world. However, the most popular definition accepted by UNFCCC and IPCC and developed by Mougeot is:

"Urban agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows and 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 2000b,p10)

This definition is not completely applied to the China's urban agriculture although it contains some key components applied. The universal idea what constitutes the concept of urban and peri-urban agriculture, relates to the factors where (location and scale), which (activities and stages), who (stakeholder) and why (motivation). (Baumgartner and Belevi 2001c,p5)

a) where (location and scale)

About the location and scale, the best-know international urban agriculture agencies RUAF indicates the locational feature of UPA on its website as: inside the cities (intra-urban) or in the peri-urban areas, may take place on the homestead (on-plot) or on land away from the residence (off-plot), on private land (owned, leased) or on public land (parks, conservation areas, along roads, streams and railways), or semi-public land (schoolyards, grounds of schools and hospitals).[2] The small-scale urban agriculture are prevailing phenomenon in most countries, both developed or developing, and play an important role in food supplying for household and ecological system conserving. But in China, most of them are existed sporadically as a hobby or for greening purpose in central urban centres.

Mougeot (2000c) argues that the most important distinguishing character is not the location but the integration in and impact on urban system, the location characteristic is a great advantage to the process where sufficient inputs, techniques are closed to the perishable products, like fresh vegetables, fruits, meat and milk.

Bon et al. (2009) presented that the concept of urban agriculture involves two parts urban and rural at same time, but the definition of what constitute then very important and vary from region to region. Thus, location is not just a geographic factor but a context that will link to UPA. When defining the location character of UPA in China, researchers combine the city planning with real situation and indicate UPA is located outside the urban centre but integrated in and have impacts in urban context (Yang 2011).

[2] http://www.ruaf.org/node/512

b) which (activities and stages)

It comes to the activities and stages, Baumgartner and Belevi (2001d, p6)suggest that the following activities have to be included: (1) acquisition and utilization of the necessary resources, inputs and services; (2) production of goods; (3) “post-production”, including processing, packaging, distribution, marketing, and recycling; (4) consumption. However, they defined a broader range for the UPA activities, while in most of literatures, the most commonly activity is production, then the other activities which directly links to deal with their productions can be thought as UPA practices.

c) who (stakeholder)

Who are participants or stakeholders? The emerging and developing of UPA is largely practitioner-led. Reviewing the processes, those involved are: the providers of resources, the providers of services; producers, the distributors, consumers, the promoters of activity and the administrators (Baumgartner & Belevi 2001e). These players, in turn, are in both formal and informal economy. Then the number of people engaged in urban and peri-urban agriculture is much higher than if only urban farmer are counted.

Obviously they are also not the traditional farmers. Different income level can take part in. And some studies indicate that in the household level, the main producer is women but some argue that the main producers are men and women are always mainly focus on the market activities. Women, also are considered as the most active and predominantly participant in urban and peri-urban agriculture(Kutiwa et al. 2010)

Some researchers indicates that the urban farmers are not possible to be the migrants since it is difficult for them to get access to urban land water and other productive resources. However, with the expansion of urban areas, the initial rural area is becoming more urban and the scattered urban centres make some cultivated land embedded in big urban agriculture concept. It creates more opportunities for migrants to obtain resources and practicing UPA.

d) why (motivation)

In industrialized countries, on one hand, due to the continuous development of social-economic situation, the drawbacks of highly urbanization are increasing significantly. People begin to realize the value of multi-functional agriculture. On the other hand, as income increases, people have more time and requirements for urban environment on leisure in term of culture, education and entertainment. In this case, urban agriculture comes into being, which is considered as a necessary component of sustainable urban development, to improve living environment, benefit human beings and increase biodiversity. Nevertheless, it always acts as an informal tool for urban low-income groups to provide necessary food and enhance their livelihoods in developing countries.

In most developing countries, the driver factor that push urban household grow food in their backyard, for example, in most African cities, UPA as a strategy to cope with the food insecurity (Drakakis-Smith et al. 1995). Urban agriculture is providing not only food but also jobs, and hope in Nairobi, Kampala, Dakar, and other cities across sub-Saharan Africa. Or as a case so typical in Asian countries, the emerging of UPA mainly links to the increasing urban population (Nugent 2000)and urbanization which result in population growth in cities while the hysteretic job market creates unemployment and food insecurity. Urban household needs to seek other means to increase income and mitigate poverty, and thus revert to agriculture. Both of these explain the contexts in which urban agriculture emerges and develops. Increasing urban poverty and dependence on food banks led many community organizations in Canada and the United States to develop intensive UA projects aimed at increasing food security and creating jobs for low income households. In US, community support agriculture was prosperous in the urban periphery in order to provide safe food and contributed to community health as well as the local connection between people, economy and landscape (Schnell 2007).

UPA is prone to Change concerning to forms or purposes, like allotment system, once the important form of UPA in Britain is the strategy to coping with the food insecurity. Even

so, crisis occurred in industrial food production systems which always causes and suffers from a lack of resilience make them looking for the diversity of UPA (Gerrard 2010).

Some Chinese researchers ascribe the differences between Chinese UPA and western UPA to its emerging and developing pattern. The UPA in China general refers to the intensive and multi-functional agriculture happen in the periphery and twilight zone among urban and rural area, with the functions that provides safe, high-quality agricultural by-products and attractive ecological nature, which always original is the traditional agriculture(Zhao et al. 2011). In addition, some villages or townships make use of the favourable natural cultural conditions to develop their agriculture to meet the needs of urban dwellers. Then, the UPA here can be recognized as market-oriented agriculture. Even the area in change, it doesn't change the fundamental characteristics of the region as a village, and neither the producers as farmers. On the contrary, in western urban agriculture happen in the early stage of industrialization, a large area of agricultural land become urban built land duo to the rapid expansion of urban, small pieces land left in the urban. It plays important role in supplying foodstuffs in special period and maintaining the ecological and reliance capability in late stage of industrialization and modern city.

2.2 Theories concerning of UPA

2.2.1 Von Thünen's model

The Von Thünen theory can be visually explained by Figure1, the black dot is the centre as 1 and there are four rings represent agricultural activities. The first ring is closest to the city, where diary and other high value products and market garden occur here with the highest transportation cost since they are more vulnerable and perishable. In the second ring, wood and fire will be produced for fuel and building materials. Wood is very heavy and therefore difficult and costly to transport. The third ring is field crops such as grain. Since grains is longer than other products and is much lighter than wood, then transport costs is considered to be lower, in the final ring where ranching is located surrounding the

central city. Animals can be raised far from the city because they are self-transporting and thus have low transport costs. This model can be used to illustrate the impact of distance between agriculture production and agriculture products consumption on land use. The model relationship between urban and agriculture is much concerning to the theoretical of Von Thünen.

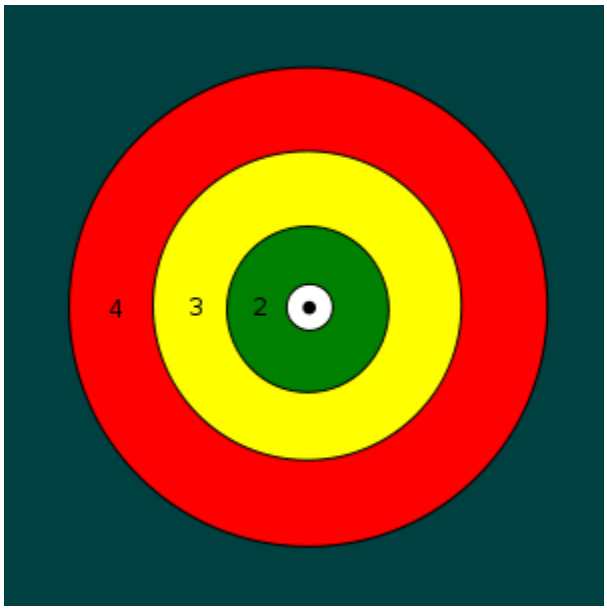

Figure 1 Von Thünen model (source: Wikipedia)

2.2.2 Urban-Rural integration

As Ye (2009) presented urban rural income gap is the most dominated reason for the urban-rural integration. The integration of urban and rural areas is to eliminate the differences between these two areas especially the income gap and allocated urban and rural resources rationally. The role UPA plays in the process of integration is determined by its geographic characteristic. UPA is defined as the agriculture and related activities located at the urban and its periphery, and then there is a junction area which connects urban and rural. On one hand, UPA is a result of urban and rural integration. Urban area is continuously expanded and brings its advanced culture and mode of production to its surrounding, and then the area is more and more influenced by the urban areas. On the other hand, UPA is vital factor that can promote urban-rural integration. For, example, by reusing urban waste, provide fresh foodstuffs and better environment to urban

dwellers, there are more communications between urban dwellers and rural farmers. UPA then promote the relation of urban and peri urban and rural area; to realize the free contribute to the integration of urban and rural.

