

# **Success Factors of Urban Farming Projects in Europe: A Case Study Analysis**

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Master Thesis submitted in fulfillment of the Degree

Master of Science

in International Tourism Management

Submitted to Prof. Dr. Dagmar Lund-Durlacher

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Vienna, 25<sup>th</sup> September 2019



## **AFFIDAVIT**

I hereby affirm that this Master's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

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## **ABSTRACT**

With the spread and rise of urban farming initiatives in Europe, new and innovative ways of shaping today's food production in cities are being introduced. Here, the major goal of urban farmers is to tackle current global issues such as the increase of highly dense cities and the linked endangered provision and safety of food supply.

The aim of this thesis is to first analyze the field of urban farming in Europe, by selecting a case study set of seven urban farming initiatives and comparing similarities and differences based on various parameters. Second, with the methodological tool of conducting expert interviews, the main purpose of this research, namely the identification of success factors that are essential to achieve when operating an urban farming company are presented. Furthermore, this thesis detects common skills that European urban farmers see as necessary for overcoming barriers in this industry.

Through the methodological procedure of conducting desk research and performing expert interviews on the selected case study set, this paper demonstrates that European urban farmers uniformly see the following three factors as most crucial for achieving success on a sustainable basis. First, possessing a skilled, well-experienced and passionate team which leads the business; second, choosing an optimal location that facilitates the operability and supports long-term viability of the company; and third, providing valuable benefits to customers, the community and the city. Furthermore, in order to overcome barriers, the seven experts explain that operational costs should be kept as low as possible, farming systems should be highly advanced and easily controllable, quality should constantly be improved, and investments into research and development should be done.

In conclusion, results show that there is still room for conducting further research such as sharing best practices of farming concepts as well as revealing detailed know-how on viable business models and advanced growing techniques. Ultimately, it is proved that actively supporting urban farming can help resolve today's issues of food provision and availability across the world.

## **ACKNOWLEDGEMENTS**

On behalf of this thesis, I would like to express my gratitude to my supervisor, Prof. Dr. Dagmar Lund-Durlacher for her continuous help and assistance.

More importantly, I would like to thank Prof. Lund-Durlacher for introducing me to the research topic and for her patience throughout the learning process of this study. Additionally, I am very thankful for the in-depth knowledge shared by every expert during the interviews.

Lastly, I would like to sincerely thank my family for their mental support from the start to the completion of this thesis.

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## LIST OF ABBREVIATIONS

BIGH =	Building Integrated GreenHouses
CO <sub>2</sub> =	Carbon dioxide
CSA =	Community shared agriculture
DWC =	Deep water culture / direct water culture
EC =	Electrical conductivity
FAO =	Food and Agriculture Organization
GISCO Eurostat =	Geographical information system of the Commission
ICT =	Information and communication technology
IFAD =	International Fund for Agricultural Development
IMTA =	Integrated multi-trophic aquaculture
LED =	Light-emitting diode
Ltd. =	Limited (Private limited Company)
NFT =	Nutrient film technique
NOAA =	National Oceanic and Atmospheric Administration
PVC =	Polyvinyl chloride
SAFE (Alliance) =	Stop abuse for everyone
UA =	Urban Agriculture
UF =	Urban Farming
UN =	United Nations
UNDP =	United Nations Development Programme
UNFPA =	United Nations Population Fund
USP =	Unique selling proposition
U.S. =	United States
U.S. EPA =	United States Environmental Protection Agency
UPA =	Urban and peri-urban agriculture
V-Farm =	Vydro Farm
ZUS =	Zones Urbaines Sensibles



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# 1 INTRODUCTION

Establishing a green city as the model for the future now counts as one of the most important global trends. Cities and communities have become increasingly aware that taking action in the form of creating functional and sustainable urban environments is a necessity when considering how to reduce the negative effects of population growth.

More precisely, the spread of urban farming initiatives worldwide as well as in Europe highly contributes to the rising global development of greening cities and sustainable food supply. This study will focus on the concept of urban farming since more and more well-developed European countries such as Denmark, Netherlands, Belgium and others are adopting and supporting urban farming initiatives. Hereby, a chosen case study set of European urban farms will be explored and analysed in order to detect the most common success factors as well as barriers existing when running an urban farming initiative.

