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Master's Thesis of Science in Agriculture

**Conditions for Developing Urban Agriculture
for Sustainable Food Production**

지속가능한 식량 생산을 위한 도시농업의 조건

February 2021

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Conditions for developing urban agriculture for sustainable food production

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submitted in partial fulfillment of the requirements to the faculty
of Graduate School of International Agricultural Technology
for the Degree of Master of Science in Agriculture

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Abstract

Conditions for developing urban agriculture for sustainable food production

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More than half of the world's population lives in urban areas, and one-third of the urban dwellers live in desperate poverty without access to adequate food. Given that urban poverty has become a serious problem, urban agriculture has been regarded as one of the major strategies for securing food in various cities. Many conditions exist in urban agriculture, which vary in agricultural types and systems. However, only few studies have been conducted, that too, on a limited scale, providing information about conditions for the implementation of urban agriculture. Based on these contexts, the purpose of this study is to identify conditions for urban agriculture for its better implementation. This study used literature that focused on the food supply role of urban agriculture as analysis data to classify the urban

agriculture conditions within the three dimensions—necessity, ability, and opportunity—and the enabling and constraining conditions for urban agriculture within these dimensions were identified. Additionally, this study determined the primary and secondary conditions for urban agriculture according to the degree mentioned in the literature. Overall, our work provides a decisive guideline for identifying the priorities of the conditions to be considered when establishing urban agriculture revitalization policies. This paper will contribute to the establishment of effective urban agriculture policies in urban development and planning.

Key Words: *Urban agriculture, Food supply, Sustainable food production, Enabling condition, Constraining condition*

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List of Abbreviations

UA	Urban Agriculture
FAO	Food and Agriculture Organization
UN	United Nations
UNFPA	United Nations Population Fund
GDP	Gross Domestic Product
NGO	Non-Governmental Organization
UPA	Urban and Peri-urban Agriculture

1. Introduction

Over half of the world's population dwell on the city side, and the urban population has been rapidly expanding worldwide. According to a United Nations report, the number of urban dwellers will grow by approximately 5 billion by the year 2030 (UNFPA, 2007). Rapid urbanization has diverse negative consequences, such as the loss of agricultural land (Ayerakwa, 2017), food shortage (Gallaher et al., 2013), a higher rate of unemployment (Gupta and Gangopadhyay, 2013; Karanja et al., 2010), deforestation (Gupta and Gangopadhyay, 2013; Pulliat, 2015), and environmental pollution (Chandra and Diehl, 2019) in urban areas (Baud, 2000). In particular, the reduction of agricultural land due to urban sprawl directly affects food security (Filippini et al., 2014; Diehl et al. 2019), and fragmented agricultural land reduces the sustainability of existing food systems (Filippini et al., 2014). Simultaneously, more than 30% of the world's urban dwellers presently reside in slums (UN-Habitat, 2006; Okpala et al., 2007), and billions of people around the world remain in poverty (Fernandes, 2008). In this regard, there is a growing demand for subsistence agriculture among urbanites (Filippini et al., 2014; Filippini et al. 2018). The necessity of food security has led to the revitalization of urban agriculture (UA) among city dwellers globally (Rich et al., 2018), and the role of agriculture in food

production in urban and peri-urban areas is becoming increasingly important to ensure food demands are met (Filippini et al., 2014).

Ensuring food security within the urban population, particularly in the poorest households, has become a tremendous challenge in many cities (Oyedele et al., 2017, Korth et al., 2014). Millions of urban poor cannot afford enough food to stay healthy, and this has had adverse effects on their well-being. This situation is not limited to the Global South, but it is also evident in the Global North (Gupta and Gangopadhyay, 2013; Jonas and Wilson, 2018). In addition, as globalization has increased, many countries have been importing much of their food supply. This incidentally increases their vulnerability to global shocks, such as the coronavirus disease (COVID-19) pandemic. This emphasizes the importance of producing food within cities or regions (Mcdougall et al., 2020; Olsson et al., 2016).

Several benefits of UA have been identified in the previous studies, including strengthening social bonds (Alaimo et al., 2010, Ghose and Pettygrove, 2014), providing cultural spaces (Saldivar-Tanaka and Krasny, 2004; Schmelzkopf, 1995), and enhancing environmental quality by supporting ecosystem services (Ayerakwa et al., 2020; Barthel et al., 2010; Gardiner et al., 2013). This study focuses on the role of urban and peri-urban agriculture (UPA) in increasing the food supply for individuals, households, and communities, thus improving food security (Corrigan, 2011). It is evident that UA has long since been a significant component of food systems by

providing humankind with necessary nutrition (Badami and Ramankutty, 2015; Korth et al., 2014), and the eradication of hunger and poverty has been considered an international priority (Khumalo and Sibanda, 2019). However, ensuring food provision for urban citizens has proved to be of significant difficulty (Khumalo and Sibanda, 2019; Briassoulis, 2009). Therefore, feeding a growing urban population that is facing food insecurity, will be one of the significant humanitarian challenges of the next century (Khumalo and Sibanda, 2019; Nel, 2012), and the Food and Agriculture Organization (FAO) now considers UA as the potential to encourage urban food security (Redwood, 2012). For this reason, this study will focus on the role of UA in ensuring food security.

The promising benefits and opportunities of UA have been found in many studies within urban contexts; however, a small study has been conducted to examine the specific conditions that enable successful planning and implementation of UA (Mendes et al., 2008). A recent study stated that various factors influence sustainable food production in urban areas, ranging from available areas, climatic conditions, topography, water availability, soil quality, and motivations that drive city gardeners (Richardson and Moskal, 2016; Ruggeri et al., 2016). A few studies were conducted to determine the elements that contribute to the successful implementation of UA. However, these studies were limited to a specific city, country, or continent, and minimal research covers a particular facet, which has an influence on the

successful development of UA (Koont, 2008; Shumate, 2012; Rosset, 2005; Wiggins, 2005; Bal, 2009; Opitz et al., 2016; Grebitus et al., 2017; Bourque, 2000; Ha et al., 2015, Prain and De Zeeuw, 2007). In this regard, there is a need to systematically classify the components of UA by conducting a study on the overall conditions and factors for the introduction, development, and maintenance of UA to improve future decision-making and help formulate relevant government policies and urban planning strategies (Chandra and Diehl, 2019). Thus, this research examines the enabling and constraining conditions influencing the introduction, implementation, and sustainability of a range of UA activities, and the role of UA in food supply, filling the gap between UA influential factors described in preceding research and the successful implementation of UA. Considering the enabling and constraining conditions for UA, the purpose is to summarize the case studies related to UA activities in order to: (1) identify what conditions that influence UA are described in the literature and (2) classify UA enabling and constraining conditions. Through this, it bridges different fields of study and links conversations that take place in various locales on the subject of enabling or constraining conditions for UA as a role player in food supply.

2. Review of Literature

2.1. Urban Agriculture and Knowledge Gap

Various previous studies have confirmed that there are gaps in policy adoption and implementation of UA, and in institutional actors and various stakeholders within UA (Dubbeling et al., 2010; Huang and Drescher, 2015). Moreover, many actions supporting the promotion of UA have increased steadily, although there is still a certain institutional reluctance for the inclusion of UA in domestic urban master plans (Cissé et al., 2005). Additionally, it was found that there was little data available in establishing effective UA plans, guiding principles, targets, or goals for implementing UA (Mendes et al., 2008).

By reviewing previous research, it was discerned that there are still fewer studies that provide information for establishing effective UA policy, and it is apropos to investigate what factors enable or constrain the practice of urban and peri-urban agriculture to improve food security in low-income households (Khumalo and Sibanda, 2019). Thus, more studies are needed to systematically classify the factors of UA to improve future decision-making and help formulate relevant government policies and planning strategies (Chandra and Diehl, 2019).

2.2. Urban Agriculture and Condition Analysis

Research on the conditions for UA has been carried out in various ways by identifying the conditions that affect UA (Table 1). However, these previous studies were limited to certain cities, countries, or regions as research areas (Bal, 2009; Koont, 2008; Wiggins, 2005) and they addressed UA conditions restricted to specific fields, including social, economic, and political conditions (Opitz et al., 2016; Grebitus et al., 2017). Shumate (2012) found factors of successful UA planning and implementation by conducting case studies in the Waterloo region and Agriburia in North America. From the Waterloo region, the success factors were observed in two-factor categories; individuals and groups, and UA success components were observed in two-factor categories: people and economics in Agriburbia. Both case studies covered UA conditions with limited boundaries focusing on human characteristics and economic aspects. Furthermore, Grebitus et al. (2017) investigated the success of UA in the aspect of consumer behavior in a case study in the USA. Koont (2008) also explored various principles underlying UA success in Cuba by analyzing technological, political, historical, and economic circumstances. However, all these studies were limited to certain areas of analysis.

Therefore, this study includes various fields and classification systems to categorize the UA conditions that led to the occurrence, continuation, and development of UA and the world case study of UA. Thus, it can be said

that this study is a more comprehensive and systematic study that is different from the studies addressed so far.

The analysis of enabling conditions has been conducted in various academic fields. In particular, the study of 'enabling condition' conducted in social science was used for identifying enabling condition for decision making (Waite et al., 2015), knowledge conversion (Martin-Niemi and Greatbanks, 2010), payment for ecosystem services (Huber-Stearns et al., 2017), and knowledge organization (Choo and de Alvarenga Neto, 2010). These works chose a literature review methodology to identify the enabling conditions of their research subject. It is a well-known fact that scientific research articles or published journals are excellent materials conveying validity to research subjects. Furthermore, the academic journal's peer review process justified the information of the paper. Based on this fact, a literature review analysis using academic literature focused on UA opted for this study as well.

Table 1. Urban Agriculture and Condition Analysis

Title of research	Research area	Conducted condition category/ Used term	Citation
Urban agriculture/community gardening: Starting and maintaining successful programs	USA	Social, economic & political	Bal (2009)
A Cuban success story: urban agriculture	Cuba	Social, economic & cultural	Koont (2008)
Success stories from African agriculture: what are the key elements of success?	Africa	Success elements	Wiggins (2005)
Contributing to food security in urban areas: differences between urban agriculture and peri-urban agriculture in the Global North	Global North	Ecological, social & economic	Opitz et al. (2016)
Relationship between consumer behavior and success of urban agriculture	USA	Ecological, social & economic	Grebitus et al. (2017)
Urban agriculture and related water supply: Explorations and discussion	Australia	Constraints & factor enabler	Moglia (2014)

3. Theoretical Background

3.1. Urban Agriculture and Food Security

Urban agriculture (UA) is a concept that has attracted increasing environmental activity, poverty activists, and urban planners because of its ability to cope with various environments, including economic and social pressures in urban areas (Henn and Henning, 2002). To date, scholars have established various definitions of UA. The basis of all these definitions is that UA is associated with food production on the city-side. Some scholars put their focal point on inner-city areas when considering UA (Howe, 2002; Broadway, 2009; Cohen et al., 2012), on the other hands, few others focused on agricultural activities not only in inner urban areas but also in peri-urban areas in their study (Mougeot, 2000; Pearson et al., 2010; Van der Schans and Wiskerke, 2012; Mok et al., 2014). This research defines UA according to the FAO's definition as follows: the growing of plants and the raising of animals within and around cities (FAO, 2019).

UA has a great capacity to cope with the various environmental and social pressures arising from urban areas, and it has been proposed as a possible solution to global challenges. Different roles of UA are emphasized under various circumstances depending on the purpose of practicing UA in

certain areas, and it is known to play an important role in food and nutrition security, health, development of local economies (Chagomoka et al., 2015; Vitiello and Wolf-Powers, 2014, Smart et al., 2015), social inclusion and gender relations (Olivier and Heinecken, 2017), and ecological and environmentally sustainable management (Gren and Andersson, 2018; Hanson and Schrader, 2014; Broadway and Broadway, 2011). Among various UA functions, this study focuses on the role of the food supply by emphasizing the contribution of securing food within and around urban areas.

There are four aspects to food security: food availability, accessibility, utilization, and stability, and this study mainly focuses on food availability and food accessibility in the context of UA development. Food availability means that there is sufficient food to address supply and meet people's needs (Chappell and LaValle, 2011). In the aspect of food availability, UA associated with dietary diversity and calorie availability. From the research conducted by Zezza and Tasciotti (2010), it is evident that confirmed there is a correlation between the participation of urban households in agricultural activities and improvement of dietary diversity and calorie consumption. Food accessibility refers to the physical and economic ability to obtain food (Rocha, 2007). It is recognized that over half of food insecurity is induced by obstacles that keep people from acquiring food (Chappell, 2018). When urban households produce food through UA, they have easier access to nutritious food while supporting a more diverse and qualified diet.

UA can provide more stable sources of food and reduce the negative impacts of variable food prices. In addition, household food expenditure can also be reduced to ensure costs for food or additional needs (Poulsen et al., 2015).

As urban poverty intensifies, food security in urban areas remains an urgent priority. Not only in the Global South, but also in the Global North, millions of urban poor cannot afford nutritious food to stay healthy, which has affected the well-being of the urban poor globally (Jonas and Wilson, 2018). In addition, ensuring food provision for urban citizens will prove to be one of the greatest difficulties facing humanity in the next century (FAO, 2017). The importance of UA continues to be discussed as an alternative to urban poverty and food insecurity as it can increase the physical supply of fresh and nutritious agricultural products and improve the economic access of urban poor to food (Stewart et al., 2013). Thus, it is an opportune time to investigate the enabling or constraining conditions for adopting, implementing, developing, and sustaining UA in terms of the UA food supply function.

3.2. Urban Agriculture and Income Levels

There are different reasons why UA is taken up in cities across the world, and the diverse approaches to UA by income level have been discussed in many prior studies (Stewart et al., 2013). According to the World Bank in 2019, ‘low- and middle- income countries’ consists of three categories, according to their level of incomes: ‘low-income economies’ which are countries where the GDP per capita is lower than or equal to \$1,025 per year, 31 countries fall in this category; ‘lower-middle-income economies’ (GDP per capita between \$1,026 and \$3,995 per year, 41); and ‘upper-middle-income economies’ (GDP per capita between \$3,996 and \$12,375 per year, 60). The World Bank has identified a group of 80 countries as ‘high-income economies’, where the GDP per capita is over \$12,375 per year.

A comparison of UA in the low- and middle-income countries and high-income countries reveals both similarities and differences. Certainly, the discussion of food security in urban areas varies from region to region. Food insecurity issues re-emerged in the cities of the high-income states, and with-it, UA, it never went away in the low- and middle-income states (Bryld, 2003). The rapid growth of some cities has led to poverty, food insecurity, and increased unemployment amongst the urban population (FAO, 2007; Dubbeling et al., 2010).