2.2.3 Comparative advantage

Then meaning of comparative advantage can be understood that if goods can be produced in a relative low cost.

The application of comparative advantage theory in analysing the emerging of UPA can generally get the following conclusions: First, the development of urban agriculture do not have the advantage in land resources and always compete with the urban development in land. Urban expansion has accelerated the reduction of arable land which makes arable more scarcely. Therefore, land-intensive products should thus not as a suggestive alternative. Secondly, compare to rural agricultural, urban agricultural develops with relatively capital and technology advantages, which means that there are better pre-conditions for capital-intensive and technology-intensive agricultural production, such as high-tech agriculture and facility agriculture. Thirdly, consider the more densely populated in cities and its surrounding, it provides a strong labour resource advantage for producing high value cash crops like vegetables, fruits, horticulture and animal feeding as well as agricultural products processing. Besides, it also provides a sufficient labour force to agriculture-related services, such as rural tourism, recreational agriculture and experience agriculture.

2.3 The benefits of UPA

UPA has always not just provided food productions but multifunctional, it plays others roles in the economy, society and ecology which help to mitigate some of the key challenges in our modern society, global warming, rapid population growth, international and domestic food insecurity, urban waste.

2.3.1 Food Security

Food security has been recognized as a major purpose of practicing UPA. Initiative UPA contribute to urban food self-sufficiency and nutrition by helping to provide all citizens with increased access to nutritious foods and reduce their food expenses which results in food security.

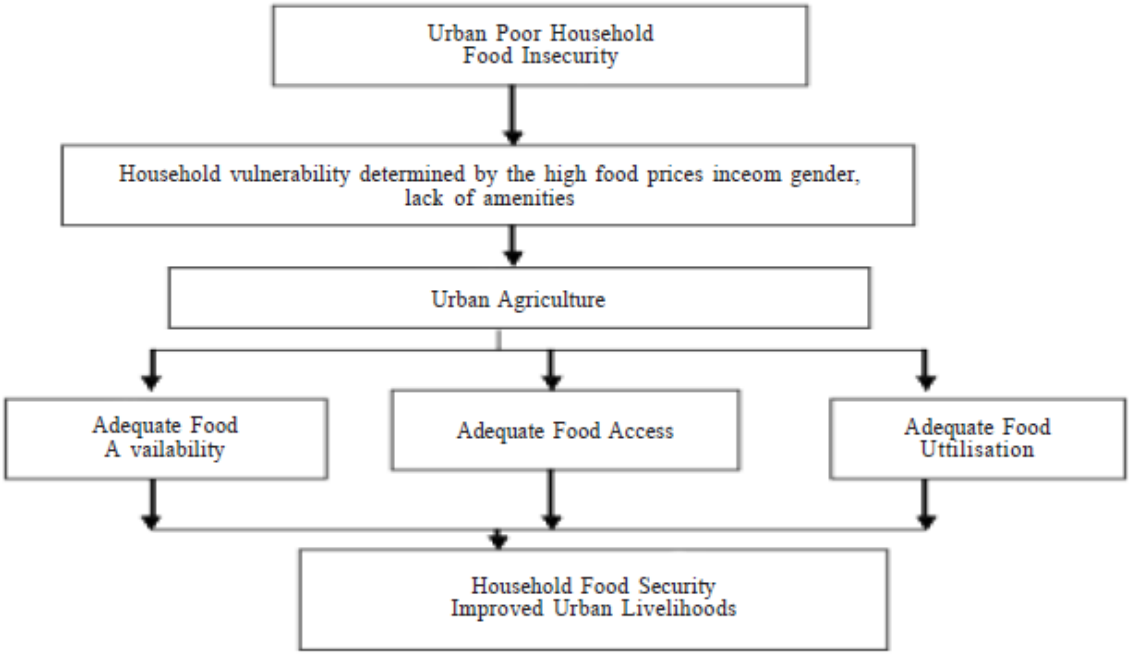

Figure 2 The Conceptual framework for urban agriculture as a tool for household food security

(Source: Kutiwa et al. 2010,p87)

Kutiwa et al. (2010) indicate that urban agriculture is one way to escape the food insecurity and poverty cycle in a cash intensive environment and develop a conceptual model to address three components of food security. Households involved in urban agriculture can produce their own food and get immediately the fresh product for consumption. The money saved from the supplement of food make household get access to dietary diversity. The food utilization refers to the nutritional security in terms of food quality. . Additional, the major products in urban and periphery is fresh and perishable products such as vegetables, fruits, eggs and milk, which is a complements for rural agriculture but not completing with it (Mougeot 2001e).

The relatively large number of studies that took many cities as specific cases that have looked at the link between UA and food security and indicate that there is indeed an impact of UA on child nutritional status, household per capita dietary energy requirement, food access and quality and reduces prices.(Ellis et al. 1998; Kutiwa et al. 2010; Nugent 2000; Armar-Klemesu 2000; Crush et al. 2010; Hubbard & Onumah 2001; Zezza & Tasciotti 2010; Tefera 2010)

For example in many Asian countries, they have a long history of practicing urban and peri-urban agriculture with a great diversity of products to overcome the conflicts between big populations and limit arable land. As an example, many cities in China are able to be self-reliant in non-grain foods. Singapore is 25% self-reliant in vegetables and 100% in meat. In late 1980s of Cuba, the collapse of socialist bloc which had accounted for 85% of Cuba's trade in economic slump made Cuba agriculture face challenges to provide food but to the locally-available resources.

But potential food safety risks may be higher for UPA production than those in rural areas because urban environment are more polluted.

2.3.2 Income generation and Employment

By growing the food in their own backyard or farmland, producers fulfil their own basic needs or sale the products on markets, even both. As a consequence, the "fungible" and "real" income is generated (Baumgartner & Belevi 2001e,p10). Firstly, when a household produce food for their own consumption, the saving expenses on foodstuffs can be thought as fungible income. The experiences, most from African countries, show that the saved money or income would otherwise be spent on basic needs or invested in household capital. Urban agriculture is therefore playing important role in mitigating poverty. Secondly, if there are more products than household needed, they tend to sell the surpluses on market, which comes to another complementing source of household income. In this way, urban agriculture not just increases food security.

Liu and Xu (2008) explore the interaction between urban agriculture and peasants' income in China and find that there is a synergetic relationship between increasing peasants' income and urban agriculture, and competition relationship between maximization of short-term income and sustainable development of ecology.

There is also a connection between urban labour market and urban agricultural production. Within the more urbanized cities, more and more urban unemployed labour and migrants fail to find adequate employment, them they tend to work on farm for subsistence. The phenomenon of urban agriculture in many cities of the developing world is a reality although its magnitude in quantitative terms is still undetermined.

Generally, agriculture is not the only source for households' income, but also the largest employment sector, especially in developing countries. UPA creates employment in production, processing, marketing and other related economic activities. It is also an important source of employment for women (Maxwell, 1993, p38). Nevertheless, most of these jobs are temporary or seasonal. So as it is, it still contributes to household income.

While, Nugent (2000) insists that urban agriculture does not make a substantial contribution towards urban employment according to official data. He explains it as the conflict between labour force skills and needs of local employers, even the ability of local economy to absorb them.

Some scholars also believe that external effects should be included in the economic value of urban agriculture. Viljoen and Bohn (2005) think that comprehensive economic evaluation of urban agriculture need to take a number of external factors into consideration, such as the positive impact of fresh local food on health, the cost of food transportation. If calculate the saving transportation costs and environmental benefits, urban agriculture can get a significant economic benefits. An assessment on the ecological service value of urban agriculture in Shanghai shows that the great part of its ecological service value has not been well explored and performed in in market (Wu & Zhang 2008).