## 1.1 Context and Problem Statement

Facing the challenges of today's world, especially in view of increasing population numbers, economic growth and poor environmental conditions, many global issues surrounding the production and availability of food arise. Predictions state that by the year of 2050, the planet will possess nearly ten billion people, implying an increase of 2.5 billion in comparison to today. Viviano (2017) states that this will lead to a major discrepancy between the number of disposable agricultural areas and the usage of water and fossil fuels, unless action is taken accordingly. To be more specific, agricultural land and fertile soil need to be created while ensuring a decrease in the use of water and natural resources as far as possible (Viviano, 2017). More alarming is the statement of Viviano (2017) concerning the challenges of tackling the problem of food provision in the future where he argues that "the planet must produce more food in the next four decades than all farmers in history have harvested over the past 8,000 years" (Viviano, 2017). It is clear that today's approaches which are deployed by the agricultural sector, namely using "fertilizers, pesticides, energy-intensive or water-demanding tools" (Miccoli et al., 2016) will not solve the alarming issues of the global

food situation. This is due to the fact that these measures possess “many trade-offs which eventually lead to the exploitation of natural ecosystems” (Miccoli et al., 2016). In response to these challenges, Caughill (2018) points out that there are already new technologies which are paving the way for enabling the cultivation and production of food “in places where it was previously difficult or impossible, and in quantities akin to traditional farms” (Caughill, 2018). More precisely, urban agriculture and the developed technologies on the market are strongly spreading across cities and urban areas, both worldwide and at the European-level, with the aim of feeding citizens as well as boosting the environment and economy locally. Although, urban farming cannot be considered as the solution to resolve the problem of hunger and the access to sufficient food, it certainly can help in leveraging the awareness and action towards innovative and sustainable food production practices (Caughill, 2018).

## 1.2 Research Aims

To begin with, this thesis has the purpose of thoroughly exploring urban farming by first conducting desk research and thereby providing a holistic insight into secondary literature on the topic. Subsequently, the next aim is to present the chosen case studies and summarize the most important characteristics detected. Here, describing their business models in terms of ownership form, years of establishment, target groups, organizational structure, finances and operations, as well as determining their business goals and objectives is part of the first step. This will be done by answering the following questions:

- *What is the urban farming initiative about (basic company information)?*
- *When was the urban farm established?*
- *Who are the persons in charge of the initiative?*
- *To whom is the urban farm addressed?*
- *What goals and objectives are set for the program?*

Based on the information provided, the major research objectives lie in the comparison and analysis of the selected cases by showing similarities and differences as well as questioning why these urban farms are as successful as they are. Here, their determined business goals will be measured against their current performance status. These insights will be explicitly examined through the methodological process of this study.

Within the scope of this thesis, expert interviews will provide the basis for the investigation of the factors contributing to the augmenting success of the urban farming projects, the identification of common skills and strategies applied, as well as the definition of barriers faced during the process of operation.

### 1.3 Research Questions

The focus of a qualitative research design is laid on exploring the central concept or phenomenon of a study, whereupon a leading research question and some associated sub questions are formed. More concretely, the intention in a qualitative case study investigation is to explore the respective process by dealing with the topics which emerge from studying the cases (Creswell, 2014, p.139).

Thus, with attention to the subject of investigation, the main research question will be determined as followed:

*What common factors / skills do European urban farmers see as necessary for overcoming barriers and achieving success in the industry?*

In the light of the central question, the following sub questions aim to examine the phenomenon in depth:

- *What are the motivation and objectives behind the initiatives?*
- *By what means are the projects funded?*
- *Who and how are the respective audiences reached?*
- *What values (economic and other) does the urban farm deliver?*
- *Who should benefit and how can the community in the specific urban area benefit from the project?*
- *What risks are involved in establishing an urban farming initiative?*
- *Is there a potential in effectively combining urban farming with tourism?*

In view of the above identified research questions, a definition of the term “success factor” will be provided to briefly clarify its context throughout the paper. According to WebFinance Inc. (2018), key success factors are “the combination of important facts that is required in order to accomplish one or more desirable business goals”. This implies that as a first step, urban farming initiatives need to reasonably set business goals, track their performance throughout their term of operations and later, analyze

whether they have reached their goals or are still in need for improvement in some areas. The optimal result eventually is achieving their aims and consequently evaluating their project as being successful. Apart from aligning the business goals with the project's performance, there are of course other important key factors for a viable and prosperous urban farming business which will also be described in the following paragraph.

Connecting these insights to the cases of investigation, a preliminary assumption of factors that are crucial in running an effective urban farming initiative will be given to later detect whether the respective program goals lead to a successful project implementation or not. These assumed factors are developed both based on literature inputs given by Pölling et al. (2017) and on the author's own developed ideas. Potential factors are, for instance a favorable economic condition which should be required as the study sites are European cities; project viability referring to the specific location, the available resources in the urban area; a clear unique selling proposition implying an innovative concept or a new phenomenon where unique benefits are brought to the target audience; a strong project team that leads the initiative; sustainability in terms of making use of existing resources / reutilizing given assets in the urban area; a positive market environment where the initiative is ideally among the pioneers in this field; as well as both external (market opportunity, competitors) and internal (resources, professional competence of program implementation) layers have to be met.