Most researchers have identified that low- and middle-income groups

engage in UA to secure food, generate profits, or produce supplementary for their living (Bruinsma, 2001). On the other hand, many high-income households implement UA with concerns of environmental and socio-cultural benefits (Bowler et al., 2010; Stewart et al., 2013). In other words, different aspects of UA can be observed depending on the purpose of performing UA, which varies depending on the income levels. Thus, diverse conditions can be identified that enable or obstruct the implementation of UA.

3.3. Enabling and Constraining Conditions

The notion of enabling conditions has emerged in several academic fields, including political science, economics, and ecology. The enabling condition has been applied to a variety of subjects and in a range of contexts, and some scholars have even found certain enabling conditions in their study (Dawson and Robinson, 1963). Several researchers have emphasized the significance of enabling conditions as “creating the enabling conditions for policy implementation” and foundational need for “knowledge” (Rands et al., 2010).

The enabling condition is “an imperative concept to increase the likelihood of an intended change in the governance approach, strategy, or management regime” (Huber-Stearns et al., 2017), and diverse terminology is used to refer to the concept of enabling condition (Table 2). According to the precedent studies, “the presence of enabling conditions can facilitate the emergence of a policy, whereas the absence of key enabling conditions can present a barrier to management or sustained policy action” (Huber-Stearns et al., 2017). For this reason, conducting research on enabling conditions is crucial for facilitating a certain scheme. Furthermore, the study on analyzing conditions that hinder the growth of certain systems is also worth investigation for enhancing the implementation of new strategies such as urban farming. For this reason, it is necessary to examine the enabling

conditions for drawing forth successful UA by conducting studies on remarkable stories. In this regard, this study deals with the enabling and constraining conditions influencing the implementation of a range of UA activities, particularly on the role of the food supply in UA.

This study defines enabling or constraining conditions for UA as elements that increase or decrease the chance of implementing UA in the governance approach, strategy, or management regime. Diverse terminology is used to refer to the concept of enabling conditions and constraining conditions. Due to the lack of a consistent and concrete definition for enabling and constraining conditions, this study examines the enabling and constraining conditions based on the terms of conditions (Table 2) and extracted the activation and inhibitory conditions being addressed in studies through contextual reading. This study seeks to investigate what UA activation and constraints various researchers and practitioners mentioned in the literature by reviewing documents from various perspectives.

Table 2. Terminology Examples of Enabling Condition

Terminology	Focal Area(s)	Citation
Variables associated with self-organization for collective action	Collective action, new institutional economics	Ostrom (2009)
Facilitating conditions for the successful governance of common-pool resources; Critical enabling conditions for sustainability on the commons	Collective action, common-pool resources	Agrawal (2001)
Antecedent conditions associated with the successful adoption and operation of community-based collaborative governance arrangements	Collaborative governance	Weber (2009)
Appropriate social arrangement for dealing with harmful effects	Transaction cost economics	Coase (1960)
Enabling conditions for policy implementation	Ecology, biodiversity conservation	Rands et al. (2010)
Preconditions for policy diffusion	Environmental policy, policy diffusion	Kern et al. (2005)
Social dimension that enables adaptive ecosystem-based management	Resilience theory, adaptive governance	Folke et al. (2005)
Enabling factors in past experiences of policy innovation	Policy innovation	Binks et al. (2020)
Create an enabling environment for policy practitioners to improve management; factors for enabling conditions in the form of enabling context and resources	Management of water-related energy	Binks et al. (2020)
Enabling context aware resource allocation	Resource allocation	Murtagh et al. (2019)

Table 2. Continued

Terminology	Focal Area(s)	Citation
Requirement to take action to protect or enhance the environment; Enablement	Sustainability practices	Murtagh et al. (2019)
Enabling environment	Community Forest Enterprises	Macqueen (2013)
Factors that enabled their success in the circular economy	Commercializing human excreta derived fertilizer	Moya et al. (2019)
Enables	Instructional capacity building	Talley and Keedy (2006)

Note: modified from Huber-Stearns et al. (2017)

3.4. Compositional Elements of Urban Agriculture

In line with the increasing arguments to preserve or develop appropriate UA systems (Kamoshita, 2007), this study was designed based on the principles of Choguill (1995) to demonstrate the development and conservation of UA enabling or constraining conditions. Choguill (1995) presented the principle of the construction of UA, and three categories correspond to this: necessity, ability, and opportunity. Different studies have used this model (Figure 1) to explain the introduction of UA to secure food and reduce urban poverty (Islam et al., 2019; Hossain, 2013). Furthermore, this model provides reasons for why UA is taken up in urban areas across the world by summarizing the three dimensions of UA drivers (Moglia, 2014). This model, which covers the various aspects of forming UA and explains the introduction of UA with a focus on the role of food supply, is suitable for distinguishing the conditions for the generation, continuation, development, and maintenance of UA. focusing on the role of food supply. Thus, it is appropriate to apply this model to clarify the conditions that make up UA.

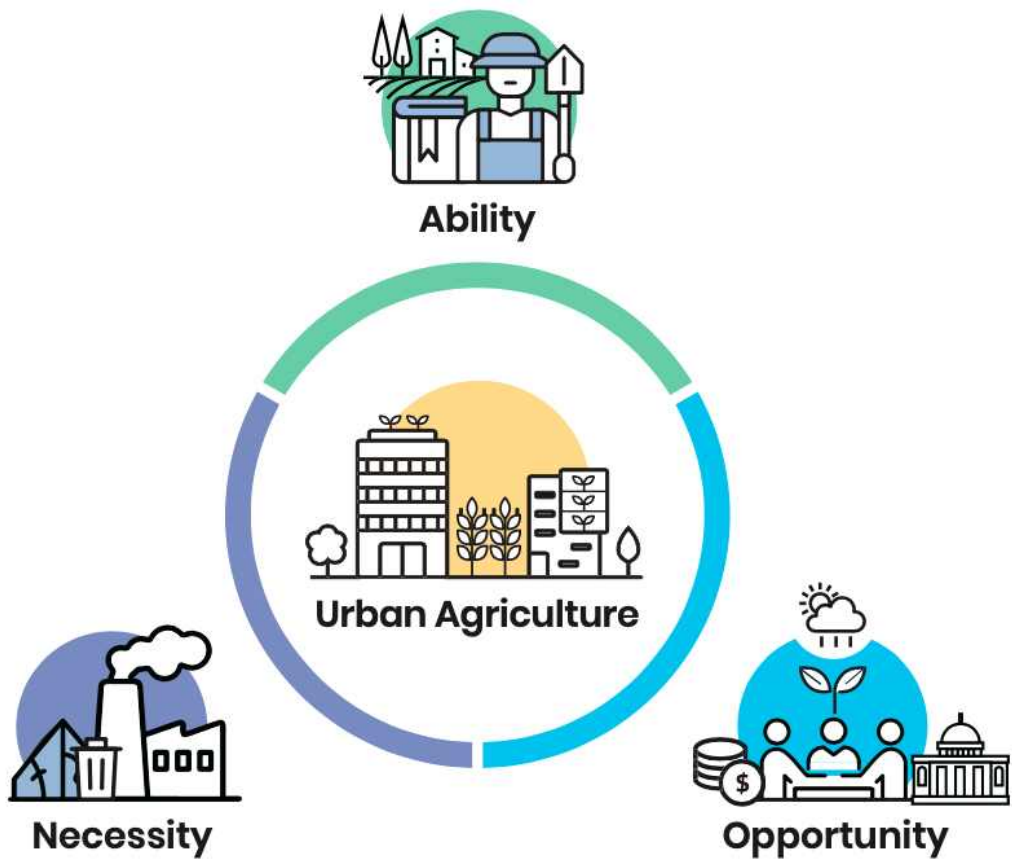
The three requirements of UA to be implemented within the urban boundaries are explained as follows. Necessity can be defined as a deficient state and the pursuit of such deficiencies. The necessity conditions corresponding to UA can be poverty and unemployment. Poverty, for example, is known as the primary initiator of UA to reduce expenses by

cultivating food, especially in developing countries (Masvaure, 2013). The vulnerable households in the city are more likely to implement urban farming, which enables people to continue their living. Not only poverty, but other factors also call for urban farming practices. Cities have re-examined the need for UA to preserve urban landscapes and supply a short distribution network for sustainable development. Ability refers to the capacity to perform certain functions (Sen, 1985), in this study, it refers to the capacity to implement UA practices. This is an influential element in the conduct of UA, with respect to the availability of workers, farming knowledge and skills, and cultural factors (Masvaure, 2013). Lastly, the opportunity is a set of circumstances that enable urban farming to be performed, for example, climate conditions, political support, watering systems, and land access (Masvaure, 2013).

All three dimensions, necessity, ability, and opportunity, are fundamental to UA. It is difficult to carry out UA even if one of them is lacking. For example, without access to land (opportunity), one in need of farming due to poverty (necessity) and has a farming skill (ability), it will be impossible to start UA. Moreover, these three areas are interlinked and characterized by their interaction with each other. The government's educational support, for instance, is classified in the dimension of opportunity, which affects the ability of farmers to carry out urban farming practices. Thus, there is no complete separation and distinction between the three dimensions that explain

the occurrence of UA. However, this study categorized UA enabling or constraining conditions based on direct statements described in the article by demonstrating what the subject of the condition is.

Figure 1. Compositional Elements of Urban Agriculture



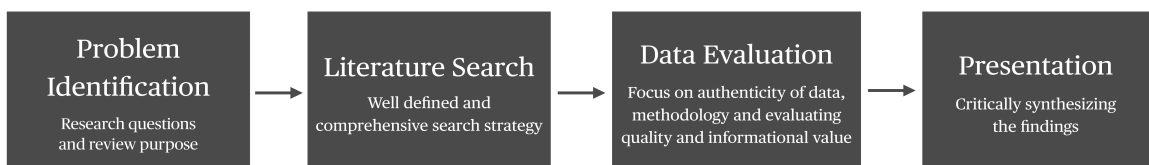
Note: modified from Choguill (1995)

4. Data and Procedure

This study identified enabling and constraining conditions for UA in different national income levels with varied backgrounds and approaches to UA implementation. Individual enabling or constraining conditions for UA have been discussed by a diverse variety of scholars and disciplines across a range of topics (Lu and Bai, 2015). However, these studies are dispersed across publications in multiple fields of study and remain blurred. Therefore, this study suggests that it is imperative to actively synthesize an understanding of enabling and constraining conditions beyond city-specific or country-specific boundaries. As an integrative review is widely considered an appropriate way to summarize the current conceptual thinking (Broome, 2000), this study applied non-experimental research for a comprehensive understanding of the phenomenon of UA and includes case studies. According to Berg et al. (2004), the case study analysis is “a method in which researchers systematically gather sufficient information about a particular social environment, event, or group so that researchers can effectively understand how the subject works or functions” (Berg et al., 2004). Furthermore, a collective case study is a method for gathering several cases to improve the ability to theorize about a broader context (Berg et al., 2004). Thus, this method has the potential to capture various perspectives and the complexity

of evolving phenomena (Whittemore and Knafl, 2005) by sampling various integrative reviews in conjunction with the multiplicity of purposes (Figure 2). To determine the conditions for UA (**problem identification**), the literature suitable for this study was selected from the literature search query presented in Chapter 4.1. Literature selection (**literature search**), and identification of the UA conditions revealed in the literature according to the research criteria are presented in Chapter 4.2. Coding and tabulating (**data evaluation**). The UA conditions of the finally extracted data will be specified in Chapter 5. Result (**presentation**). In this regard, the integrative review of a collective case study is considered suitable because it has the strength to systematically search, rigorously review, critically analyze, and comprehensively synthesize empirical and theoretical literature (Whittemore and Knafl, 2005).

Figure 2. Analysis Flow Chart



Note: modified from Whittemore and Knafl (2005)

4.1. Literature Selection

Academic journal databases, including Scopus and Web of Science, in May 2020 were explored to aggregate academic journal literature on enabling and constraining conditions with a primary focus on UA. The literature on UA and its focused function as food suppliers were included by using terms such as food security (Table 3) with related key terminology describing target key terms. However, it did not comprehensively represent all the literature on the topic (Korth et al., 2014; Warren et al., 2015; Clucas et al., 2018). Therefore, purposive samples of the literature were used to select abundant informative cases aimed at insight about the phenomena (Creswell and Creswell, 2017). Our intent was not only to attempt a comprehensive analysis but also to find case studies that provided rich information on enabling and constraining conditions for UA. A total of 352 documents were extracted using the search string (Table 3). From this, 276 articles were obtained, excluding duplicates and inaccessible papers. Of these, 211 papers were included in the screening process of title and abstract reading, and finally, 115 papers were selected, according to the criteria for inclusion of literature established by the researcher.

Literature inclusion criteria:

- 1) Publication, or academic journal
- 2) Written in English

- 3) Used “Urban and peri-urban agriculture” and “Food security” terminology in the title
- 4) Study areas identifiable by reading the title and abstract to distinguish case study

Table 3. Document Collection Keywords

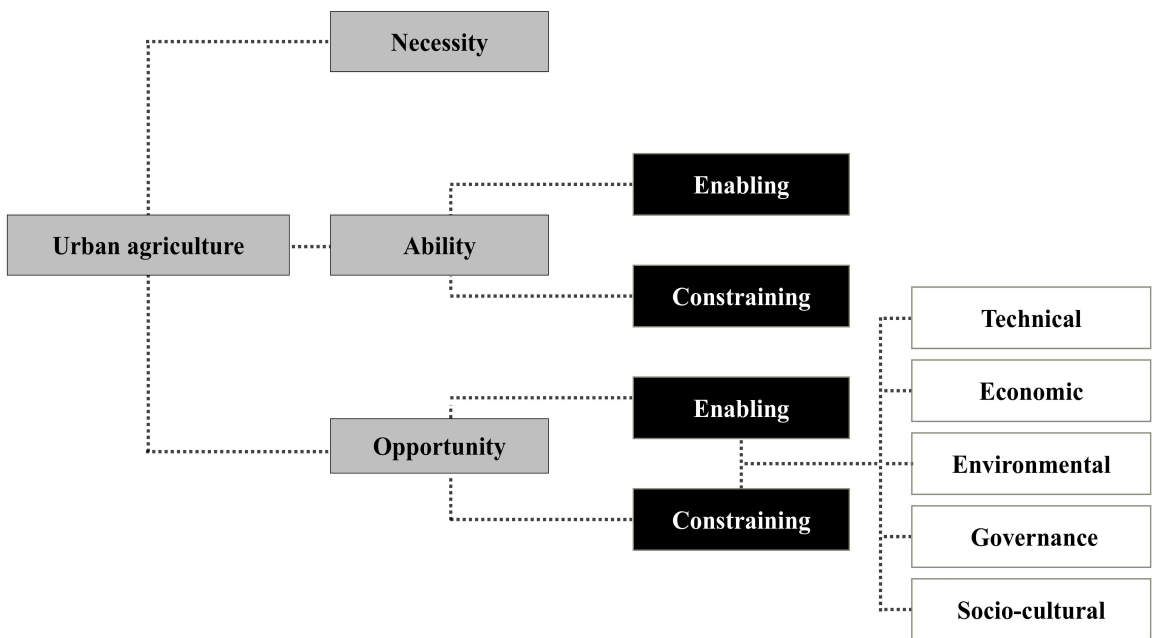
Concept (Keyword)		
Urban agriculture		
Urban	Urban, City, Peri-urban, Periurban, Metropol*, Town, City adj*	Warren et al. (2015); Korth et al. (2014); Clucas et al. (2018)
Agriculture	Agriculture, Farm*, Crop*, Food production, Commun* garden*, Private garden*, Allotment garden*, Semisubсистен* farm, Home garden*, Food process*, Agricultural park*, Livestock	
Food security		
	Food adj* secur*, Food adj* insecur*, Nutrit* adj*secur*, Nutrit* adj* insecur*, Food suffic*, Food insuffic*, Nutrit* suffic*, Nutrit* insuffic*, Hunger*, Food distribut*, Food procurement	Warren et al. (2015)
	Food insecurity, Food poverty, Food insufficiency, Hunger	Holley and Mason (2019)
	Food insecurity, Food security, Food availability, Food utilization, Food access	McKay et al. (2019)
	Diet, Food access, Food availability, Food by-products, Food demand, Food prices, Food processing, Food production, Food quality, Food safety, Food security, Food sovereignty, Food supply, Food supply chain, Food systems, Food transfer	Hatab et al. (2019)