2.3.3 Public health

The aim of public health is to promote the well-being, prevent diseases and disabilities, and enhance the quality of life (Baumgartner & Belevi 2001f,p10). Urban agriculture can contribute to communities in both physical and mental way. On one hand, urban agriculture provides green spaces in urbanized cities, which can reduce stress, create a sense of peacefulness. Also the experiences of urban parks, forest or other forms of agritainment have positive on getting close to nature, being with children, getting inspiration and feeling relax. A study has been conducted in urban parks in Amsterdam also confirm that besides many environmental and ecological services, urban nature provides important social and psychological benefits to human societies, which enrich human life with meanings and emotions (Chiesura 2004).On the other hand, working on a small-scale farmland is good chance to do physical exercise and strengthen physical quality. Public health can also be classified into traditional health hazard and modern health hazard. Traditional health hazard are more related to undernourishment while modern health hazard mainly focus on the pollution, stress and over-nourishment. Since urban agriculture can help to increase food security, provide more green spaces, and decrease in health risks by properly waste disposal. Even so, there are still some potential health risks derived from poorly practiced urban agriculture.

2.3.4 Social inclusive

According to Bailkey et al. (2007), urban and peri-urban agriculture can contributes to the social inclusion of marginal groups by providing them an opportunities to feed their families and raise their income, while enhancing self-confident .

Others indicate that urban agriculture plays an active role in educating urban dwellers on natural knowledge, agrarian techniques and keeping regional culture diversity. Urban agriculture provides a useful space for social interaction, and Chinese scholars think it is a now and efficient way to promote “urban-rural integration” by harmonizing urban and rural economy and society (Qiu et al. 2005).

2.3.5 Ecological benefits

By implementing UPA, the diversity and quality of the ecological system will improve undeniably, but the effects are not as noticeable as the social and economic effects.

Urban waste is considered one of the most serious and pressing urban environmental problems. To explore the contribution of urban agriculture to ecological system, a lot of studies focus on the inputs and outputs of local production and consumption. Smit and Nasr (1992) indicated that UPA is a tool to convert the consume-dispose open loops into consume-process-reuse closed loop system that makes use of urban waste, like organic waste, wastewater and solid waste, and reduce the amount of landfill and carbon emission, thus reduce the ecological footprint in cities. A considerable potential of UPA could consist in reusing urban solid and liquid waste for local food production, thereby saving resources and energy.

Table 1 Classification of organic waste materials (Altieri et al. 1999)

Animal Wastes	Plant Residues	Industrial Waste	Residential Waste
Manure, Urine, Feathers and fur, Bones and blood and Bio-digested waste	Crop residues, Tree and hedge clippings, weeds, Leaves and branches, Sawdust and ashes	Coffee pulp, Sugar cane residues, Rice husks, Paper, Cardboard and other biodegradable waste, Bio-digested waste	Organic household waste

In 1999, Altieri et al.(p137) classified the organic waste with in urban agriculture as a supplement soil fertility in Cuba are animal wastes, plants residues, industrial wastes and residential waste (Table 1).

Many urban by-products become agricultural inputs, including domestic and market composted that are used on crops, and brewery by-products that are used to feed animals. On the other hand, the by-products of urban agriculture themselves become inputs elsewhere, sometimes in the case of integrated crop-livestock production system, such as manure organic fertilizer used in crops growing, and crop straw for fodder and biogas generating. In northern China, waste wheat and maize straw has been turned into biogas

generation and thus make use of biogas as cooking energy, bio slurry as crop fertilizer in rural households (Jiao et al. 2011).

While by recycling of significant amounts of household waste and animal excrements, and by make better use of land in or near the marshlands and is also preventing the pollution of surface water properly managed, ban horticulture is making important contributions to environmental sustainability in Cotonou. And even greater contribution are expected by recycling household waste and liquid waste on a much larger scale and putting it at the horticulturalists' disposal at competitive prices, and by protecting the natural water-storage function of the swamps (Brock & Foeken 2006).

2.4 Problems and constraints of UPA

The same state is that from the literatures there are huge studies on the multi-functionality or its role of UPA and its benefits, but its potential risks are always drawing more attention with in production , other problems like land use, authority recognized

2.4.1 Health risks

In general, urban agriculture would cause risks to the health and ecological environment. FAO pointed out that often in a large number of long history of intensive commercial district, inappropriate use of chemicals (fertilizers, pesticides and insecticides), may lead to pesticide residues in crops or groundwater. It is said that urban agriculture uses urban waste for example, liquid or solid wastes contaminated by pathogens, metals as inputs to bring more risk the public than traditional agriculture does. Also the urban and peri-urban land for production of food may be detrimental to the public interest. And if the practitioners or other persons who lack of management knowledge or are not familiar with hygiene, health problems of animal feeding may also occur.

The use of wastewater and organic waste in agriculture may increase contaminate in agricultural products and pollute soil and underground water. A study on urban farming practices in small-scale vegetable farming systems in the Yangtze River Delta Region of

China shows the environmental risk that application of cow manure, N and P to vegetables results in high Cd in some vegetables and high concentrations of N and P in surface water (Huang et al. 2006). And study conducted by Anikwe & Nwobodo (2002) shows that deal with the urban waste by dumping have negative influence on the soil properties and productive at the dumping site in long term.

2.4.2 Land problems

Have been realized the benefits and its contributions to cope with challenges in sustainable urban development, many governments and organizations begin to integrate urban and peri-urban agriculture as an active part in the complex urban context. Land problem are classified into two groups, land use and soil property influenced by UPA s.

However, empirical evidence presented here from the city of Kano in northern Nigeria suggests that urban agricultural activities and livelihoods are being threatened by acute problems of tenure insecurity and encroaching land development (Lynch et al. 2001). And also UPA in Cuba is also not the problem free with the major limitation of land and water scarcity as well as poor quality of urban topsoil and irrigation water in the densely populated areas(Altieri et al. 1999).

Urban agriculture is an illegal and unaccepted land-use in most African cities at the beginning. Recently, realizing the benefits derived from urban agriculture, some planner or governments begin to take it into the city planning and ensure its legal status.

On the contrary, in most Asian countries, urban agriculture is accepted as a normal urban function and land use (Smit et al. 2001) for they recognizes the benefits of urban agriculture applied in densely populated cities with intensive farming systems. In the last century, China had developed a strategy and policy, which including land planning and waste disposal to support urban agriculture. So does Japan the country which include urban agriculture in the regular census.

After the reform of land tenure system in 2008, China's urban land is owned by the municipality and developers may lease the right to use the land; rural land is collectively owned by the commune with the more productive Household Responsibility System (HRS). This makes more urban agriculture located in peri-urban areas. The major constraint of land use in China is its use right transferring (Jin & Deininger 2009).

2.4.3 Authorities Perceptions

The greater challenges in the implementation of UPA is that most urban planners and environmental managers, either with the government or with NGOs, are more concentrated on the economic benefits of UPA while not even aware of the other benefits of UPA, let alone of its possible social and environmental benefits. As Quon (1999) found that without awareness of the social, economic and environmental benefits of urban agriculture, clear government response passively in the land use planning process, and provide less resources, technical and financial support.

2.5 approaches promoting UPA

UPA is operated in much form such as in the gardens, backyards, small plots However, in recent years, with the increase of scale of urban agriculture, the supportive originations are emerging which can make small producers together, deliver information, training to the producers as well help them to join market.

Bon et al. (2009) point that to avoid or mitigate the problems of pollution, organic agriculture as suggested alternative has been already pushed in many cities which is also benefit for the biodiversity. They also present the practicing system that first to diversify their activities which can reduce the cost as well as avoid the risks for environment and human being.

Chapter 3 Materials and Methodology

This chapter start by giving a brief description of research area, the periphery of Zhengzhou city, and then the methodology and structure of research questions applied in the case were illustrated.

3.1 The state of UPA in Zhenghzou

Zhenghzou city is the capital city of Henan Province and best known as a major transportation hub of China. It covers an area of approximately 7446.20 square kilometres with an estimated population of 8.66 million according to 2010 census, of which 329 square kilometres is built up area and 5.51 million live in built up area. The total cultivated land is 2921 square kilometres. The city lies within the region where agro-climate conditions are characterized by continental monsoon climate with an annual average temperature of 14.3℃ and a non-frost period of up to 220 days, which is suitable for grain , oil plants, vegetable and fruit producing; The annual precipitation averages 640.9 mm.

Zhengzhou city has prominent regional and transportation advantages and has experienced rapid economic growth in recent years as well as the average disposable income for residents in urban and rural areas, according to the 2010 statistic they are RMB 12893.82 and RMB 12438.16, respectively. The City is becoming increasingly urbanized with more than 63 per cent of the population living in urban areas in 2010 (figure 3). It is a combined result of rural –urban migration of rural people seeking employment in cities and the extensive spatial expansion of cities into rural areas. This enormously change in a short period has brought along more challenges to local context: the disparity between urban and rural income, loss of farmland, loss of diversity, deterioration of environment, etc.