4.2. Coding and Tabulating

Using literature inclusion criteria, 130 case studies from 115 publications were finally included in this study, followed by a full screening reading process. Enabling/constraining conditions were broadly identified by reading papers and identified conditions were extracted based on the following criteria. Sentences and paragraphs in a research paper are the unit of condition analysis, and information that is directly stated in sentences or paragraphs, containing expressions that have positive or negative effects on UA were obtained. The extracted information was then used as a basis for the analysis and was grouped based on three categories of requirements for the construction of UA presented by Choguill in 1995 (Masvaure, 2013; Choguill, 1995). The three descriptive categories are necessity, ability, and opportunity (Figure 3) (Choguill, 1995). The classified conditions were grouped again into detailed items depending on their characteristics and types. Conditions corresponding to necessity were classified according to their similar characteristics to the condition for UA due to a certain deficiency. Conditions corresponding to ability were grouped as enabling/constraining conditions for UA depending on the existence of a certain condition. Finally, the conditions corresponding to opportunity were described as external influences, which were further classified into six sub-categories based on the factors affecting the success of UA projects mentioned in the preceding

study: technical, economic, and socio-cultural factors (Dehnavi and Süß, 2019), and two more categories, environmental and governance factors, were added by the researcher.

Figure 3. Structure of Urban Agriculture Condition Category



Note: modified from Dehnavi and Süß (2019)

5. Results

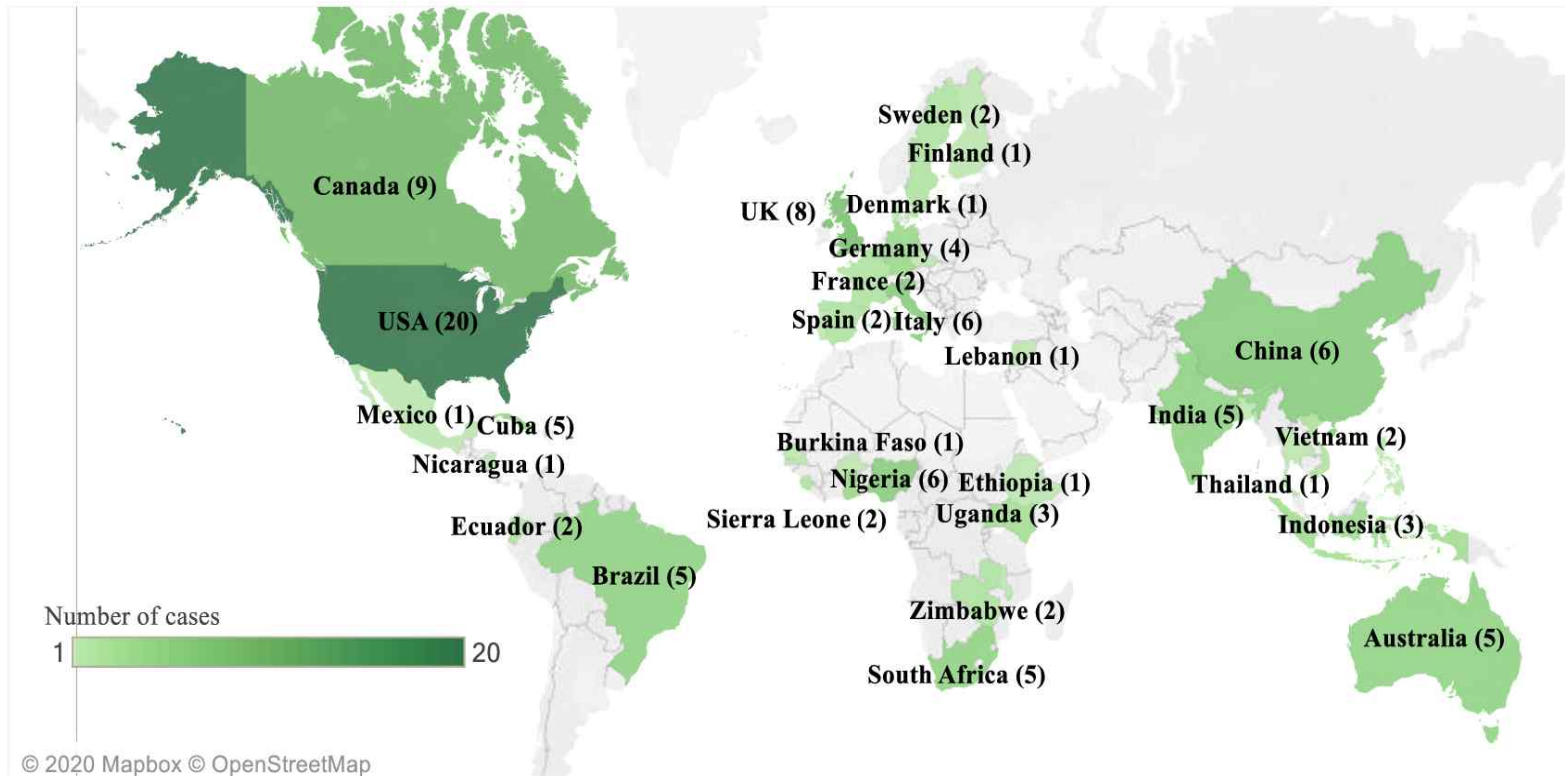
5.1. Descriptive Analysis

Following the literature inclusion criteria, a total of 115 articles and 130 case studies were aggregated after data collection. Figure 4 shows that the number of articles is lopsided towards certain countries, especially the United States (n=20), Canada (n=9), and the United Kingdom (n=9) though the literature was randomly extracted from academic journal databases. This indicates that previous studies on UA and food security have been most vigorously conducted in these few countries. According to the regional distribution of publications, key countries that have a considerable number vary in different continents (Figure 5 and 6). Nigeria (19%), South America (16%), and Ghana (13%) account for approximately 50% of all studies in Africa. In Asia, China (29%) and India (24%) are two major countries, and Brazil (75%) is the primary country leading urban farming research in South America. Among European countries, the UK (28%), Italy (19%), and Germany (13%) have been active in research. Lastly, the USA and Canada, as mentioned, take up most of UA studies in North America. Given that this study will examine the results by regions and income levels later in the Discussion section, these core countries may represent their regions for interpretation.

Before 2010, only a few studies were collected, but a significant uptrend in UA research was observed since this point (Figure 6). Articles from both low-and middle, and high-income levels have been almost equally distributed. This trend suggests that agriculture practices in cities and food security started coming into the spotlight since 2010 as poverty issues became a priority (Khumalo and Sibanda, 2019), even though agricultural practices in urban areas were widely implemented a long time ago (Knowd et al., 2006).

Figure 4. Geographic Distribution of the Collected Case Study on Urban Agriculture and Food Security

(N=130)



Note: The greener the color, the higher the number of case studies

Figure 5. Regional Distribution of the Collected Literature on Urban Agriculture and Food Security

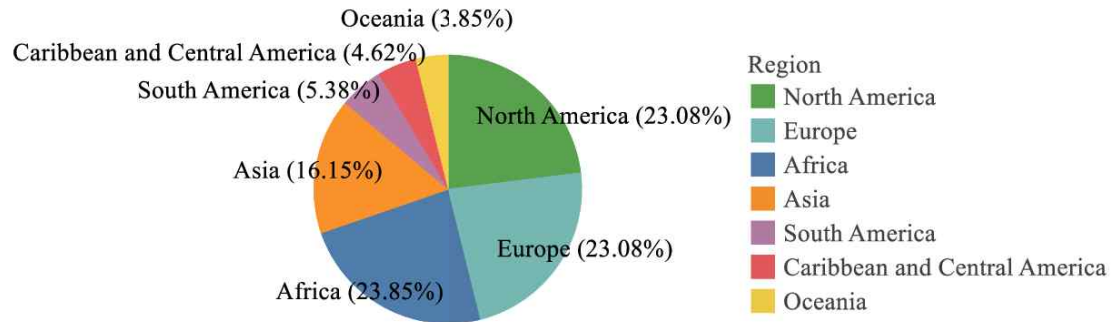
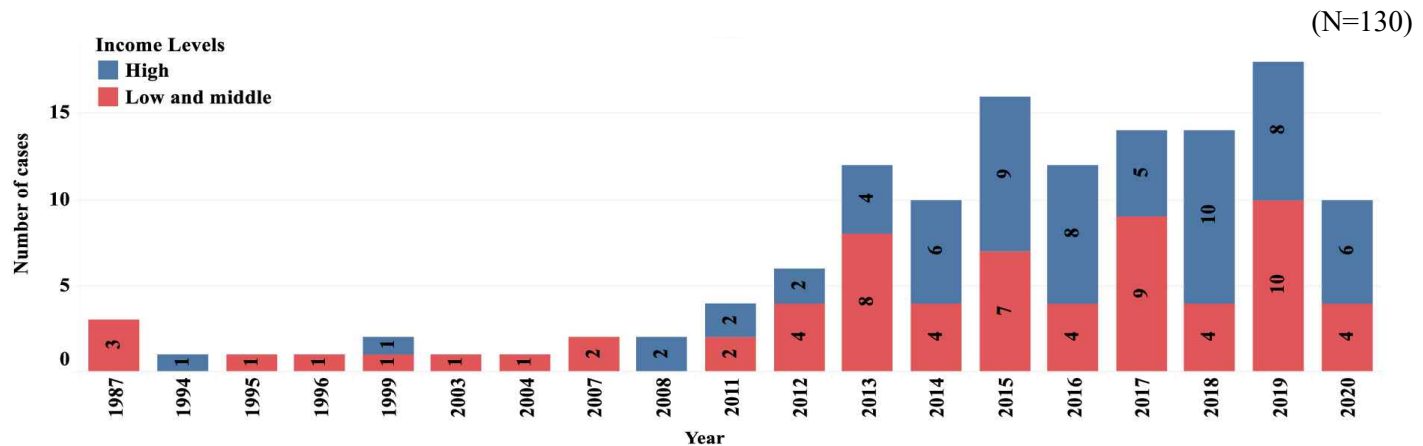


Figure 6. Distribution of the Number of Collected Literature by Year on Urban Agriculture and Food Security



5.2. Conditions for Urban Agriculture

5.2.1. Necessity

As a result of the analysis of the unfulfilled conditions leading to the occurrence of UA, the following conditions could be identified: increase in food price and demand, unemployment and low wages, food safety or quality, economic and food crisis or war, food stability and security, environmental concerns, and social concerns (Table 4*). With the increase in urban population, the food demand of the people living in the city has also increased, and with the lack of food supply and rising food prices, urban residents have begun to secure enough food by participating in UA (FAO, 2009). In addition, the rapid spread of urbanization led to an increase in unemployment and urban poverty rates, which became the driving force behind food production in urban areas [A**.82]. Furthermore, in Rio Claro, Brazil, the high price of medicine and health care systems were conditions that induced planting of agricultural and therapeutic properties in urban home gardens [A.7].

The domestic and global economic crisis and food crisis are major

* The detailed information of each condition is shown in Appendix 2

** This thesis offers information on selected case studies at Appendix 1. The article number from Appendix 1 will be presented like [A. #].

reasons for participation in UA. Historically, urban gardens appear as an applicable system of providing food during periods of economic stress, such as a period of war (Cotton, 2009). For instance, in Indonesia, the governor of Jakarta introduced a policy of using empty land for agricultural development as a possible solution to satisfy food demands during the 1998 and 2007 global food crises [A.46]. Zambia, additionally, encountered an economic crisis that led to a rise in household food production in the 1970s, and according to a report in 1994, 80 percent of low-income families practiced various forms of urban farming [A.112].

The UA is also formed in response to a growing national interest in food security and stability, an increase in demand for local food, and a sustainable food chain. The practice of UA to go further from urban food production and to a sustainable food supply chain is being encouraged [A.89]. This is a prominent phenomenon not only in developing countries but also in developed countries, as shown by the promotion of a 'local food' movement to promote sustainable local food production [A.92]. Various countries and cities are interested in the cost and stability of future food supply, adopting regional food farming strategies to reduce food insecurity, and developing various regional agricultural programs [A.16;46]. This led to a regional agricultural movement beyond the level of introduction of UA.

Not only food security issues but food safety issues are also major drivers of emerging UA practices. In response to dietary-related diseases in

cities, urban farming is becoming popular [A.96]. Concerns about food safety and agricultural activities in urban areas are steadily increasing, with urban community citizens at the center for safe and nutritious food production [A.93;95]. According to an interview by an urban farmer, the most important motivation for starting urban farming is to provide clean and safe vegetables to families who have responded to food safety issues [A.110].

Some UA has been implemented to improve the city's green infrastructure while increasing the educational, social, and recreational space of urban residents (Saldivar-Tanaka and Krasny, 2004). A new type of urban food garden in the Czech Republic began to emerge—a garden that played a role in promoting ecological and social benefits for the urban society around 2012 [A.29]. In addition, Barcelona's urban farming activities are often carried out through social and therapeutic purposes [A.76]. Moreover, as concerns over climate change and greenhouse gas emissions are rising due to the long food supply distance, efforts are being made to produce foods with less environmental impact through UA [A.14;105].

Table 4. Urban Agriculture Conditions of Necessity

(N=130)

Category	Condition (Number of case study)
Necessity	Increase of food price and demand (31)
	Unemployment/Low wage/Save money (13)
	Food safety/quality (15)
	Economic/Food crisis or War (4)
	Food stability and security (22)
	Environmental concern (20)
	Social concern (17)

5.2.2. Ability

Ability, one of the components of UA, is described as internal and potential to the performance of UA, its innate nature, or its given things. The UA enabling conditions of ability were found awareness and motivation of UA stakeholders, labor or human resources, household size, and commitment of UA participants (Table 5*). First, personal awareness and motivation were identified as momentum in the UA movement [A.6], and raising awareness of the importance of UA was required to sustain urban farming in Fiesole, Italy [A.34]. Moreover, it was found that many UA projects have been successful due to raised awareness of the need for foods [A.95]. Second, the presence of human resources such as farmers, agricultural scientists, and urban planners responded to the implementation of UA as basic conditions that enabled UA [A.27]. Enhancing human capacity by providing farming knowledge or information to urban farmers is necessary to achieve success in multifunctional agriculture [A.79;110;27;25]. Farming techniques and knowledge keep healthy urban gardens and crop production going [A.62;110]. In addition, the size of the household also plays an important role in the performance of UA. According to a study, large households mean that they have cheap family labor and that they have more potential to conduct UA [A.60;62]. Lastly, urban gardeners' commitment or engagement in processes for urban

* The detailed information of each condition is shown in Appendix 2.

agricultural production proved to be an enabling factor for the successful implementation of UA [A.12;29;36]. In particular, a bottom-up approach to urban food production has been found to motivate more urban farmers to grow their own food [A.35;36;79].

The conditions that disable UA classified as ability condition have been shown as farmers' poor health, lack of farming knowledge, urban farmers' vulnerability or dependency, lack of acceptance and involvement of urban farmers, and lack of qualified labor or time (Table 5). Poor health is a factor that hinders urban farming. Various forms of UA are constrained by the health risks of farmers because of their advanced age; they are no longer able to cultivate their agricultural properties in their land [A.41;55;111]. In addition to this, farmers' lack of knowledge of agricultural technology and poor understanding of UA is one of the major obstacles to practicing UA [A.76;39;5;102], and lack of training programs and farming skills are often cited as factors that frustrate UA in various studies [A.48;109;97;93;11;5]. The farmers are occasionally relying on governmental supports system and this leads to impeding the development of sustainable UA [A.9]. Another frequent concern of UA is the lack of acceptance and involvement in urban farming practices [A.38;76;93]. Community gardens, especially, require stronger participation of members to sustain the gardening systems; however, it is sometimes difficult to maintain the system because of mobilizing farm labor and negative perception of agriculture [A.69;101]. Furthermore, time

was noted as a key issue for managing farmland [A.108]. The most mentioned UA challenge among urban farmers is limited time for farming [A.93], and this time constraint hinders the improvement of urban gardens [A.109].

Table 5. Urban Agriculture Conditions of Ability

(N=130)

Category	Conditions (Number of case study)	
	Enabling conditions	Constraining conditions
Ability	Motivation/ Awareness (37)	Farmers' health (3)
	Labour/ Human resource (21)	Farmers' lack of knowledge (13)
	Household size (2)	Farmers' vulnerability/dependency (2)
	Commitment of UA participants (10)	Lack of acceptance and involvement (6)
	-	Lack of (qualified) labour/time (7)

5.2.3. Opportunity

The opportunity UA conditions represent a series of situations that enable or obstruct UA. These conditions were classified into technical, economic, environmental, governance, and socio-cultural subcategories, resulting in Table 6. As shown in Table 6, many UA-opportunity conditions are included in the environmental and governance subcategories. Each subcategory represents the types of enabling and constraining conditions. This study grouped conditions depending on the character of the condition and named them in comprehensive terms. Detailed information on the specific conditions grouped is given in Appendix 2.

Table 6. Urban Agriculture Condition of Opportunity

(N=130)

Category	Subcategory	Condition (Number of case study)	
		Enabling condition	Constraining condition
Opportunity	Technical	Research and technical development (20)	Limited storage facility (1)
		Agricultural education and training (19)	Poor technology (1)
		Farming method/system/tool (8)	Lack of data (1)
	Economic	Distribution channel/market (11)	Poor distribution channels/market (10)
		Prices and direct selling (4)	Poor financial condition (11)
		Collaborative arrangement in market system (5)	Economic crisis (1)
		Consumer demand (1)	Low production volumes/income (4)
	Environmental	Arable land (34)	Limited arable land (54)
		Resources (34)	Scarcity/contamination of resources (32)
		Fertile soil (14)	Lack of fertile land (11)
		Climatic condition (7)	Harsh climatic condition (7)
		Proximity (1)	Limited accessibility (1)
		Pollination (1)	Disease/weed/pest (9)
	Governance	Policy (60)	Lack of institutional infrastructure (40)
		Governmental institution (20)	Political corruption and disputes (5)
		Strong governmental will/talented leader (10)	Incompetence system and structure (5)
		Non-Governmental institution (9)	Discourse (1)
		Collaborative partnership among stakeholders (9)	-
		Participatory UA policy-making (9)	-
	Socio-cultural	Social capital (28)	Crimes (8)
		Movement (3)	Reckless urban development (16)
Promotion or publicity (2)		-	

Technical Condition

Technical enabling conditions for UA included the research and technological development of UA, the agricultural education and training of urban farmers, and the use of suitable farming methods, systems, and equipment (Table 6). Instructions on farming skills and technical advice should be provided to farmers to enhance their farming capacity [A.23]. Moreover, place-based research and development in the agricultural sector are fundamental for the successful implementation of UA [A.30;36], and this is one of the ways to stimulate interest among local people and encourage them to participate in UA practices [A.89]. Not only agricultural research and technical development, but the development of platforms governing agricultural education and training to empower urban farmers' capabilities also have positive effects on cultivating crops successfully in urban areas [A.71]. In the same vein, enhancing the accessibility of farming workshops and technical training services has been confirmed to enable the implementation of UA by increasing the chance of success [A.93]. In addition, UA is being promoted by appropriate farming methods, systems, and tools [A.26;76;65] in many different cities, and these are considered as key ingredients for gardening to succeed. For example, in Montreal, UA was put in a food system plan and developed equitable food system goals that function to increase and support UA [A.17]. Organoponicos in Cuba [A.26] and container vegetable gardening in Canada [A.15] are actively used as urban crop-growing agricultural systems

that consider urban land issues, which play a role in alleviating urban food insecurity. However, inappropriate technical conditions of agriculture disabled the development of UA, and the conditions corresponding to this are limited storage facilities that are fundamental for the destruction of agricultural products [A.41], and lack of UA technology innovations [A.68] and reliable data for UA policy making [A.33] (Table 6). Particularly, the lack of storage facilities that can provide the proper humidity and temperature needed to maintain freshness until perishable agricultural products reach consumers is cited as one of the requirements that undermine urban farming [A.41]. Furthermore, securing reliable data that could be used for developing UA policy is limited in some countries, and the lack of data used to direct policies on UA in developing countries hinder the revitalization of UA (Zezza and Tasciotti, 2010).

Economic Condition

Economic conditions for improving UA practices were observed in suitable distribution channels and markets, retail price from direct selling, collaborative relationship between producer and consumer, and availability of consumer demand (Table 6). According to a prior study, it has been found that for UA to contribute substantially to food security in the city, not only the production of agricultural products but also the formation of markets is important [A.40]. The existence of a distribution network of agricultural

products or a market for agricultural products directly affects the income of farmers performing UA and further contributes directly to the revitalization of UA [A.9;27]. A successful UA is also dependent on selling at retail prices directly to consumers [A.1]. In the USA, many policies encourage the sale of urban-produced foods within the city, for example, the California Cottage Food Act [A.94]. In addition, the collaborative arrangement of agricultural producers and urban consumers is an important circumstance in the market system [A.34;79] as it enables direct trade. Through this, consumer prices can be lowered, enabling the production, distribution, and consumption of UA smoothly. Furthermore, the success of UA projects depends on the demand of the consumers for UA products, which is the power to sustain UA [A.37].

Constraining conditions observed in implementing UA include insufficient distribution systems of agricultural products, lack of input costs, economic crisis, and low production volumes and wages (Table 6). The limited UA markets and distribution channels limit the activity of UA [A.25;41]. Like the enabling conditions for UA, various studies have shown that it is impossible to activate UA under conditions where UA distribution and market structure are not in place; these are crucial, especially for small farmers [A.102]. Another key barrier identified by urban farmers is financial constrains for new farmers [A.16]. Since initial agricultural investment costs include processes such as obtaining permission for land use [A.16], many studies have mentioned that the most important challenge for starting UA is high

operation costs [A.19;42;104] and it reduces people's desire for gardening activities [A.80]. Economic crisis, moreover, is one of the key driving forces leading to UA practice in the USA, but it also functions as a restraining factor. For example, in Zimbabwe, there was a study that the economic crisis caused difficulties in implementing new agricultural policies, which prevented the induction of UA [A.113]. Finally, the low agricultural production volumes do not guarantee sufficient wages for urban farmers, resulting in the slow implementation of UA by people [A.25;16;97].

Environmental Condition

The environmental conditions in developing UA including the existence of arable land, available resources, fertile soil, suitable climatic conditions for crops, proximity to UA services, and pollination conditions (Table 6) were observed. The key condition that makes UA possible is the land for food production (Thibert, 2012). Securing the site of the event in urban areas is an essential aspect of supporting UA, and a great deal of effort is being made to provide land ownership to urban dwellers who wish to grow food in numerous cities [A.40;12;31]. In Cuba and Vietnam, for example, land reform has been implemented to secure land for urban farmers [A.111;44]. The vast untapped urban opening area is actively used as a 'new plantation' of cultivation to seek solutions for securing land for agriculture [A.44;47]. Another important consideration of UA is "suitable" land [A.48;65]. The poor

soil quality in urban areas can be improved by adding organic manure and compost to the soil [A.10;25], and the fertile soil enhances crop production, thus contributing to food security [A.10]. Material resources such as quality seeds, water, and fertilizer (compost or manure) are important elements to ensure the success of UA [A.35;26;56;4]. Seed quality is the basis of an agriculture-based food production system, which then determines the volume of final yield [A.10]. The availability of water or an appropriate irrigation system for cultivation is being emphasized in many studies as crucial elements for farming [A.4;13;103], and it is apparent that favorable water quality is a pivotal component of urban farming design [A.55]. Furthermore, fertilizer or compost improves soil fertility, which affects the volume of agricultural outputs [A.65;68;92;74]. Similarly, the “proximity” condition is important in obtaining adequate resources for cultivation, such as seeds or fertilizers [A.110]. Additionally, as pollination of flowers closely affects the yield of agricultural products, appropriate conditions for pollination have been identified as essential for maintaining or enhancing food production in urban areas on a local or regional scale [A.78]. Finally, climatic conditions are considered as environmental factors that affect agricultural production [A.19]. Adequate climatic conditions according to cultivated crops can foster sustainable urban farming conditions and are likely to affect UA, especially in the case of outdoor cultivation [A.50;53].

The environmental conditions that make the practices of UA difficult

were largely observed land issues, scarcity or contaminated resources, lack of fertile land, harsh climatic conditions, limited accessibility, and disease, pest, or weed problems (Table 6). The limited access to high-valued land and scarcity of arable land are the most important constraints for people involved in urban farming [A.5;14;79;84;113]. In Ghent, for example, the lack of land responding to the growing demand for UA is a key barrier [A.6], and the intense competition for access to land [A.9] is a worldwide issue in urban farming sectors. Furthermore, public vacant land is not always available for urban farming practices, but it may be used for sports fields or other marginalized spaces [A15]. Not only the presence of land but the quality of soil is also an important issue for growing food [A.4;38;93;109]. Poor urban soil fertility limits farmers' income, contributing to low yields [A.10], and the most cited challenge among farmers is maintaining soil quality and fertility [A.93]. Moreover, the shortage of resources and contaminated resources have been identified as UA revitalization inhibition conditions in many studies, and the scarcity of inputs for food production sometimes result in low-quality food produced in urban areas [A.25;43;39;80;112]. Difficulties in water supply due to the lack of irrigation systems and soil and air pollution in urban areas have been major inhibitors of urban farming activities, as they make it difficult for crops to grow and bring food safety issues [A.88;64;19;108]. In addition, the success of growing crops is dependent on the growing season and weather [A.27;46;40;107]. Adverse climatic conditions such as heavy

rains, flooding, and drought can reduce the yield of agricultural production [A.55;46]. Another environmental constraining condition of UA is accessibility because the lack of accessibility to farming areas and UA services make UA-related stakeholders feel limited in carrying out urban farming [A.76]. Finally, damages from diseases, pests, and weeds are cited constraints among gardeners [A.108;93], and according to literature, many urban farmers encounter challenges from pests and disease (24%) [A.63].

Governance Condition

The governance conditions affecting the development of UA were identified as UA policies, the role of non-governmental and governmental organizations, a strong government that may help to develop UA, and collaborative partnership among UA stakeholders, and participatory policy-making (Table 6). For successful implementation of UA, a strong commitment, will and participation of government or leaders is crucial [A.44;36;34]. Strong governmental will affect directly by making it possible to generate urban development plans to preserve agricultural land in urban areas [A.34], and many studies emphasize the importance of government leaders' support and needs for revitalizing UA [A.1;89;29;107]. Not only governmental institutions' endeavors but the role of non-governmental organization is also important for the success of UA [A.5;14;71]. Efforts to sustain UA within the regions by non-governmental organizations are key inducers of informally initiated urban

agricultural projects [A.86]. Thus, collaborating with NGOs and governmental actors in several cities has occurred frequently to facilitate the rapid growth of UA [A.14;86;96]. Supportive governmental UA institutions also play a central role in the growth of UA [A.5;12;25;29;33]. Different kinds of UA supporting governmental institutions exist in many cities and countries, including the sole department of UA, research institutions for developing farming skills, urban farmers' educational organizations, legal institutions, and so forth [A.13;23;25;27;44]. These institutions play a role in contributing to the growth of UA independently and simultaneously in cooperation. Likewise, it is found that the support of governmental and non-governmental institutional structures is needed to nurture the development of UA [A.47]. A strong participatory approach fosters UA participants' responsibility by involving UA policy making process [A.36], and open debates including stakeholders, internal and external actors in UA systems, may increase the awareness regarding the significance of urban farming systems [A.6;12;29;34;36;53;74]. The presence of collaborative partnerships among stakeholders as well as the participation of stakeholders in the establishment of UA policies, has also been found to be an important factor enabling UA [A.6;11;24;36;79;86]. Public and private partnerships among UA stakeholders are revealed to have a role in promoting local food policy and its influence on the UA policy building [A.79;36]. Through this, it is also possible to ensure that the UA practices are more active and sustainable. The last

governance enabling condition is UA policy. The policies play a role in promoting UA and inhibiting poverty and food insecurity [A.40;61;65], and it is crucial to have a city planning strategy for the successful functioning of UA [A.47;15]. In addition to the UA planning policies, economic policies such as financial incentives, tax cuts, and subsidies play an important role in solving urban farmers' difficulties that may have occurred due to low productivity; and through various economic policies [A.7;8;76;80], the economic burden of farmers can be relieved. Legal policy instruments such as law or regulation can give the applicants, the right to plant more. Land reform policy, for instance, can serve as a protective device by improving land tenure security and ownership among urban farmers [A.111;25].