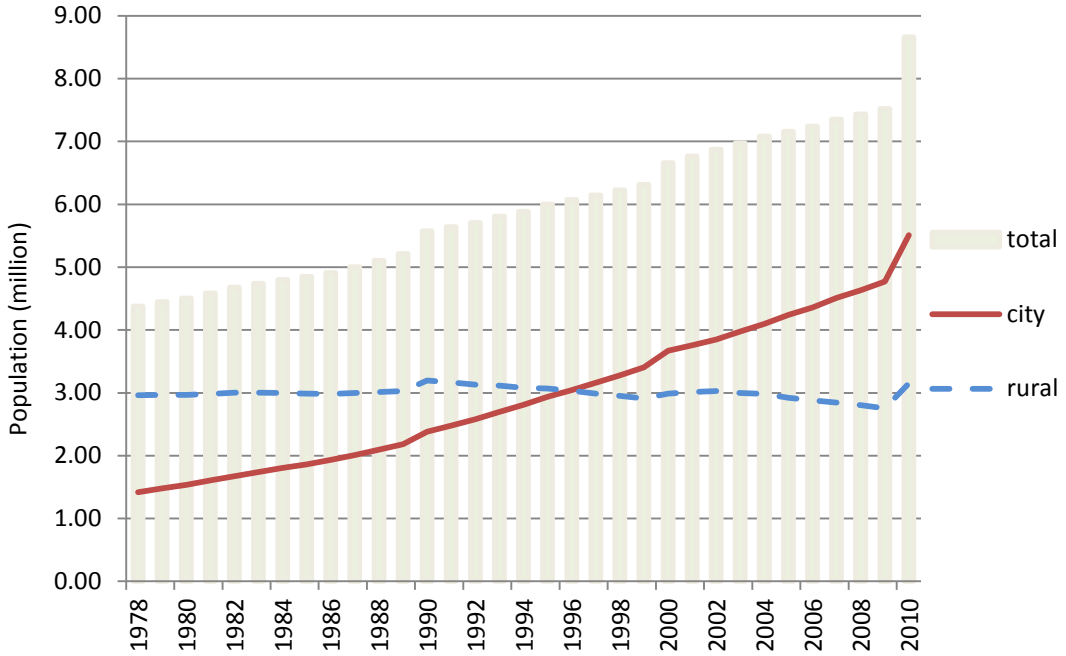

Figure 3 The comparison of urban and rural population in Zhengzhou

(Source: http://www.zzstjj.gov.cn/tjww/tjsj/ndsj/webinfo/2011/12/1323917831719836.htm)

To meet the demands of urban residents looking for a better liveable city and cope with these challenges, and make the city more liveable and sustainable, the government learned experiences from other cities, like Beijing, Shanghai and Wuhan and integrated the development of UPA in peri-urban area within the Zhengzhou Master Plan (Figure 4) according to the local conditions.

Urban agriculture takes several forms in Zhengzhou, which can be categorized into five groups according to major purpose: small-scale farm cultivation (survival), recreational agriculture (leisure), agriculture demonstrated parks (exemplary) and agricultural production base (commercial) and urban forest (ecological) (Yang 2011). The most important manifestation of UPA in Zhengzhou is recreational agriculture or agro-tourism which draws more attention from urban dwellers, policy- maker and researchers. Recently more profitable recreational activities are well-planned and created, such as fishing, sightseeing, growing and pick your own vegetable and

agritainment[3]. In addition, there are many traditional harvest festivals organized by local governments or cooperatives referring to a specific product. For example the Zhongmu Watermelon Festival, where visitors enjoy not only watermelon picking and taste fresh fruits with their family, but also the annual competition of local producers to pick out the biggest watermelon.

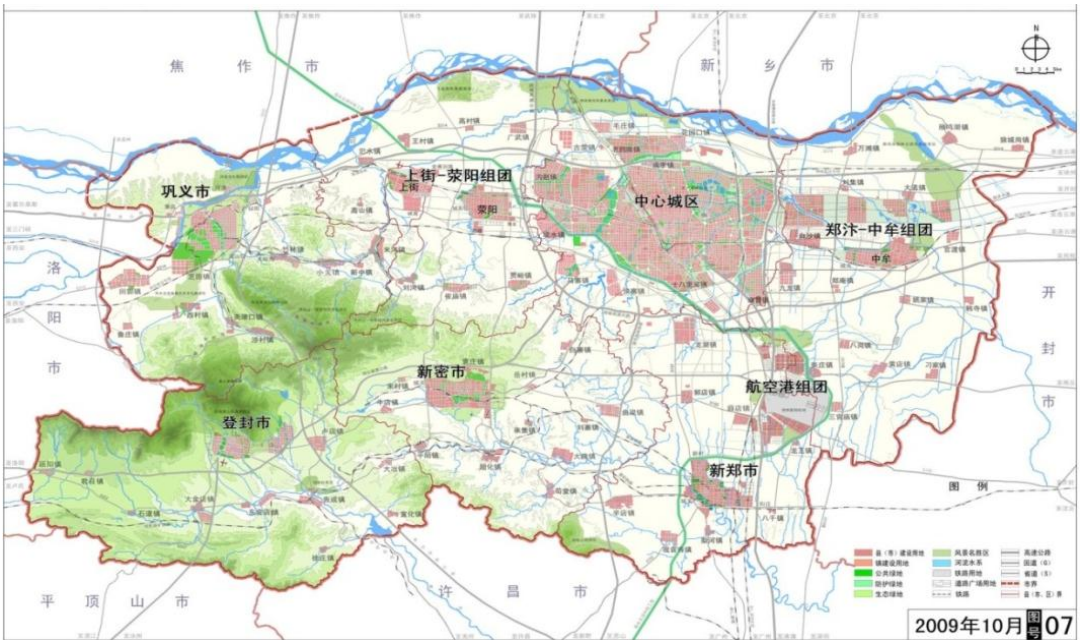

Figure 4 Map of Zhenghzou City Planning

(Source: Zhengzhou Planning Bureau)

It is existed extensive and varieties of products are produced by families or enterprises. The peri-urban area is recognized as the basket of grain, vegetable, fruit, meat, eggs, milk and aquatic product for urban and rural dwellers. Its main stable crops include maize, cotton, and wheat. In addition, Zhengzhou also produces cash crops such as Yellow River carp, Zhongmu watermelons, Xinzheng jujube, dried persimmons, Guangwu pomegranate and Zhongmu garlic, all of which are specialties that are rarely found outside the region. Sanquan and Synear, two of China's largest fast frozen food producers and the major consumers of local food products, are also located in the city. The development of urban agriculture also enjoys the advantages of credit, market information, human resources, technology and close to market in Zhengzhou city.

[3] Agritainment: it is a blend of words agriculture and entertainment.

Rely on the business advantages of the rapid development of exhibition economy, Zhengzhou City benefits from its convenient transportation, is hosting a series of large-scale regional and national business exhibitions every year. In which Zhengzhou National Commodity Fair & Consumer Goods Expo is one of the three biggest national trade fairs in China. Zhengzhou City has several influential large-scale agricultural products wholesale markets in flowers, vegetables, fruit, nursery stock, grain and aquatic products. For instance, Zhengzhou Maozhuang vegetable wholesale market had a trading volume up to 900 million yuan with an 80,000 square metres trading space. It is promoting the development of a more than 200 square kilometres vegetable base directly by wholesaling vegetables to Beijing, Liaoning, Guangdong and other provinces.

3.2 Research Methodology

The study began at the stage of reviewing literature to have an idea about urban agriculture in worldwide and in China, and next gathering general information about Zhengzhou city: secondary data on Zhengzhou's agricultural, economic and social conditions. On the basis of a comprehensive understanding of the context, more specific information referring to UPA was collected. In the same time, a package of methods including email with local researchers and telephone interviews with local village officials was applied to define UPA, survey scope and main research questions.

Figure 5 Zhengzhou Administrative Boundary and Research Area

According to Zhengzhou City Planning (2009-2020), we defined the study area as villages enveloped by the city and the peri-urban area which is showed on the map with an inner circle indicate the city centre and the area between inner and outer circles is defined for case study. Many small-scale farming, recreational agriculture, and agriculture demonstrate parks are located in this area. While there are many studies on recreational agriculture and agriculture demonstrates parks, I mainly focus on households take part in urban agriculture activities in a small-scale farmland. The selected households are most in junction area of the city with district (county level) and township.