The governance conditions impeding UA were found to be lack of institutional infrastructure, political change and disputes of land use, the system of separation of government and civil society, and existing discourse in society (Table 6). Failure to support the UA practices through governmental infrastructure may undermine ordinary citizens' ability to participate in them [A.30;38]. More sustainable UA systems are supported by policy agreements that create new agricultural policies in urban areas [A.51], and the lack of institutional infrastructure is mentioned in many cities [A.57;68;79;82]. The UA systems have some risks, and it is reported that UA can easily fail without adequate institutional support. They should be developed with the long-term solutions to improve urban food production by

treating them as a key component of urban planning [A.100;102;107]. Another constraining condition is wealthy elites or corrupt politicians taking advantage of their power positions to use capitals of UA developments [A.71], resulting in the slow development of UA. Furthermore, the tension between policies involved in constructing an international megalopolis and securing the city's food supply also play a part in the limited acceptance of farming in urban areas [A.111;113;4]. UA practitioners have faced many barriers from the limited coherency of UA-related topics. In some cities, the state and civil society operate independently, even within one municipality, and it complicates the development of such farming activities [A.11;38;79]. A study has shown that the discourse formed within the society where UA policy is implemented affects the development of UA. For example, in the UK, certain practices that could be a constraint to the promotion of urban farming were favored by the neo-liberal discourses of 2008, which have been stated as an obstacle to the implementation of UA [A.92].

Socio-cultural Condition

The socio-cultural conditions to improve UA are being addressed in many studies and have been identified as follows: social capital, movement, and promotion or publicity of UA (Table 6). Community-based and grassroots actions are pivotal factors for the long-term implementation of UA [A.8;34;38]. Community-supported farmland is more sustainable, and it

provides social inclusion among urban farmers, which enables participants to feel strong bonded interests [A.44]. In this regard, many community participatory processes have been used for the success of UA by strengthening farmers' networks and partnerships [A.74;75;58;53]. Moreover, the growing movement to promote UA grew at the community, regional, national, and global levels, a large-scale change took place to practice UA, and the movement carried out the function of catalysts that enabled UA development [A.38;44;52]. Lastly, word-of-mouth recommendations, UA festivals, and the media and events within the UA initiatives were mentioned as success factors of the UA project in various studies [A.38].

Socio-cultural conditions that hinder UA growth are proven to be crime-related problems and reckless urban development (Table 6). Urban farmers faced challenges of theft due to food shortages in urban areas, and the risk of theft destroys social capital by creating mistrust and fear among city dwellers [A.71;42;5;8]. In addition, reckless urban development is one of the major problems in implementing UA. Rapid growing urbanization causes competition for land between UA and more high-valued uses such as housing and commercial development in many cities [A.11;44;21;86], and a huge urban influx eats up existing agricultural land in urban areas (Lovell, 2010). Thus, the higher the land pressure for urban development, the greater the burden on arable land for urban cultivators [A.68;29].

6. Discussion

The results provide fundamental information that influences the implementation of UA, focusing specifically on the enabling and constraining conditions. This research has implications and provides insight from diverse perspectives. It also indicates potential challenges for future consideration for promoting UA practices (Huber-Stearns et al., 2017). The UA enabling and constraining conditions were identified differently based on the income level of the country. Thus, this section will discuss how the enabling and constraining conditions differ and are emphasized depending on the national income level.

6.1. The Rise of Urban Agriculture

UA contributes to household food security in developing states (Poulsen et al., 2015; Warren et al., 2015) as well as developed states, especially in times of crisis during the 20th century (Ackerman et al., 2013; Edmondson et al., 2014). The poor urban residents who suffer from food insecurity spend their income on purchasing food and still endure decreasing food supply and quality (Drescher, 2002). Regardless of the national income level, the food supply role of UA could be identified as the main driving force behind urban farming as inferred from the pathway that induces the occurrence of UA (Figure 8). As urbanization progresses, the population increases, and the demand for jobs and food increases rapidly [A.7;24;39]. This leads to soaring food prices and high unemployment [A.48], and poor urban dwellers remain in poverty or suffer from food shortage problems [A.55]. Urban low-income communities faced with urban poverty and high unemployment desire to produce food or income through agricultural activities and implement UA for this purpose [A.46;62]. In addition, the results of the pathway (Figure 8) showed that UA was being promoted at the household level due to poor food supply in urban areas due to war and international economic crisis [A.82;25;102], and that UA was being implemented to secure safe food from the threat of disease in the city [A.18;19;38;110].

However, apart from the UA's food supply role, it was confirmed

that the reason for introducing UA activities was emphasized distinctively depending on national income level (Figure 7). Figure 8 shows the distinctive path of UA between low- and middle-income and high-income states. The UA in high-income countries is vitalized for social, cultural, and environmental purposes, especially in times of peace (Guitart et al., 2015). Unlike low income-level countries, social, environmental, and cultural movements are more seen in North American and European cities (Jones, 2002) and these movements have been found to affect the implementation of UA. Social integration, such as community building, cultural benefits like leisure, fresh and healthy food, and environmental concerns were found to be the main driving forces behind the introduction of UA in high-income states (Bell et al., 2016). In this regard, the awareness of the environmental role of UA has brought an increasing interest in UA in many developed countries (Caputo, 2012; Hall et al., 2014). On the other hand, the introduction of UA based on environmental motives was addressed through some research, but it was confirmed that the introduction of UA based on cultural and social motives was not dealt relatively in countries with low-income than those with middle- and high-income (Figure 7 and 8). The results confirm that agricultural activities are still widely regarded as a means of income and savings in low-income countries (Byerlee and Sain, 1986). Therefore, this study shows that differences in views of UA exist depending on the national income level. The vague objectives cause confusion in projects or new

systems (Dey and Schweitzer, 2014). In this regard, the UA system should be implemented by identifying the objectives of UA introduction and applying appropriate means and methods. This shows that the national income level can be used as an important indicator for identifying the objectives of UA in production.

Figure 7. Urban Agriculture Necessity by Income Level and Region
(N=61)

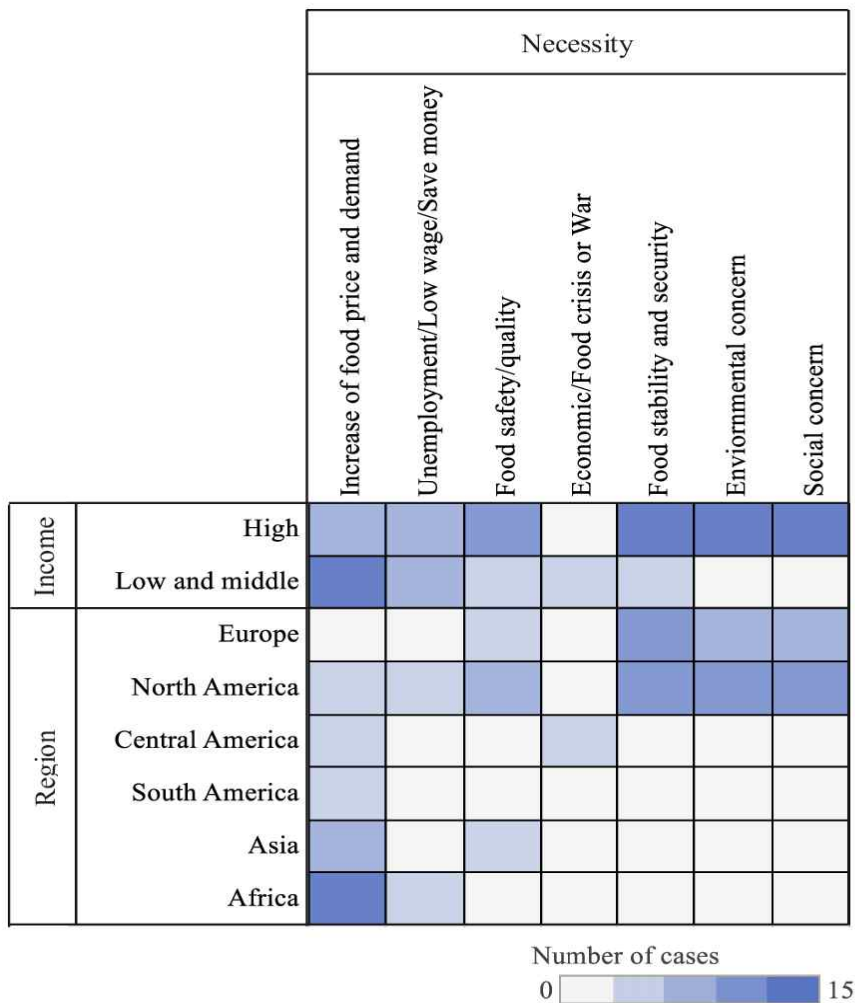
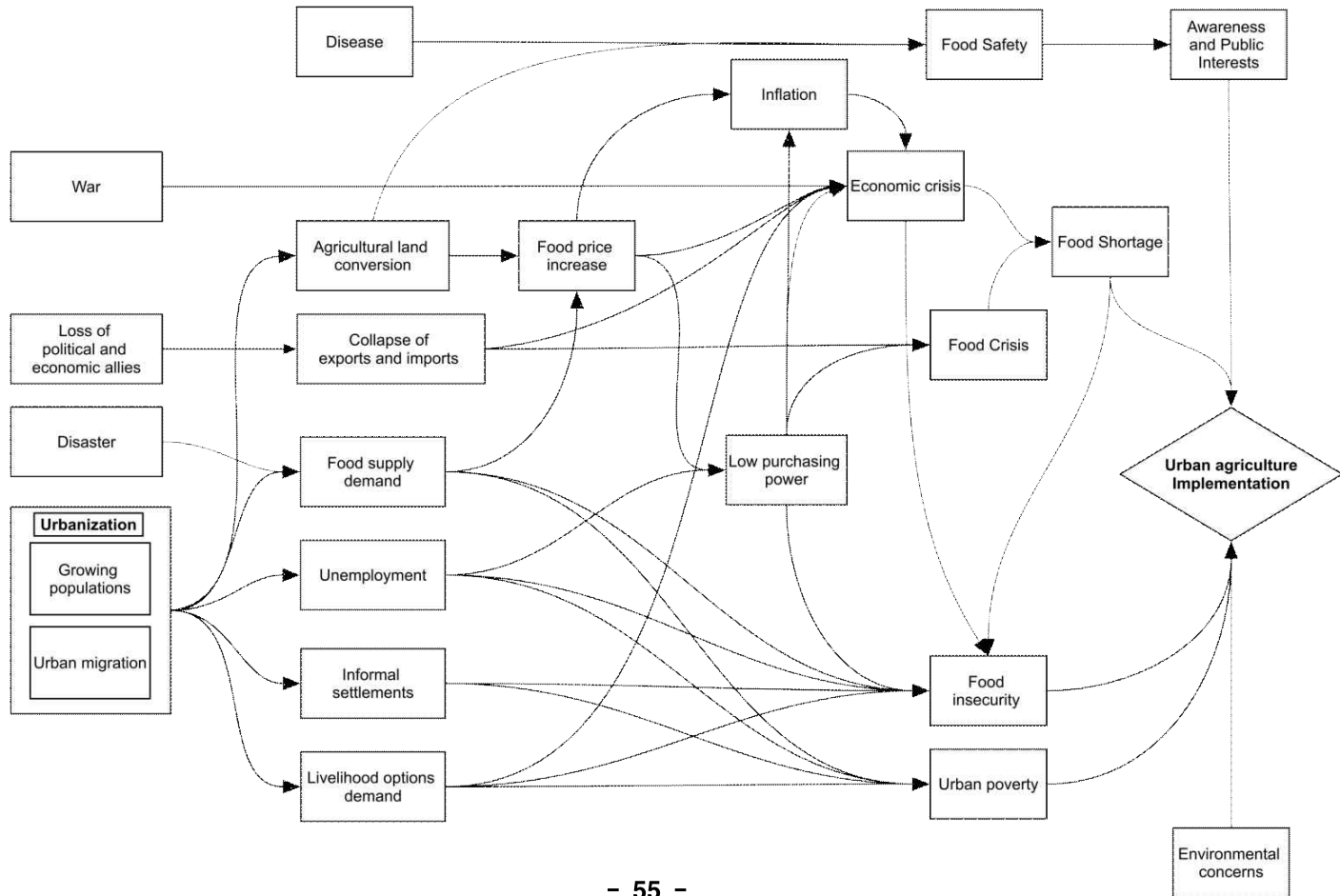
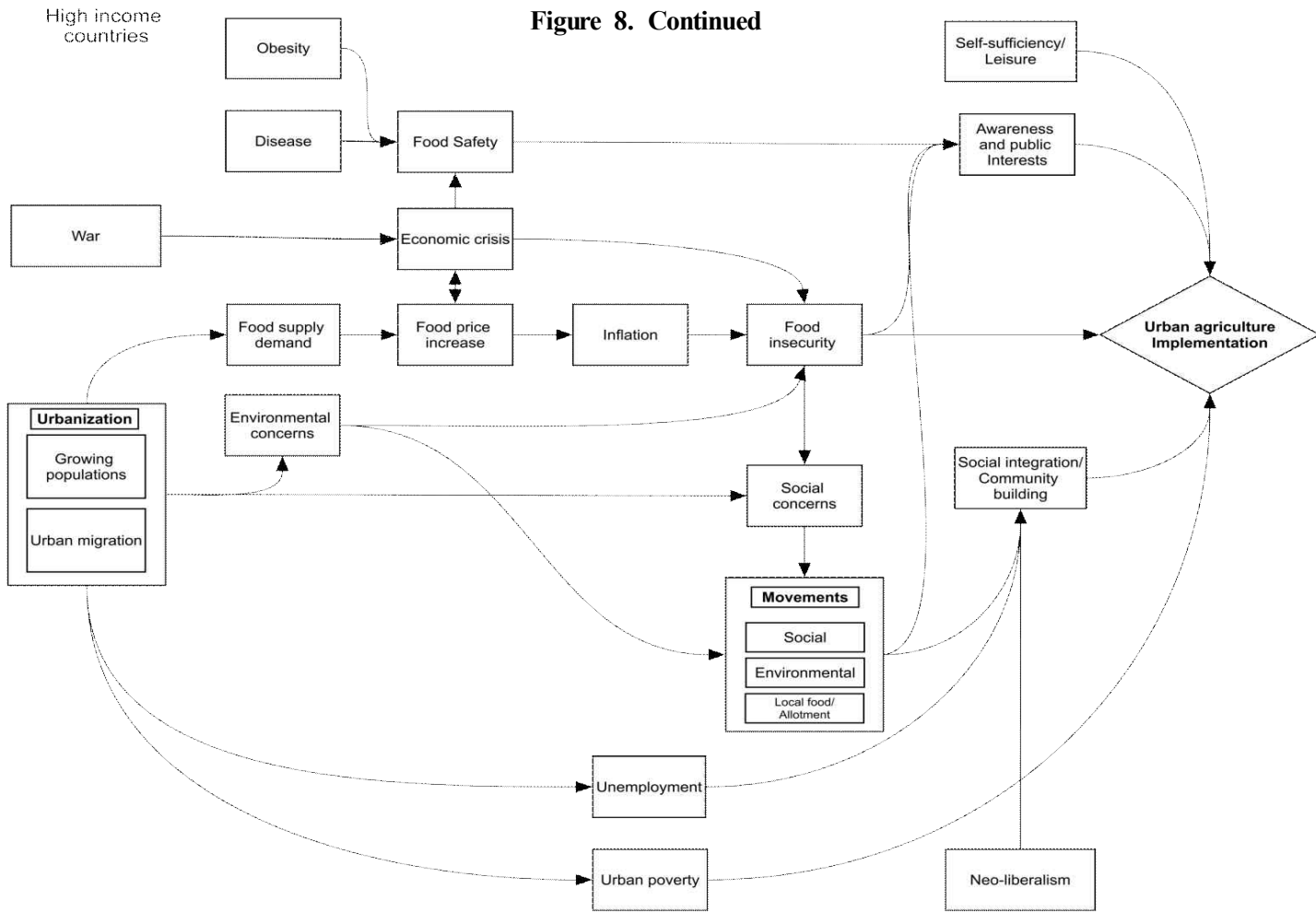


Figure 8. Pathways of Urban Agriculture Implementation by Income Level

Low and middle income countries





6.2. The Enabling Conditions and Income Levels

The UA conditions show that the degree of conditions mentioned in the literature varied, and there were differences in the conditions, depending on the income level. In Figure 9, the darkness of color in space indicates the degree of conditions mentioned in the literature. The more the condition is mentioned, the darker it is, which can be interpreted as the UA dominant condition.

Many conditions have been found in the literature regardless of the income level. These conditions include farmers' motivation and public awareness for practicing UA, labor and human resources, availability of arable land and resources (water, seed, fertilizer, etc.) for farming, UA policy, and governmental institutions, and social capital, and they have great positive impacts on the development of UA. Mougeot (2005) has defined UA as agricultural practices by using 'human' and material resources to satisfy the needs of urban populations. From this definition, it is possible to shed light on 'people' who play a major role in UA. Public participation in UA is based on the motivation for agricultural activities, and those who participate in urban farming provide human resources for the foundation of the formation of UA. Thus, human resources with compelling motivation for UA can be regarded as a major factor in carrying out urban farming (Redwood, 2012). Land and resources have not been cited as a basic composition for

UA in various studies (Baumgartner and Belevi, 2001; Redwood, 2012). Strong social capital, such as partnership and network among participants, enables the individuals to distribute and obtain resources, and it engenders collective efforts to practice UA (Peake and Trotz, 1999; Agrawal, 2000).

Appropriate policy and governmental institutions are the most effective condition to encourage responsible UA (Redwood, 2012). However, there are slight differences in the governance conditions for UA according to the income level. It is evident that the role of policy and governmental institutions are emphasized in low- and middle-income countries, whereas the conditions are widely distributed through the condition categories in high-income countries, emphasizing not only the importance of governmental actors but also other actors, including non-governmental actors, private actors, and diverse stakeholders. Although many attempts have been made to distribute authority in developing countries, the role of the governmental organizations is dominantly prevalent in addressing different reform options within the country, and many targeted changes have been undertaken by the government (Wamukonya, 2003). Many national governments and city administrators, however, fail to recognize UA despite agriculture being practiced for a long period in most African countries. This hinders the development of urban farming in developing countries [A.113]. It is evident that not only the private sector but individuals also continue to depend on governmental support to meet their demands (Wamukonya, 2003). Therefore,

the role of institutional structures or government is being emphasized for improving urban cultivating practices [A.5;47].

Conversely, in developed countries, the role of multi-stakeholders was apparent between urban dweller and policy manager, between farmers and officials, and between voluntary and public sector actors in the formation of UA [A.23;36]. Not only this, many European countries highlight the role of the involvement of gardeners and their neighborhood actors for sustainable preservation of urban food gardens [A.29;34]. A new discourse of multilateral world order and establishing new patterns of cooperation between multi-actors has been formed since the 1990s. Since then, the diverse actors' involvement in policy decision-making has become more important worldwide. Compared to developing countries that did not appear to create space for the effective participation of multi-actors (Humphrey and Messner, 2006), many Western countries recognized the significance of multi-level inclusion in their governance approach and put more effort into including various stakeholders in their governance system (Vukasovic et al., 2018). Since diverse interests lie among different stakeholders, the acknowledgment of interests among different actors is the first step toward the success of certain policy/public activities successful (balance is one of the crucial factors).

The technical condition was dominantly addressed as a UA enabling condition in low- and middle-income countries, including the development of UA technology and the agricultural education system. Unlike high-income

countries, which have accomplished advances in scientific technology through innovation, most of the economic development in low- and middle-income countries depends on primary industries, and to this day, much technological advancement and introduction for corresponding industrial development are still required in various ways (Odingo, 1981; Madu, 1989). Rostow and Rostow (1990) observed that the advancement of technology in less developed countries enhances economic opportunities (Rostow and Rostow, 1990). In this regard, low- and middle-income countries have a relatively strong need for innovation that can effectively address constraints on existing agricultural activity in cities as compared to developed countries.

The importance of commitment to urban food production is seen more clearly in high-income countries than in low- and middle-income countries. From the UA ability condition, the commitment issue on carrying out UA activities among urban farmers is emphasized in high-income states [A.29;36]. It has been reported that many successful UA programs are formed through strong involvement in urban farming [A.36]. Unlike UA in low- and middle-income states, where most households depend on agricultural activities for survival strategy (Byerlee and Sain, 1986), UA is not only used as a means of subsistence but also as ancillary activities such as leisure in high-income countries (Deelstra and Girardet, 2000). This supports the fact that high-income countries tend to have relatively low levels of commitment to agricultural activities compared to low-income countries, and that the

promotion of urban farmers' commitment to agricultural activities is an important condition for the successful implementation of UA in high-income countries.

6.3. Constraining Conditions and Income Levels

Constraining conditions depend on regions and income levels, as shown in Figure 10. As per the heat-map, limited arable land and scarcity or contamination of farming resources were dominantly mentioned in literature regardless of income level. Land use within urban areas, the center of various industrial activities, is mentioned in various studies as a major constraint in the revitalization of UA [A.107;113;82;55]. Furthermore, the soil fertility is poor due to urban contamination [A.10;39;45;107]. This suggests that it is fundamental to provide fertile arable land and agricultural resources to farmers, and this fact firmly proves that these conditions should be secured for progressing UA practices.

The shortage of arable land and resources as well as the shortage of institutional infrastructure is also a constraining condition of UA that stands out dominantly in both income levels [A.113;109;107;89;82;76;42]. It was found that urban farming remains risky without proper institutional support and it leads to failure [A.100], and individual citizens cannot continue UA without support from the city administration [A.38]. Moreover, it has been reported that the confusion and overlapping administrative structures may cause problems in promoting UA in some countries [A.84]. This means that the lack of support or inadequate institutional infrastructure is considered a major factor that can hinder farming in all urban areas.

Reckless urban development is comparatively mentioned a lot as a UA constraining condition in high-income states, that is, in urbanized states, urban farming competes for land with higher value uses such as housing or commercial development [A.11]. Despite the different potential benefits of UA, only a small proportion of the arable land for UA has remained available worldwide [A.4]. As the land in urban areas becomes more expensive as the city develops, more coercion is required to convert land from commercial uses to the garden. Additionally, more effort is demanded in high-income countries where urbanization has completed compared to developing countries where urbanization is underway (Azadi et al., 2011). In fact, UA has been measured as having a negative impact on urban development despite the potential benefits of UA, which impedes the promotion of UA (Nsangu and Redwood, 2009). Thus, UA is crucial to be considered together in the process of establishing an urban development plan for the continuation of UA, which will effectively ensure the use of arable land in urban areas (Mutonodzo, 2009).

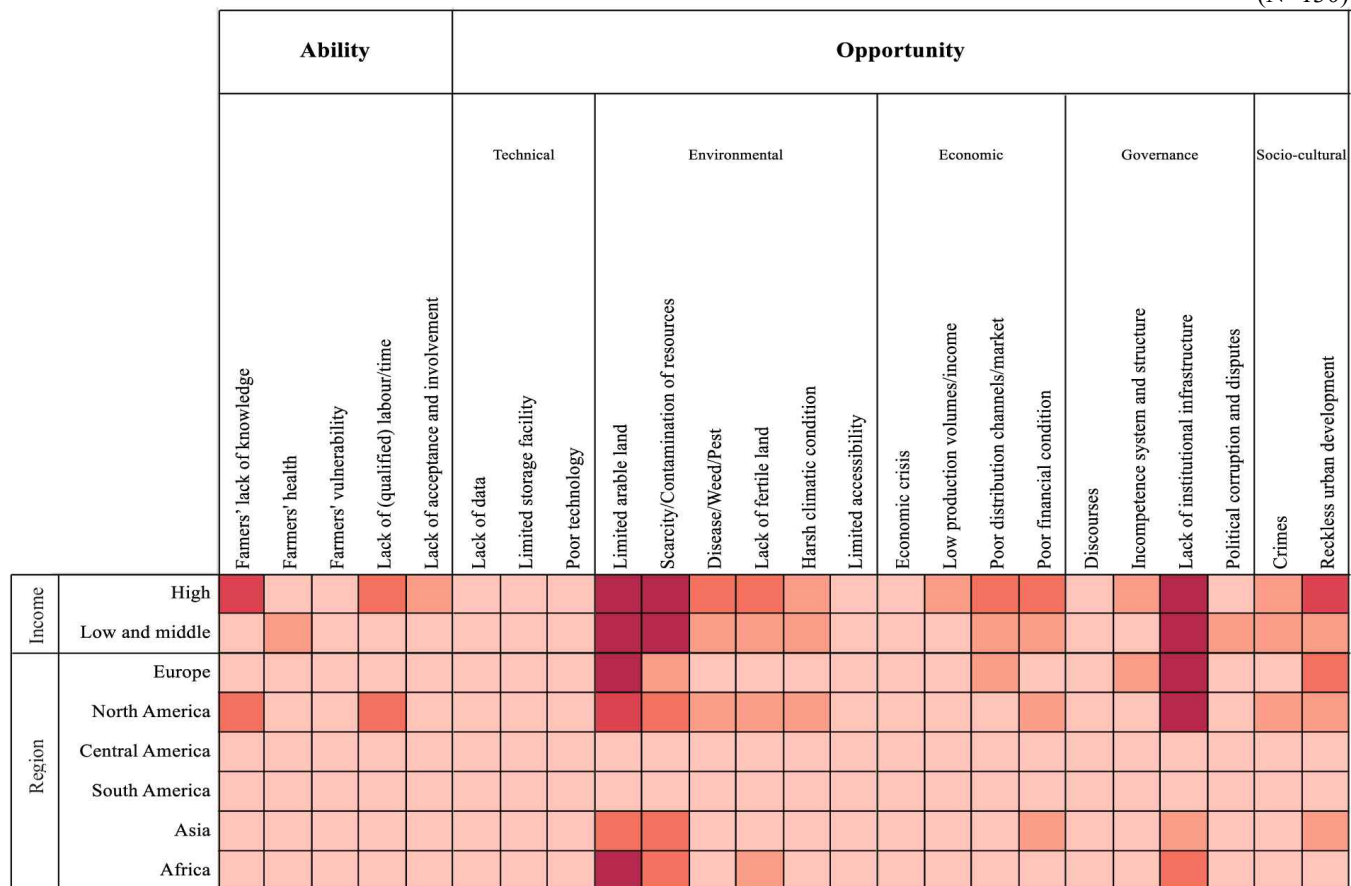
The lack of agricultural backgrounds and knowledge concerns were frequently discussed in the case of high-income countries. Urban residents from high-income states suffer difficulties in carrying out urban farming due to the lack of understanding of agriculture [A.16;38;76]. According to Kaufman and Bailkey, the persistence of lack of capacity among people is a major obstacle for practicing UA nowadays (Kaufman and Bailkey, 2000).

Despite the need to convey relevant agricultural knowledge to enhance the capacity to carry out urban farming, time constraints make it difficult to deliver agricultural skills to urban populations [A.105;108;109]. The most cited challenge among urban gardeners is the lack of time for farming in the highly industrialized cities [A.93;108]. To cope with this, the issue of lack of time among urban farmers must be resolved first.

Each country has different materials, capital, and infrastructure, which affect the development and growth of the region (Scott and Storper, 2003; Ingram and Kessides, 1994). Growth is positively affected by infrastructure assets, and infrastructure development is effective in combating poverty by producing financial benefits (Calderón and Servén, 2004). The different economic levels, infrastructure, and resources of the country differ depending on the income level. It can be inferred that approach and support for the introduction of new systems will vary depending on the infrastructure and resources owned by the state (Scott and Storper, 2003). In other words, the darker color signifies a condition that plays an important role in enabling UA in the country.

Figure 10. Constraining Conditions by Income Level and Region

(N=130)



Number of cases

0 15

6.4. Urban Agriculture Conditions and Urban Planning

Given that UA conditions are identified by income and region levels, three suggestions are made through this study. First, there are fundamental UA conditions for sustainable food production: people's motivation for doing urban agricultural activities, appropriate UA policies, and governmental institution in charge of UA, social networks and partnerships among different UA stakeholders, usable land and resources for farming, and human resources who carry out agricultural activities. These conditions were revealed dominantly regardless of states' income levels by taking up the darkest two stages of the heat map illustration (Figure 9 and 10). These conditions should be addressed first when establishing UA policies in urban planning (Table 7) and we named these conditions as 'primary conditions' of UA for food production in this study. The primary UA conditions affirm the idea suggested by McSorley and Porazinska (2001), who demonstrated elements of sustainable agriculture with several elements including human resources, water, temperature, energy, and others. Larder et al. (2014) found an opportunity to motivate food producers within the food system through the right to choose or to enact choices. Food production in the backyard, for example, is related to the ability to choose where food came from and how it was grown. Likewise, Larder et al. (2014) emphasized that efforts to secure urban farmers' rights by the local government are needed to establish a participatory

UA system for urban residents. Furthermore, a recent study has addressed the significance of the city policies or programs to increase UA. In Toronto, the political work of the UA system has been modified to increase support for UA at the municipal level. The city allows urban farmers to sell home-grown food at markets by revising city guidelines. They also create a Residential Apartment Commercial Zone to provide sites that allow practices of urban farming as part of the revitalization of UA (Wekerle and Classens, 2015). The Municipal Government of São Paulo, in addition, introduced several UA programs through the law and ordinances. For instance, the Ordinances 003/2006 and 004/2006 of the Brazilian Federal Government aimed to implement support centers to facilitate the development of urban community gardens, facilitate federal resource transfers, and help purchase agricultural equipment and inputs (Amato-Lourenço et al., 2020). These policy devices and active government support not only enable the revitalization of UA but also enable the ultimate participation of people.