The fieldwork took place during 5th and 18th June, 2012. In this stage, the work was conducted by my local friends. They suggested that do not use a written questionnaire since most of farmers do not willing to answer it and it is better to have a talk with them to obtain their recognition. Then semi-structured interview is an alternative and applied in the field work. I outlined the main questions and prepared scrip for interviews.

Information and data gathering by methods of field observation and semi-structured interviews have been used to assess impacts and contributions of UPA on food security, income generation, ecological diversity and environment awareness on ways of dealing with wastewater and organic wastes on household level.

The first group of questions were about basic household information, age, gender, educational level, main labour in household, migrants or not. For collecting this information, I want to understand the socio-demographic characteristics of study area. Beyond this, the information of who is actually responsible for urban agriculture production, consumption and management, the educational status of main labours, differences between younger and older persons as well as between local people and immigrants in agriculture.

The second group of questions were asked to obtain the structure of agriculture system, agriculture practices, agricultural input and output, market performance. Particularly, how household distribute their food products and motivations, their food availability

and food consumption, the income structure, job opportunities and how they get access to and communicate with market as consumer and producer respectively. Also some questions about how local cooperatives operate were talked about.

The third part of questions was mainly about the environmental awareness and their behaviours in practicing UPA or operating relative business. Since the environmental impact of it cannot be so notable in a short-term and difficult to measure. In the study, the perception of environmental problems and how the household member response to the increasing environmental degradation and ecological deterioration concerning to waste disposal and use of wastes as raw material, or waste regeneration.

In the analytical stage, both the qualitative and quantitative information collected from 56 households involved in UPA was analysed to get a primary understanding and conclude the findings in the specific context. Then compared them with the generally characteristics in literature to get gaps between global experiences and in Zhengzhou city. Last but one, it is to indicate the advantages and bottlenecks. Finally, generate some recommendations for the development of UPA in Zhengzhou city.

Chapter 4 Results and Discussion

Urban Agriculture can be considered one of the most important elements in cities for achieving sustainability. In this chapter, I present the results based on the information obtained from interviews in peri-urban area of Zhengzhou city and address major gaps comparing with the literature to analysis what role of UPA plays for sustainable development on household level.

4.1 Socio-demographic results

In the case study, a total number of 56 households living in peri-urban area of Zhengzhou city were randomly selected and visited. Four aspects of information refer to socio-demographic, economic, environment and cooperatives was communicated.

4.1.1 Gender and education

The ratio of gender involved in urban agriculture is influenced by social context, economic activities, the production system and the areas then involved. In the case of this study, men and women have significantly differences in terms of household head.

Table 2 Household Head categorises by age, gender and region

Labour force	male	female	total	Percentage (%)
Local youth(< 35)	6	3	9	16.07
Local middle age(35-60)	25	7	32	57.14
Local old (>60)	9	2	11	19.64
Migrants	4	0	4	7.14
Total	44	12	56	100

Of which, 12 household heads are women, accounting for 21.43% of total interviewees (Table 2). Which might be one of the reasons is that men are always recognized as household head in traditional culture and in registration system, women who can only replace their husband as representatives for some reasons including death, separation and their husband leaving rural areas for working in the cities. In spite of this, women

take more or less equal farming activities with men and even more in domestic work and marketing activities in reality. 9 of 12 (75%) women interviewed indicate that they were mainly responsible for sell their agriculture products in farmers' markets or as street pedlar all year around to diversify their income sources. 21 of 44 (47.72%) men did involve in marketing and most of them were accompanied with their wife.

Moreover, on the contrary to common experiences of many other countries, the farmers of urban agriculture are almost farmers from rural area. Since the land in rural area are owned by the village collectives and distributed according to household size, labour size or combinations of both (Jin & Deininger 2009). Although after the land tenure reform in 2008, farmers began to have permanent land use rights and free transfer rights, less of them transferred. Therefore, urban resident and immigrants are difficult to get access to cultivated land. Then less immigrants are in this area accounting for 7.14% of the total interviewed household and they took over the land from people who are no longer in agriculture and all of these four household are engaged in cash crop production, like garlic, watermelon, and peanut, etc. and deriving almost of their income from it.

Table 3 Educational level of household head

Educational Level	Male	Female	Total	Percentage (%)
Less than 6 years	21	2	15	23.21
6 to 9 years	31	5	27	48.21
9 to 12 years	3	6	9	19.64
More than 12 years	2	3	5	8.93
Total	44	12	56	100

The agriculture labour in Zhengzhou is with relative low of overall quality scientific and technological level (Table 3). According to the data, the average educational level in the periphery area is around 7years, with 8.93% beyond 12years, 19.64% during 9-12 years, 48.21% are 6-9 years and 23.21% are less than 6 years. The following have received professional skills training accounting for 9 %. So as it is, women who are representatives of household are younger and more educated. With the increasing number of young male labour force in rural areas migrate to non-agricultural industries year by year, the phenomena is prevalent in this area that more elder and women are

engaged in agricultural production. The farmers in 35 – 60 years old group occupy more than half of the total. These remaining labour forces due to the low educational level and capacity are unfavourable factors that constrain and hinder the development of urban agriculture.

Compare with the experiences from other cities all over the world, firstly, producers who are practicing urban agriculture are initially farmers in traditional rural agriculture rather than urban dwellers. It might due to their village or their farmland are enveloped by the rapidly expanded urban area and planned by the government and researcher, then rural farmers are involved in the urban passively based on the illustration provided by Qiu et al. (2005) on the path of urban agriculture development in China. Secondly, this study also confirmed that women are predominated in urban agriculture actually like other countries.

4.1.2 Farming system

In peri-urban of Zhengzhou, like farmers did in most northern China cities, they had initially grown wheat and maize and then changed to approximately same area of cash crops. From the survey, about two-thirds of the cultivated land of household is used for planting garlic (late August to the next May) and watermelon intercropping with maize (early March to mid-August) while the remained one-third is devoted to grains and vegetables mainly for household consumption. There are 6 households involved in animal feeding, one for fishing, three for poultry and the rest for pig and cow raising but still keeping in cultivated activities.

There are more species of vegetable planted in rotation in Zhengzhou peri-urban areas, which can be classified according to principal calendar of growing vegetables as: in spring (February to may) are planting cucumber, tomato, eggplant and long bean; in summer and Autumn (May to November) are planting water spinach, spinach, lettuce, celery, cabbage, and green Chinese onion, Chinese cabbage, radish.

The cultivated land size of household is depended on the household size and average land size (Table 4). Since both the household responsibility system and land tenure system explained by Jin and Deininger (2009), people have right of transfer it. But most of them who are no longer in agriculture sector always leave their land to household. In additional in order to reducing operational cost, land is cultivated by the household member together. In more density villages, the average land is about 2 mu and that is 4 mu in less density area.

Table 4 Distribution of cultivated land (mu[4]) respect to household size

Household size	3	4	5	6
Sample(household)	9	37	7	3
Frequency (%)	16.07	66.07	12.50	5.36
Main Labour force	2	2	3.2	3
cultivated land(mu)	7-10	8-16	10-20	10-25

Learning from the household size distribution is shown in Table 4, the most common household size is 4, always parents with two children which accounting for 66.07% of the total household interviewed. Household with three members is less common. The household have 5 and 6 members are even less. But there are only 2-3 household members practicing agriculture activities.

Households in peri-urban area of Zhengzhou produce vegetable and oil plant one third of their farmland for self-consumption and the rest is used for cash crop production to generate household income. The reason for this phenomenon is generally recognized as the diversified planting can help them to ensure household livelihood by reducing expenses on high price products consumption and confront risks from market price. This coexisted system is reasonable for households who live their livelihood largely depend on agricultural production in the research area.

[4] The most commonly used unit in agriculture is mu. 1 mu equals to 0.0667 ha and $0.6667*10^{-3}$ square kilometres. To make consistency in the thesis, the following data is calculated in accordance with mu.