Moreover, the results confirm the influential urban agricultural conditions that are highlighted differently depending on income levels, and these conditions in this study were named as 'secondary conditions' for UA food production (Table 7). The determined secondary conditions for UA at low- and middle-income levels are the development of UA technology. Agriculture serves as an important engine for economic growth in low- and middle-income countries. Many urban poor households have been supported

by UA in developing countries (Aker, 2011; Ifatimehin and Musa, 2008). It is vital to find a way to increase agricultural yield to boost profits, and one promising method for this is the use of improved agricultural technologies (Aker, 2011). More information on crops, fertilizers, water, and pesticides could significantly increase crop production, while immunization and food advice could improve livestock and reduce the number of premature deaths (Shariful, 2002). For this reason, innovation in agricultural technology should first be considered by urban development planners under the rapid growth of the population, especially in cities of underdeveloped countries (Giampietro, 1994).

Finally, to revitalize UA in high-income countries, urban planners should deal with how to improve commitment to UA activities among urban farmers. Commitment can be improved by the congruency among urban farmers, autonomy to farming practices, self-interests, and positive feedback (Fornes et al., 2008). Thus, it is necessary to identify various factors to increase commitment in the community and to establish a system for them. Another UA secondary condition for high-income cities is the lack of agricultural capacity, which should be considered preferentially. Owing to the lack of trained personnel and a shortage of skilled urban farmers identified as a major constraint of UA food production in high-income countries [A.76;109], each municipal government should put more effort into enhancing individual farming ability, especially in developed countries. To achieve this,

increased knowledge and skills can be a possible way to improve human productivity (Miller, 1977) and an individual's agricultural capacity is a legitimate concern of the organization for better performance in UA.

Table 7. Dominant Conditions of Urban Agriculture

		Enabling		Constraining	
		High-income countries	Low- and middle-income countries	High-income countries	Low- and middle-income countries
Primary	Ability	Motivation/Public awareness of UA		-	
		Labor/human resource		-	
	Opportunity	UA policy and governmental institution		Lack of institutional infrastructure	
		Arable land and resources for farming		Limited/contaminated arable land and resources	
		Social capital		-	
Secondary	Ability	Commitment of urban farmers	-	Farmers' lack of knowledge	-
	Opportunity	-	Agricultural education and training	Reckless urban development	-
Research and technical development					

7. Conclusion

Through a literature review from a variety of perspectives, this study investigated how to activate or obstruct conditions within the food provisioning context of the UA. Literature was extracted to identify in which enabling or constraining conditions are described in the literature in relation to UA. The findings were then synthesized to develop a more cohesive set of enabling and constraining conditions, resulting in the necessity, ability, and opportunity conditions. As a result of the analysis, the conditions for UA, which are addressed primarily according to the national income level, were identified and the primary conditions and secondary conditions for UA were determined. The primary conditions for UA for sustaining food production are people's motivation for doing urban agricultural activities, appropriate UA policies and governmental institutions in charge of UA, social networks and partnerships among different UA stakeholders, usable land and resources for farming, and human resources who carry out agricultural activities. The secondary conditions for UA for its role as a food supplier identified distinctively by income levels are UA ability condition, commitments among urban farmers, and UA technical condition. This study provides meaningful indicators that city policymakers can consider when including UA as a food production role in urban planning. To promote rational UA, urban

policymakers should first create an environment that meets the major UA conditions within the city and secure minor UA conditions according to the main economic activity and income level of urban dwellers.

This study is the initial comprehensive study for identifying influential UA conditions covering various case studies and provides insight for UA policy establishment by providing information on enabling and constraining conditions for strengthening the food needs of urban residents. In addition to investigating the aspects of UA and how they can be promoted to support food needs, this study could use UA as an entry point for understanding wider food supply issues and food insecurity. However, this study has limitations. Only the information revealed in the paper by the researchers, not by direct observation at the site, has been analyzed in this study, which fails to address the unique characteristics of a particular country or city individually. In addition, due to the linguistic limitations of the researcher, only the papers written in English were used as analytical literature. Furthermore, this study has not considered various urban farming systems such as backyard gardens, tactical gardens, greenhouses, vertical farms, rooftop gardens, urban beekeeping, and aquaponics (Spacey, 2017). Therefore, a detailed and in-depth study is needed on the success and limiting conditions of UA by system and type of UA through future research.

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Appendix 1. List of Included Articles for Analysis

No.	TITLE	Country	Year	Journal
1	Aquaponics in urban agriculture: Social acceptance and urban food planning	Australia	2017	Horticulturae
2	Can urban agriculture usefully improve food resilience? Insights from a linear programming approach	Australia	2015	Journal of Environmental Studies and Sciences
3	Optimising diet decisions and urban agriculture using linear programming	Australia	2014	Food Security
4	Urban agriculture could provide 15% of food supply to Sydney, Australia, under expanded land use scenarios	Australia	2020	Land Use Policy
5	Rooftop gardening as a strategy of urban agriculture for food security: The case of dhaka City, Bangladesh	Bangladesh	2004	Acta Horticulturae
6	Politics of scale in urban agriculture governance: A transatlantic comparison of food policy councils	Belgium/ USA	2019	Journal of Rural Studies
7	Contributions of the old urban homegardens for food production and consumption in Rio Claro, Southeastern Brazil [Contribuições dos quintais urbanos antigos na	Brazil	2013	Boletim do Museu Paraense Emilio Goeldi:Ciencias Humanas

	produção e no consumo de alimentos em Rio Claro, Sudeste do Brasil]			
8	The potential for rooftop agriculture in the city of Rio de Janeiro: Growing capacity, Food security and Green infrastructure	Brazil	2020	IOP Conference Series: Earth and Environmental Science
9	Building knowledge in urban agriculture: the challenges of local food production in São Paulo and Melbourne	Brazil/ Australia	2020	Environment, Development and Sustainability
10	Contribution of urban and periurban agriculture to household food and nutrition security along the urban-rural continuum in Ouagadougou, Burkina Faso	Burkina Faso	2017	Renewable Agriculture and Food Systems
11	Challenges to supporting social justice through food system governance: examples from two urban agriculture initiatives in Toronto	Canada	2019	Environment and Urbanization
12	Creating new urban spaces of sustainability and governmentality: An assessment of the development of a food and urban agriculture strategy for Edmonton, Canada	Canada	2014	Research in Urban Sociology
13	Food production in the city: (re)negotiating land, food and property	Canada	2015	Local Environment
14	Green dreams: Promoting urban agriculture and the availability of locally produced food in the Vancouver metropolitan area	Canada	2011	Focus on Geography
15	Growing Food in the Suburbs: Estimating the Land Potential for Sub-urban Agriculture in Waterloo, Ontario	Canada	2014	Planning Practice and Research
16	Growing in the city: Expanding opportunities for urban	Canada	2018	JOURNAL OF AGRICULTURE

	food production in Victoria, Canada			FOOD SYSTEMS AND COMMUNITY DEVELOPMENT
17	Phosphorus cycling in Montreal's food and urban agriculture systems	Canada	2015	PLoS ONE
18	So Why Is the City of Toronto Concerned About Food and Agriculture Policy? A Short History of the Toronto Food Policy Council	Canada	1994	Culture & Agriculture
19	Alternative approaches to food: Community supported agriculture in urban China	China	2017	Sustainability (Switzerland)
20	Emergy calculation and analysis of food crops in Zhangye city	China	2015	Advance Journal of Food Science and Technology
21	Evaluation on ecosystem services value based on food production in Nanfen District of Benxi City, Northeast China	China	2015	Advance Journal of Food Science and Technology
22	Modeling different urban change trajectories and their trade-offs with food production in Jiangsu Province, China	China	2019	Computers, Environment and Urban Systems
23	Technology-driven transition in urban food production practices: A case study of Shanghai	China	2019	Sustainability (Switzerland)
24	Urban economic development, changes in food consumption patterns and land requirements for food production in China	China	2015	China Agricultural Economic Review
25	Increasing food sovereignty with urban agriculture in Cuba	Cuba	2016	Agriculture and Human Values

26	Low-carbon food supply: the ecological geography of Cuban urban agriculture and agroecological theory	Cuba	2016	Agriculture and Human Values
27	The greening of the "barrios": Urban agriculture for food security in Cuba	Cuba	1999	Agriculture and Human Values
28	Urban agriculture, planning and food price control	Cuba/ Brazil/ India	2014	Economic and Political Weekly
29	Food gardens as important elements of urban agriculture: Spatio-developmental trends and future prospects for urban gardening in Czechia	Czechia	2018	Norsk Geografisk Tidsskrift
30	Growing food in the city: Urban agriculture in Quito, Ecuador, through a feminist lens	Ecuador	2019	JOURNAL OF AGRICULTURE FOOD SYSTEMS AND COMMUNITY DEVELOPMENT
31	Exploring the future of rural - urban connections in sub-Saharan Africa: modelling urban expansion and its impact on food production in the Addis Ababa region	Ethiopia	2017	Geografisk Tidsskrift - Danish Journal of Geography
32	Farm fresh in the city: Urban grassroots food distribution networks in Finland	Finland	2017	Global Urban Agriculture
33	Shortening food supply chains: A means for maintaining agriculture close to urban areas? The case of the French metropolitan area of Paris	France	2013	Food Policy
34	Regulation of Farmland Conversion on the Urban Fringe: From Land-Use Planning to Food Strategies. Insight into	France/ Italy	2013	International Planning Studies

	Two Case Studies in Provence and Tuscany			
35	Edible cities - An innovative nature-based solution for urban sustainability transformation? An explorative study of urban food production in German cities	Germany	2020	Urban Forestry and Urban Greening
36	Finding spaces for urban food production - matching spatial and stakeholder analysis with urban agriculture approaches in the urban renewal area of Dortmund-Hörde, Germany	Germany	2015	Future of Food: Journal on Food, Agriculture and Society
37	Potential for sustainable urban food production in a medium scale city in Germany	Germany	2018	World Sustainability Series
38	Urban agriculture and food systems dynamics in the German Bonn/Rhein-Sieg Region	Germany	2016	International Journal on Food System Dynamics
39	As the city grows, where do the farmers go? Understanding Peri-urbanization and food systems in Ghana - Evidence from the Tamale Metropolis	Ghana	2015	Urban Forum
40	The geography of agriculture participation and food security in a small and a medium-sized city in Ghana	Ghana	2020	Agricultural and Food Economics
41	Urban farm-nonfarm diversification, household income and food expenditure in Ghana	Ghana	2017	Studies in business and economics
42	Urban households' engagement in agriculture: implications for household food security in Ghana's medium sized cities	Ghana	2017	Geographical Research

43	Developing solutions for dealing with water and food scarcity: Atmospheric water generator and urban farm tower	India	2018	2018 Advances in Science and Engineering Technology International Conferences, ASET 2018
44	Urban Food Security through Urban Agriculture and Waste Recycling: Some Lessons for India	India/ Brazil/ Cuba	2013	Vikalpa
45	Wastewater treatment and reuse in urban agriculture: Exploring the food, energy, water, and health nexus in Hyderabad, India	India	2017	Environmental Research Letters
46	Household food consumption patterns and food security among low-income migrant urban farmers in Delhi, Jakarta, and Quito	India/ Indonesia/ Ecuador	2019	Sustainability (Switzerland)
47	Development strategy of program of Model of Sustainable Food Estate Area (M-SFEA) based on female farmer group for social urban in Siak Regency of Riau Province, Indonesia	Indonesia	2018	IOP Conference Series: Earth and Environmental Science
48	Urban agriculture, food security, and development policies in Jakarta: A case study of farming communities at Kalideres - Cengkareng district, West Jakarta	Indonesia	2019	Land Use Policy
49	Assessing food production capacity of farms in periurban areas	Italy	2014	Italian Journal of Agronomy
50	Exploring rooftop rainwater harvesting potential for food production in urban areas	Italy	2017	Agriculture (Switzerland)
51	Multitemporal geospatial evaluation of urban agriculture and	Italy	2019	Sustainability (Switzerland)

	(non)-sustainable food self-provisioning in Milan, Italy			
52	Radical Urban Horticulture for Food Autonomy: Beyond the Community Gardens Experience	Italy	2018	Antipode
53	Revisiting the sustainability concept of Urban Food Production from a stakeholders' perspective	Italy	2018	Sustainability (Switzerland)
54	Household food security among urban farmers in Nairobi, Kenya	Kenya	2012	Agriculture in Urban Planning: Generating Livelihoods and Food Security
55	Strengthening capacity for sustainable livelihoods and food security through urban agriculture among HIV and AIDS affected households in Nakuru, Kenya	Kenya	2011	Urban Agriculture: Diverse Activities and Benefits for City Society
56	Urban agriculture, social capital, and food security in the Kibera slums of Nairobi, Kenya	Kenya	2013	Agriculture and Human Values
57	Urban agriculture and poverty reduction: Evaluating how food production in cities contributes to food security, employment and income in Malawi	Malawi	2011	Journal of International Development
58	Right to food, right to the city: Household urban agriculture, and socationatural metabolism in Managua, Nicaragua	Nicaragua	2013	Geoforum
59	Attitudinal disposition of urban dwellers towards	Nigeria	2012	Asian Journal of Agricultural

	participation in urban agriculture in Oyo state, Nigeria: Implication for sustainable food production			Research
60	Contribution of urban vegetable farmers to food security: The case of the akinyele local government, Oyo State, Nigeria	Nigeria	2013	Acta Horticulturae
61	Determinants of technical efficiency in urban food crop production in Ibadan metropolis, Oyo State, Nigeria	Nigeria	2007	Journal of Agricultural and Food Information
62	Enterprise choice decisions in urban food production in nigeria: Empirical evidence from akwaibom state	Nigeria	2012	Outlook on Agriculture
63	Food security and productivity among urban farmers in Kaduna State, Nigeria	Nigeria	2018	Journal of Agricultural Extension
64	Water, land and health in urban and peri-urban food production: The case of Kano, Nigeria	Nigeria	2003	Land Degradation and Development
65	Community food production in cities of the developing nations.	Philippines/ Zambia/ Mexico	1987	Food & Nutrition Bulletin
66	Potential mitigation of the environmental impacts of food systems through urban and peri-urban agriculture (UPA) - a life cycle assessment approach	Portugal	2017	Journal of Cleaner Production
67	From urban and peri-urban agriculture to micro-gardens: How to achieve fresh food security in Dakar?	Senegal	2014	Acta Horticulturae
68	Meeting the urban challenge? Urban agriculture and food security in post-conflict Freetown, Sierra Leone	Sierra Leone	2013	Applied Geography
69	Urban farming associations, youth and food security in	Sierra Leone	2012	Cities

	post-war Freetown, Sierra Leone			
70	Assessing Gender Inequality in Food Security among Small-holder Farm Households in urban and rural South Africa	South Africa	2016	World Development
71	Beyond food security: women's experiences of urban agriculture in Cape Town	South Africa	2017	Agriculture and Human Values
72	Does urban and peri-urban agriculture contribute to household food security? An assessment of the food security status of households in Tongaat, eThekweni Municipality	South Africa	2019	Sustainability (Switzerland)
73	Urban agriculture, food security and poverty alleviation in post-apartheid metropolitan Durban, South Africa	South Africa	2017	Africa Now!: Emerging Issues and Alternative Perspectives
74	Urban farmers and urban agriculture in Johannesburg: Responding to the food resilience strategy	South Africa	2015	Agrekon
75	Neighbourhood characteristics and urban gardens in the Toledo metropolitan area: staffing and voluntarism, food production, infrastructure, and sustainability practices	USA	2018	Local Environment
76	Resolving differing stakeholder perceptions of urban rooftop farming in Mediterranean cities: promoting food production as a driver for innovative forms of urban agriculture	Spain	2016	Agriculture and Human Values
77	The potential role of short food supply chains in strengthening periurban agriculture in Spain: The cases of Madrid and Barcelona	Spain	2019	Sustainability (Switzerland)
78	Being efficient and green by rethinking the urban-rural	Sweden	2018	Sustainable Cities and Society

	divide – Combining urban expansion and food production by integrating an ecosystem service perspective into urban planning			
79	Peri-urban food production and its relation to urban resilience	Sweden/ Denmark/ Belgium	2016	Sustainability (Switzerland)
80	Urban agriculture towards food security of Syrian refugees and vulnerable Lebanese host communities	Syria/ Lebanon	2019	Development in Practice
81	Floods and food in the city: Lessons from collaborative governance within the policy network on urban agriculture in Bangkok, Thailand	Thailand	2017	Environmental Justice and Urban Resilience in the Global South
82	Alternative food security strategy: A household analysis of urban agriculture in Kampala	Uganda	1995	World Development
83	Food and nutritional security of children of urban farmers in Kampala, Uganda	Uganda	2007	Food and Nutrition Bulletin
84	Highest and best use? Access to urban land for semi-subsistence food production	Uganda	1996	Land Use Policy
85	Building London's food democracy: Assessing the contributions of urban agriculture to local food decision-making	UK	2019	Politics and Governance
86	Emerging community food production and pathways for urban landscape transitions	UK	2012	Emergence: Complexity and Organization
87	Epigeal fauna of urban food production sites show no obvious relationships with soil characteristics or site area	UK	2019	Agriculture, Ecosystems and Environment

88	Estimating food production in an urban landscape	UK	2020	Scientific Reports
89	Food for urban spaces: The development of urban food production in England and Wales	UK	1999	International Planning Studies
90	Planning urban food production into today's cities	UK	2015	Future of Food: Journal on Food, Agriculture and Society
91	Sustainable food production in a temperate climate - a case study analysis of the nutritional yield in a peri-urban food forest	UK	2019	Urban Forestry and Urban Greening
92	The contribution of small-scale food production in urban areas to the sustainable development goals: a review and case study	UK	2020	Sustainability Science
93	Agroecological and social characteristics of New York city community gardens: contributions to urban food security, ecosystem services, and environmental education	USA	2016	Urban Ecosystems
94	Does urban agriculture improve food security? Examining the nexus of food access and distribution of urban produced foods in the United States: A systematic review	USA	2018	Sustainability (Switzerland)
95	Environmental reviews & case studies: D-town farm: African American resistance to food insecurity and the transformation of Detroit	USA	2011	Environmental Practice

96	From “Rust Belt” to “Fresh Coast”: Remaking the City through Food Justice and Urban Agriculture	USA	2018	Annals of the American Association of Geographers
97	Growing food to grow cities?: The potential of agriculture foreconomic and community development in the urban United States	USA	2014	Community Development Journal
98	Monitoring and mitigation of toxic heavy metals and arsenic accumulation in food crops: A case study of an urban community garden	USA	2020	Plant Direct
99	Not just the price of food: Challenges of an urban agriculture organization in engaging local residents	USA	2013	Sociological Inquiry
100	Reversing food desertification: examining urban farming in Louisville, Chicago and Detroit	USA	2015	Local Environment
101	Something Good Can Grow Here: Chicago Urban Agriculture Food Projects	USA	2015	JOURNAL OF PREVENTION & INTERVENTION IN THE COMMUNITY
102	Sustainable food systems for future cities: The potential of urban agriculture	USA	2014	Economic and Social Review
103	Testing the environmental performance of urban agriculture as a food supply in northern climates	USA	2016	Journal of Cleaner Production
104	The Intersection of Planning, Urban Agriculture, and Food Justice: A Review of the Literature	USA	2017	Journal of the American Planning Association

105	The role of urban agriculture in a secure, healthy, and sustainable food system	USA	2018	BioScience
106	Urban farming in the North American metropolis: Rethinking work and distance in alternative food networks	USA	2016	Environment and Planning A
107	Urban food production limits and the viability of community gardens: The case of Hartford, Connecticut	USA	2012	Local Food Systems in Old Industrial Regions: Concepts, Spatial Context and Local Practices
108	When vacant lots become urban gardens: Characterizing the perceived and actual food safety concerns of urban agriculture in Ohio	USA	2015	Journal of Food Protection
109	Extreme local food: Two case studies in assisted urban small plot intensive agriculture	USA/ Canada	2008	Environments
110	'If I want safe food I have to grow it myself': Patterns and motivations of urban agriculture in a small city in Vietnam's northern borderlands	Vietnam	2020	Land Use Policy
111	Food securitization and urban agriculture in Hanoi (Vietnam)	Vietnam	2015	Articulo - Journal of Urban Research
112	Economic crisis and food security in Africa: Exploring the significance of urban agriculture in Zambia's Copperbelt province	Zambia	2015	Geoforum
113	Coping with food poverty in cities: The case of urban agriculture in Glen Norah Township in Harare	Zimbabwe	2016	Renewable Agriculture and Food Systems
114	Urban food production in Harare, Zimbabwe	Zimbabwe	2018	Urban Food Systems Governance

				and Poverty in African Cities - (Open Access)
115	Paid work, unpaid work, and economic viability in alternative food initiatives: Reflections from three Boston urban agriculture endeavors	U.S.A	2015	JOURNAL OF AGRICULTURE FOOD SYSTEMS AND COMMUNITY DEVELOPMENT

Appendix 2. Condition List

Category	Condition	
	Type	Sub-type
Necessity	Increase of food price and demand (31)	Food price surge, land requirement for food, food shortage, hungry people, inadequate food, inadequate food access, demand for diversified foodstuffs, food poverty, etc.
	Unemployment/Low wage/Save money (13)	Limited job opportunity, decline income, supplement low wages (supplemental income), generating income, economic security, etc.
	Food safety/quality (15)	Fresh and healthy food, nutritious dietary intake, safe vegetables, etc.
	Economic/Food crisis or War (4)	Loss of political and economic allies, economic embargo, etc.
	Food stability and security (22)	National food security, local production and distribution, shorter food supply chains, etc.
	Environmental concern (20)	Biodiversity, environmental quality, prevent ecological deterioration, climate change, environmental sustainability, waste recycling, reduce waste and pollution, ecological benefits, environment degradation, etc.
	Social concern (17)	Community building, beautify and animate spaces, community coherence, social justice, educational and recreational spaces, well-being, leisure, re-connection with community, local food movement, etc.

Category	Conditions			
	Enabling conditions		Constraining conditions	
	Type	Contents	Type	Sub-type
Ability	Motivation/ Awareness (37)	Desire to ensure food, willingness, interests, desire, enthusiasm, etc.	Farmers' health (3)	Farmers' morbidity and mortality, aging, illness, etc.
	Labour/ Human resource (21)	Farming knowledge, farming skill, farming experience, labor force, innovative farmers, educated farmers, farming technique, etc.	Farmers' lack of knowledge (13)	Lack of trained personnel, inability, lack of capacity, lack of UA understanding etc.
	Household size (2)		Farmers' vulnerability/dependency (2)	
	Commitment of UA participants (10)	Gardeners involvement, bottom-up initiatives, local authorities, etc.	Lack of acceptance and involvement (6)	Need to better understand of food issues, historical connection, difficulties in mobilizing farm labor, inconsistent participation, etc.
			Lack of (qualified) labour/time (7)	Time constraints

Category	Subcategory	Condition			
		Enabling condition		Constraining condition	
		Type	Sub-type	Type	Sub-type
Opportunity	Technical	Research and technical development (20)	Investment in technology and science of agriculture, place-based analysis, technical advices, etc.	Limited storage facility (1)	
		Agricultural education and training (19)	Workshop, mentoring, publications/guidance, research center, education platform, etc.	Poor technology (1)	Unavailable technology, etc.
		Farming method/system/tool (8)	Container gardening, Patios and deck, socio-ecological agricultural systems, fencing, equipment, fertilizers, etc.	Lack of data (1)	Lack of reliable data
	Economic	Distribution channel/market (11)	Local market, transportation network, physical infrastructure, farmers' market, etc.	Poor distribution channels/market (10)	Limited certification, lack of ready market, transportation, size of enterprises, distribution

					plan, viable marketing, etc.
		Prices and direct selling (4)	Value-added sale and processing	Poor financial condition (11)	Limited input cost (operation cost), financial capital, access to capital for new farmers, lack of financial resource(mean), challenge finding financing construction, etc.
		Collaborative arrangement (5)	Link consumers, authorities, entrepreneurs and producers, etc.	Economic crisis (1)	
		Consumer demand (1)		Low production volumes/income (4)	Low wage, insufficient food provision, lack of economic viability, etc.
	Environmental	Arable land (34)	Land tenure, availability of land, land access, land	Limited arable land (54)	Small proportion of land, scarcity of land (area for agriculture),

			ownership, vacant allotment, tenure security, etc.		low availability of land, lack of land(space) intense competition for land, limited ownership for garden spaces, insecurity of land tenure, etc.
		Resources (34)	Water (irrigation system), seed, funding, air, electricity, energy, etc.	Scarcity/contamination of resources (32)	Food safety, contamination of crop, lack of variety of seed, limited resources, scarce of water, heavy metal and arsenic contamination, shortage of resource, polluted water, contaminated air, etc.
		Fertile soil (14)	Soil quality, soil nutrient levels, abundance and diversity of soil,	Lack of fertile land (11)	Poor urban soil, soil contamination, soil contamination, poor soil quality, etc.

			compost, manure, organic matter, etc.		
		Climatic condition (7)	Climate data, availability of rainwater, etc.	Harsh climatic condition (7)	Microclimate condition, adverse weather condition, drought, heavy rains, flooding, season, etc.
		Proximity (1)	(Definition) easy to access to purchase seeds, fertilizers, and even soil living in city	Limited accessibility (1)	Constraint of social opportunity, etc.
		Pollination (1)		Disease/weed/pest (9)	Pests and animals, insect damage, mammalian pest, etc.
	Governance	Policy (60)	Regulation, policy guidelines, public policy, fiscal incentive, tax reductions, credit programs, subsidies, ordinance, law, city	Lack of institutional infrastructure (40)	Restrictive policy(setting), prohibitive by law, zoning restriction, disconnection between initiative and city planning strategy, lack of

			plan, funding, loan, land reform, etc.		institutional(government) support, lack of a food planning framework, lack of government fund and incentive, lack of acknowledgement by public administration, lack of political will (legal support), etc.
		Governmental institution (20)	Municipal planning, government encouragement, governmental agency, local government, institutional structure, public administration, institutional channels, etc.	Political corruption and disputes (5)	Tension between land use interests, wealthy elites or corrupt politicians exploiting their position(power), political change, etc.
		Strong governmental will/talented leader (10)	Supportive state stance, top-down approach, supportive city staff, etc.	Incompetence system and structure (5)	Separate systems between state and civil society, complicated legislation,

					municipal barriers, overlapping administrative structure, etc.
		Non-Governmental institution (9)	NGO support, non-profit community projects, etc.	Discourse (1)	The neo-liberal discourse has favoured particular channels and practices which may be detrimental to the promotion of UA.
		Collaborative partnership among stakeholders (9)	Public private partnership, connection of stakeholders, network at different scale, etc.		
		Participatory UA policy-making (9)	Communication, public mobilization, participatory approach, etc.		
	Socio-cultural	Social capital (28)	Community-based and grassroots actions, community initiatives, common vision,	Crimes (8)	Human predation, security and vandalism concerns, gang, theft, substance abuse,

			community-supported strategy, partnership, actor network, etc.		violence and mistrust, etc.
		Movement (3)	UA movement	Reckless urban development (16)	Dense urban setting, rising land prices, competing demand on urban spaces, threat to transformation of areas, land pressure, huge urban influx, pressure to convert garden into lucrative land uses (conversion of cropland), etc.
		Promotion or publicity (2)	UA events, festivals, media, word-of mouth, etc.		

Abstract in Korean

국 문 초 록

지속가능한 식량 생산을 위한 도시농업의 조건

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세계 인구의 절반 이상이 도시에 살고 있고, 도시 인구의 3분의 1은 적절한 식량을 섭취하지 못한 채 빈곤 속에 살아간다. 현재 인류는 도시 빈곤이라는 문제를 직면하였고, 도시농업은 여러 도시에서 식량 확보를 위한 주요 전략 중 하나로 시도되고 있다. 그러나 도시농업의 성공적 시행을 위한 조건에 대한 정보를 제공하는 연구는 국소적인 차원에서만 이루어져 왔다. 이러한 이유로 본 연구는 도시농업 도입 및 시행을 위한 조건을 파악하는 데 목적을 두고 있다. 본 연구는 도시농업의 식량 공급 기능에 관한 선행논문을 활용하여 도시농업에 관한 필요, 역량, 기회 조건을 파악하고, 해당 구조 안에서 도시농업을 가능하게 하는 조건과 방해하는 조건을 구분하였다. 결과적으로 본 연구는 선행 연구 결과를

기반으로 성공적인 도시농업 실행을 위한 주요 조건과 부수 조건을 확인하였다. 본 연구는 성공적인 도시농업 정책을 수립하면서 종합적으로 고려해야 할 다양한 조건들의 우선순위를 파악하는데 결정적인 정보를 제공하며, 도시발전 계획과정에서 효과적인 도시농업정책을 수립하는 데 기여할 것이다.

주요어: 도시농업, 식량 공급, 지속가능한 식량 생산, 활성조건, 저해조건

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