4.2 Food security

During the study, the average amount of foodstuffs consumed by household member were estimated and showed in the Figure 6. Different districts in Zhengzhou administrative boundary were classified respect to the geographic lactation, inter or peri-urban. The average data of different group are calculated

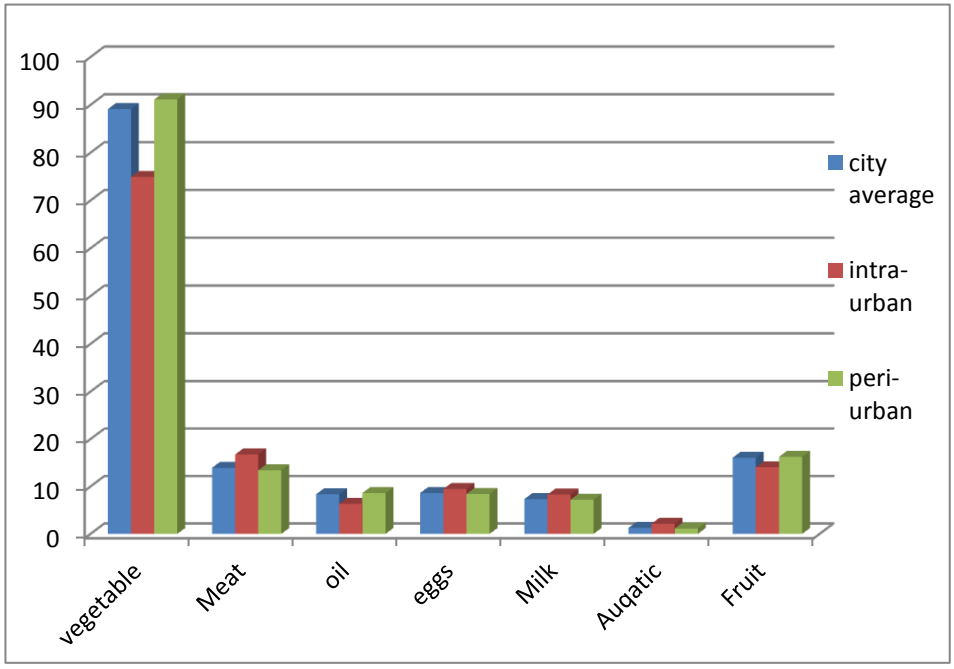

Figure 6 Comparison of foodstuffs between intra and peri-urban (kg/per person per year)

(Source: 2011 Zhengzhou Statistical Yearbook)

It is obvious that people in peri-urban and rural areas consume more fresh vegetable, oil and fruits than that in intra-urban areas and less consumption on meat (pork, beef and poultry), eggs, milk and aquatic food. The households interviewed also confirmed that they consume more fresh vegetables all year around than their friends and relatives by comparing the amount of that they purchased from markets. Produced own vegetable for make household available to ensure their food security by reducing expenses to obtain fungible income which can be used for other nutritional products. 31 of total 56 interviewees explained that they have consumed more and more meat, milk and aquatic food, especially in the case of women are responsible for preparing food put more attention on elder and children' diet.

In the survey, it was found that household consumed 70% of vegetables, 60% of oil crops, and 95% of grains that produced by themselves, purchased meat products, eggs, milk, fruits and fish from farmers' markets or supermarkets. It should be pointed that they exchange 5% of grains and 15% of oil with their neighbours and give them to their relatives as presents. The rest 30% of vegetable products and 25% oil were sold in various markets or street vendors. For example, when they sell their watermelon by a truck in street corner, they always set some space aside for fresh vegetables or other products. Since the vegetables are for self-consumption, they always plant in an organic way which is thought much safer. But it is not well assessed that whether there are other element may be detrimental to consumers, such as metallic element in soil.

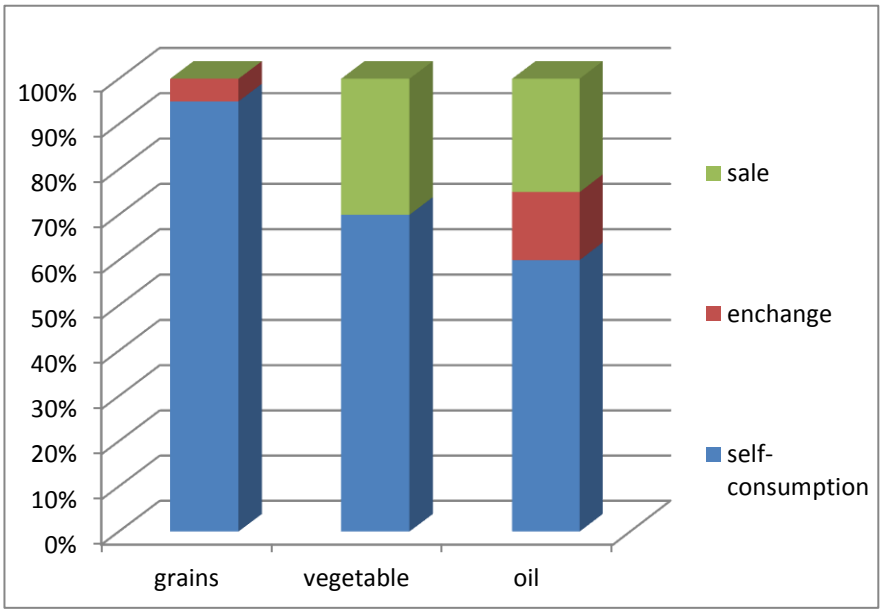

Figure 7 Distributions of urban agriculture products

Therefore, we can conclude that households practicing UPA activities are thought more advantageous in improving their food security because of better quality and quantity of food that are available and accessible, which may lead to a higher nutritional and health level of household. On the other hand, food products consumed in producers' household or sold in a variety of markets can increase the food supply and food security in cities.

For the urban dwellers, who have increasing demands of fresh vegetable and fruit products, and they can buy them in a relative low price. Then, by buying fresh food

from UPA farmers, both of them can benefit. Although there is currently no data about the amount of fresh food stuffs they consumed, urban dwellers can buy more fresh and safe products. The prices[5] of cucumber, tomato and eggplant, which are the most commonly consumed vegetables in summer in study area, have been compared in farm, farmers' market and supermarket where then purchased in the study period.

The prices of vegetable in supermarket are 35%-107% higher than that directly purchased in farm and farmer's market. Then old urban dwellers prefer to purchase perishable vegetable and fruit in these two kinds of markets(Zhu et al. 2009) rather than in supermarkets because of the relative low price and much fresher while they prefer to purchase meat, milk and aquatic food in supermarkets where the quality can be guaranteed. Thus, urban consumers also get access to fresh food stuffs at a lower price.

Table 5 Comparison of main vegetable price in three different markets

	(1) Farm	(2) Farmers' Market	(3) Supermarket	(3):(1)	(3):(2)
cucumber	0. 92	1.3	1.57	0.71	0.21
tomato	0. 82	1.3	1.7	1.07	0.31
eggplant	1.4	1.93	2.6	0.86	0.35

Then it can be concluded that urban agriculture, especially vegetable production is satisfying a certain percentage of urban vegetable demand. However, it doesn't mean that UPA plays significant role in supplying more vegetable and fruit to urban dwellers.

4.3 Income generation and employment

The city are expanding everyday with urbanizing and populated more and more people who migrate from rural areas to seeking better livelihood here. It is said that the most important economic benefit of UPA for the household is income generation, not only for who do agricultural activities but also for other local people by creating job opportunities in the processing, transporting, marketing, etc.

[5] The price was recorded on 7, 14, and 18 June and values in Table 5 are average price.

Baumgartner and Belevi (2001e, p10) defined the income from urban agriculture into fungible and real income. Producing of foodstuffs for self-consumption makes household save a certain amount of their income otherwise have to spend on purchasing them, especially green leafy vegetables. Then the income saved by consuming self-production food is so-called "fungible income", which takes a big share of the total household income. According to the description of households, they get grain crops by producing themselves or exchanging with neighbours or relatives, and growing oil crop. Nearly 80% of vegetable the consumed is produced within one-third of their cultivated land. For example, the average consumptions of grain, vegetable and oil are 177.54 kg, 91.12kg and 8.59 kg per person per year (Figure 6) respectively. Then the average income saved by consumption of self-products per person is summed to RMB 623.22[6], which takes up around 4.9% of the average income for one person. At the same time the real income from sale of products on markets are different from household to household. But 49 households confirmed that income from selling vegetable on market was increasing and it is an important cash income for their families which accounts for 10 % of total income in average.

Information collected in the study area shows that agriculture is still the dominant source of households' total income for 37(66%) household are almost full-time worker in labour-intensive agriculture and without other source of income than urban agriculture. The other members of household may take part in urban agriculture as full time job or part-time paid job in other sectors. For them the part-time job has happened just in the slack season in winter.

Based on the survey of 56 households', it shows that higher-income farmers engaged in not only high-value cash crops, like garlic, watermelon and peanuts which is more or less same as their neighbours did, but also take much more part-time jobs in cities and villages. For example, biogas tank constructions in the village, one can spend 2days on building one tank then earned RMB 120-200 and also provide other equipment to the

[6] The average price of flour, vegetable and oil are RMB 2, s and 10 respectively. The estimated expenses on these three food for per person is calculated as: 177.54kg*2 +0.8*91.12kg*2.5+ 8.59kg*10=623.22

biogas users, like biogas stove, biogas lamp as well as services.

The average income of the highest group is 19738, which is 1.55 time than that of study average of RMB12735. Within the highest group, four out of five household have at least one member engaged in part or full time paid job in construction services sectors.

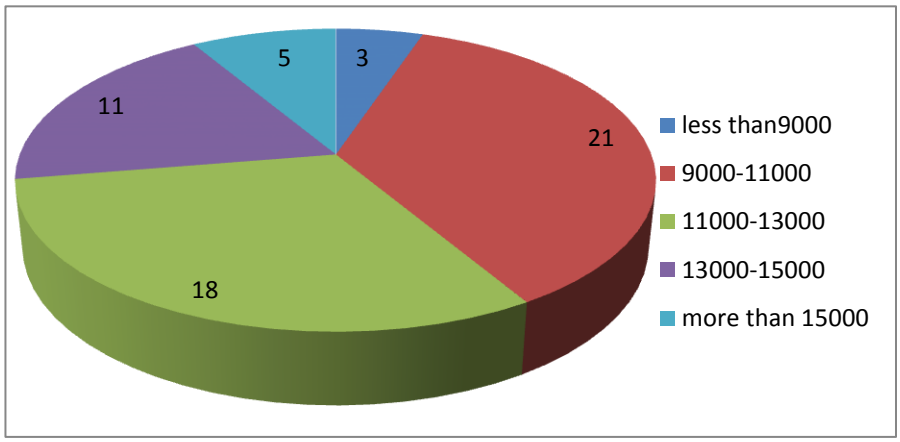

Figure 8 Classifications of household income (RMB/per person per year)

From the above Figure 8, it is certain that UPA can contribute to household income in fungible and real forms even the proportion is not as significant as that from part-time job in other businesses. And most of the job opportunities created in urban agriculture in the study villages is absorbed endogenously. Since for the immigrants, it is very difficult for them to be recognized by local people.

What should be taken into consideration is that the members who take part-time job are always young and middle aged male labour force in UPA. High degree of labour rely on part-time job may on one hand, more elder and female labours are practicing UPA, and on the other hand put less attention on farming, both resulting in a decreased quality of urban agricultural activities.

In this study, the function of income generation has been proved. However, the extent of its contribution to the total income is relative low. The role of UPA in employment is not so obvious. As observed in the peri-urban area of Zhengzhou city, the job opportunities are mainly part-time job and always more easily available by local people who also in

agriculture production as a farmer.

4.4 Marketing and Cooperatives

4.4.1 Households' concerns to marketing

When asked to list the most important problems affecting their agriculture activities, as presented in literature and expected, fluctuation of food price and its unpredictable was the top one (47 interviewees mentioned it as the first choice). Communicate with market which the second is highly mentioned problem is close behind. Expect price of products, marketing, price of agriculture input, technology (18) and training (15), agricultural subsidy policy (8) and disastrous weather also (7) draw some attention from farmers.

Table 6 The ranked concerns in urban agriculture

Rank	Concerns	Cumulative number	Percentage (%)
1	Price of products	47	83.93
2	Marketing	41	73.21
3	Price of Agriculture input[7]	28	50
4	Technology	18	32.14
5	Training	15	26.79

Since without the price information of product and capacity to make a correct prediction, farmers slowly respond to the market and cannot make a correct decision on choosing crops. On the other hand, 66% of total household mainly practice in agriculture activities, and they are more vulnerable concerning the low price of agriculture. Even urban agriculture farmers are more close to the urban market, if it is not possible for them to sell their fresh vegetables or fruits at a higher price since they have a higher transaction cost compare with the retailers. They also care about the agriculture input price. Even the price of food is creasing, the more rapidly increasing price of agriculture input, such as pesticide, fertilizer, plastic film and seeds.

[7] It includes the price of seeds, pesticide, fertilizer, plastic film and agricultural machinery

4.4.2 Function and status of cooperatives

Farmers can decide to plant what crops and buy seeds, fertilizers and pesticides themselves as well as organize the sale of their products in the local market. However the nature of farmers makes them more vulnerable in production and in market. Within the market, the urban UPA producers who are characterized as dispersed small-scale farmers have less access to services, credit, new technologies and other marketing facilities or with higher transaction costs to obtain them, so it is difficult to meet the increasing demands of consumers concerning quality and quantity standards, and further lower negotiation power with agricultural inputs supplier and wholesaler. Some supportive approaches should be introduced to overcome these risks.

In recent years, especially after 2005, a large number of cooperatives are springing up government-led or community-led in order to deal with a high level of uncertainty and market failure, and promote the specialization of agricultural production, increase farmers' income and overcome the vulnerability of small-scale farmers in marketing.

When looking into the mechanism of cooperatives, their objectives are: to provide useful market information, seek lower price agriculture inputs with lower transaction costs, minimize risks and maximize revenue. For most farmers, this means more support are available that will improve their performances.

Based on the study about farmers’ cooperatives in Zhengzhou area, it shows that there are 194 cooperatives on agriculture, 187 animal feeding cooperatives, 20 agricultural machinery cooperatives, 11 fishery cooperatives and 11 for others in 2007 (Xu & Jia 2008). Even a booming number of cooperatives, farmers who are involved in have complaints about its services. From the report of Xu and Jia (2008) and the observation in the case study, most of the cooperative are set up based on the production activities, rather than their functions.

In opposite, it is found that less household joined in cooperatives and 11 household have ever joined but quit. They explained that most the local cooperatives operated by private

person are weak in negotiating with big wholesalers or supermarkets, providing less technical guidance and information as well as training. In addition, less government-led cooperatives are in this study area.

4.5 Environmental perceptions and behaviours

Although there are difficulties in measuring the extent of contribution of urban agriculture to environment in the study, it is observed and undeniable that urban agriculture could play a potential role in managing urban open spaces by making better and efficient use of land in peri-urban area, and cleaning the air by reducing dust and absorbing pollutants as well as regenerating the soil. For example, in the case study, we found that people no longer abandon their land when then they don't farm the land but divide it into several small pieces and rent them to urban dwellers, for what they can obtain around RMB 1000. Meanwhile, urban dweller can grow their food for themselves. This efficient land use function of UPA is thus playing an important role in reducing the negative impacts of urban growth on environment in the city by reusing organic waste in agricultural production while have a low perception on reusing wastewater.

4.5.1 Wastewater disposal

As learned from the study, since water supply in Zhengzhou is realizable and high efficient because of closing to the Yellow River, water quality of groundwater in the city is safe and the quantity us relative abundant, wastewater irrigations not so popular in the peri-urban area. In addition, a township government official indicated that a lower rate of wastewater was treated in this area, which is less than 50%. Moreover, the irrigated water in this area is the underground water from the well and farmers can get access to water easily just pay for the electronic fee. Less the farmers have an idea about wastewater irrigation or did accept it. For reject to use wastewater in agriculture, they are afraid that the waste water may contains pathogens or with higher level of chemical element that are detrimental to human.

Then it is necessary to introduce main techniques such as the drip irrigation to UPA and provide relative training about wastewater to increase the amount of wastewater used in agriculture.

4.5.2 Organic waste disposal

In the study area, biogas is the most popular method to make use of organic waste. From 2005, the municipal governments encourage and provide subsidy such as concrete and pipelines to install biogas tank in households. Household make full use of their domestic organic waste, crop straw and wastewater in biogas generation, and it is also continent to purchase pig manure by RMB 10-15 per truck which can maintain at least three months for biogas generation.

Within the interviewers, 85.71% of the total tanks are still working and more than half of them can use it for 10 months. Within the household, the biogas can be used for lighting in backyard, kitchen and toilet as well as smoking mosquito special in summer.

Table 7 Classification of Biogas Use in Study Area

	Number of Household	Frequency (%)
> 300days	7	12.5
180 – 300 days	31	55.35
60 – 180 days	10	17.86
< 60days or never	8	14.29
Total	56	100

The products of biogas can fulfil the household energy consumption, agricultural by-products producing and processing; when biogas slurry used together with a chemical pesticide, it could greatly increase the productive, reduce the amount of pesticide application and contribute to the environment protection; biogas residues can be directly used as organic fertilizer.

The economic benefit is evaluated as well. First, is the reduced the household expenses on energy consumption, such as coal, gas, and electricity. On the other way, it is greatly increased productive by using biogas slurry and biogas residues. The average cost is

estimated in table 8.

Table 8 Average cost comparison of household energy consumption (RMB)

	Before using	After using	Saved expenses
coal	560	200	360
gas	540	180	360
electric charge	600	600	0
Fertilizer	250	100	150
Total	1950	1080	870

The cost saved on energy consumption can be RMB 870 and the increased income from crop production is about RMB 200. Then total profit is RMB 1070, which is 8.4% of annual income for one person.

However, they also mentioned that the bad performance of guarantee the subsequent related services made the biogas not very well used, the service like maintenance, carry manure and the materials' input and output cannot be guaranteed.

4.5.3 Environmental problems perception

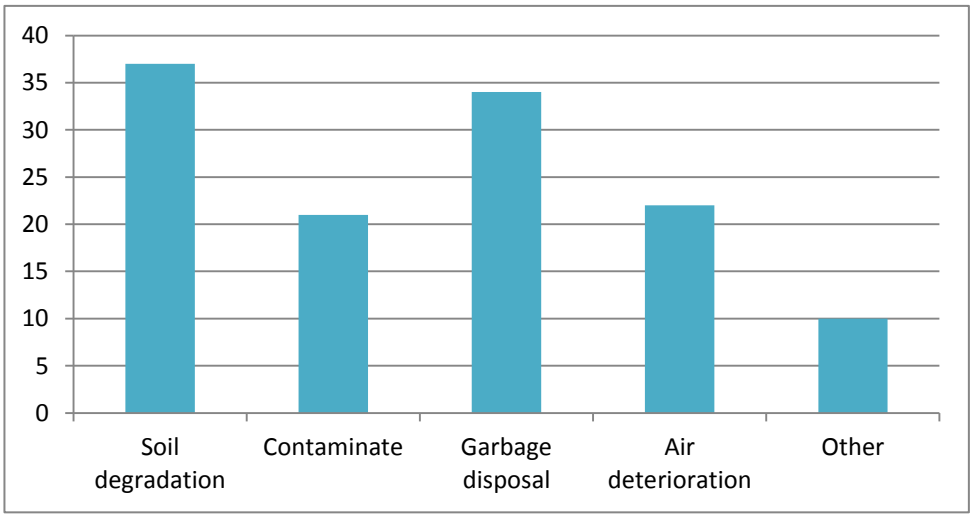

Figure 9 The perceived environmental problems

When asked about the perception of the environmental problems, they ranked the problems in their mind from the choices I supplied.

The farmers put more attention on soil degradation and the main way they applied to avoid it is intercropping and rotation. They intercrop maize, garlic and water melon on one piece of land. They also try to not use too much pesticide and fertilizers in the farmland but use biogas residues and waste straw as alternatives.

To keep a cleaning and tidy living environment, they collect domestic waste together and then will be disposed centrally. The interesting thing is that they make full use of the kitchen waste. For example, mashed eggshell can put in the land growing vegetable, and leftovers for pig or poultry feeding. It is nor common to sort the waste.

These results are consistent with some previous literature findings which concluded the positive role in using of urban organic waste. However, there are also other risks which may lead to environmental degrading, and unhygienic if poorly practiced.

Chapter 5 Conclusion and Implications

5.1 Conclusion

From the study, we conclude that UPA has become an integral part of Zhengzhou society. However, the UPA in the city periphery contains some different aspect compare with other cities in global wide.

At first, the concept of UPA in Zhengzhou owns some specific characteristics. The first findings respect to the location of UPA. It is apparently that UPA in Zhengzhou city refers to the peri-urban areas, where is the junction area of the city with district (county level) and township. According to the Zhengzhou City Planning (2009-2020), the broader region including Zhongmu county and Xingyang are also planned UPA practicing area for cash crop production. Then the geographic characteristic is not so determined and it is market –orientation.

The next finding is those producers who are practicing UPA are rural farmers. Since the expansion of Zhengzhou urban area, lot of rural farmers are now in peri-urban areas. They are more convenient to get access to urban resources as well as the urban market. Less educated elder people and men are dominated in the household management and agriculture producing while women are active in marketing.

For the role of urban agriculture plays in food security, it is significant for producers' household which supply more grain, vegetable and fruit for consumption, another source for them is enchanting foodstuffs with neighbours and relatives. But for the urban dwellers, they actually can buy more fresh vegetables and fruit from UPA producer at a relative low price but it is not so accessible for them, even the amount of vegetables and fruits from UPA they consumed is not sure. Then it is not obvious for urban dwellers.

The findings about income and employment are very similar to that of food security. Producers generate fungible and real income from practicing UPA and have priority to the created job from UPA. And household involved in the part-time or fulltime job in are with higher income.

Producers benefit from UPA but are more vulnerable in marketing activities as an individual while the cooperatives in Zhengzhou are not so well developed.

To assess the environmental aspect, the perception of UPA producers on wastewater and organic waste and their actions for improving environmental performances are analysed. They do better in organic waste by using biogas and reduce energy expenses while have not aware the advantages and disadvantages of taking use of wastewater.

To sum up, the contributions of UPA in Zhengzhou city are more enjoyed by the producer themselves.

5.2 Implications

Along with the benefits of UPA, weaknesses or bottlenecks still exist within the current system in Zhengzhou. It is also important to discuss and identify the factors that improve Zhengzhou’s UPA system. By group weaknesses or bottlenecks in to three aspects, this thesis also provides insight into the way in which Zhengzhou can further improve UPA.

UPA is practicing by farmers in Zhengzhou areas, to reduce their vulnerability and enhance the ability and equip them and have better performance, and integrated them in urban context and transforming the benefits of UPA to urban areas, it is a necessary to promote the development of farmers’ cooperatives, diversify their functions and enhance their capacity.

Although in Zhengzhou city, the urban agriculture area has already planned for, within this area, farmers didn't get any guidance or suggestions and with the insufficient socialized services and scientific research systems for their agriculture and marketing activities. Then to promote the sustainable urban development, it is better to give useful

guidance to them. Meanwhile, the development of UPA cannot be only focus on peri-urban areas of the city, since it is just one aspect of urban agriculture, not the whole. And different with peri-urban context, urban area is full of the business district, residential institutions, restaurants, hotels and entertainment places, densely populated, and even little farmland, the now modes of UPA should be created and introduced. According to the experiences from other countries learned from literature, make full and efficient use of city fragmented spaces, like backyard garden, balcony, roof, walls, stairs or containers on the ground to grow vegetables, fruits, flowers as well as horticultural products. In this way, urban land can be used in an effective way, and urban dweller can be well embedded in the UPA to fulfil their needs for UPA products.

Finally, Zhenghzou, located in North part of China, as other cities in northern China, is insufficient in water resources even it is close to Huanghe River. From the study, producers and consumers as well as governments didn’t realize potential risks of long-term water shortage and benefits of using wastewater rather than groundwater in UPA. Then governments can develop a strategy for water resources and environmental protection by using wastewater, giving high priority to the efficient use of water and water conservation. The local governments should take an active role in supporting the use of treated wastewater and invest on urban wastewater treatment facilities, and providing training or materials for a generally understand and improve the awareness of benefits from using wastewater.

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Appendix: Structure of Interview Questions

Household information

1. A description of members in household.
   age, gender, job, educational level, relation, local or immigrants;
2. Role of each member in household.
   Who are responsible for household works, who cares about vegetables, who take the work communicate with village officials, who sell their products in markets, etc.

UPA activities

1. The main products of your farmland and have you change your production and reason.
   Grains, cash crops, and the method of rotation or intercropping
2. Reasons take part in agriculture and will you continue in agriculture or you want to change;
3. the inputs and outputs of your farm
4. How many products you produced consumed by your family? What , and other ways to deal with the product,
5. Other source of food
6. The sale your products on market, who, which markets and frequency? How to decide the price?
7. Main sources of household income and ratio.
8. Do you think UPA is good for your health, physical and mental?
9. What do you think are the challenges in UPA? What are the main concerns?
10. What kind of help you get from other people, government and communities?
11. Do you know the cooperatives in your village?

Environmental perceptions and behaviours

1. How do you percept the environmental risks in agriculture? Have you do something to avoid them? Soil degradation, Contaminate, Garbage disposal and Air deterioration, or others
2. How do you think about wastewater and other organic waste? How do you deal with them in your Household?