## **1.4 Structure of Thesis**

This thesis is structured in seven chapters, including the appendices. First, the problem and incentive of the thesis topic is recognized where upon a detailed overview of the research questions and objectives is provided to break down the research idea and the approach of how to properly address it. Next, a review of the existing literature will be provided to the reader in order to detect what areas have already been studied and how these insights can contribute to the methodological part of this paper. Subsequently, the methodology chapter will introduce the tools used for the qualitative research as well as thoroughly present the case study set which later on will be analyzed and evaluated. Upon investigation of these cases, the results of the conducted expert interviews will be summarized and a detailed content analysis will be done. As a final section, future research possibilities as well as recommendations based on the study results will be provided.

## 2 LITERATURE REVIEW

This first main part of the thesis will give the reader a thorough summary on the relevant literature sources of the topic of urban farming. During the process of exploring the theoretical insights, it will be detected that even though many authors touched on the research matter, very little on the factors contributing to success of urban farms in-depth has been examined. Consequently, the following literature input connected with the methodological results will lead to a systematic analysis of success factors, motivations and barriers of urban farming businesses.

### 2.1 Introduction

The following major component of this thesis will explore the core know-how of urban farming, its concepts and purposes in order to link the literature with the methodological application at a later stage. To start with, the reader will be given a short overview of the history and origins of urban farming, discovering the background as well as the development of the phenomenon over the years. Subsequently, an insight of the most relevant literature related to the thesis topic will be provided. Here, the goal is to summarize trends, show a framework for the different terminologies that exist, as well as to look into the spread of urban farming initiatives around the world and in Europe in detail. Focusing on the case study locations in Europe, a thorough examination of the different models, types and installation methods detectable will be presented.

Overall, the fundamental aim is to demonstrate how the research done for this work will fit into and enrich existing sources and papers published on urban farming.

#### a. History and Background

With the omnipresence of green urban environments and the different types of urban agriculture today, the question arises where this development originated. Urban gardens that served not only as a nourishment source but also as social spaces, accessible to both rich and poor people in urban areas can even be traced back to Persia, approximately 4,000 years ago (Keshavarz & Bell, 2016, p.8). Beyond this, in the early times, citizens in mostly peasant environments engaged in creating garden areas mainly for cattle and chicken stock but also for growing food. As a matter of fact, there was no clear differentiation between the rural and urban yet, cities as such were characterized by being central points for religion, commerce and government, some being

very dense like in ancient Egypt and others lightly populated like in Europe. Here, Bell (2016) emphasizes that due to the space capacity in most European cities, towns were rich in food gardens and animal farms (Keshavarz & Bell, 2016, p. 1).

Furthermore, records regarding the role of gardens and the importance the civilized folk put to them were also found from the Babylonian era. McFarland addresses the “Hanging Gardens of Babylon” - a famous example from the ancient world which was described as a garden that was constructed aboveground and “watered by an interior irrigation system which siphoned water from the Euphrates River” (McFarland, 2016, p. 243). Another example that is reported from these times are the ziggurats of ancient Mesopotamia which had rooftop gardens as well. Archeological discovery of urban gardens has also been made in Pompeii where large rooftop gardens served the public, as well as to satisfy personal wishes of the supreme such as Pope Pius II who constructed a palazzo with a magnificent garden on the top (McFarland, 2016, p. 243).

Next to evidence of urban gardens among the wealthy and sovereignly ancestry, residences with green space in metropolitan areas can also be found within civil society. Here, Norwegian people engaged to a large extent in the creation of urban green gardens as a fix part of their residential constructs. Commonly spread within “dense and built-up areas with high value real estate,” these gardens also aimed as a protective mechanisms of climate conditions and decay (McFarland, 2016, p. 243).

Subsequently, throughout the course of the industrial revolution during the mid- and late-nineteenth centuries which followed the agricultural development, significant movements of population were the result. With people migrating to towns for work, cities in Europe thereby faced a huge expansion in inhabitants (Keshavarz & Bell, 2016, p. 8). Furthermore, to ensure that urban poverty does not gain predominance in the industrial cities, politicians started providing the public with areas to grow vegetables and fruit, which ultimately meant the start of urban gardening as we know it today. Since then, these urban green spaces and farms have spread all around the world, with specific countries being pioneers. In Europe, the leading countries were the United Kingdom, Germany and Denmark. An overview of the fourteen pioneer countries in supporting urban allotment gardens and laws associations is provided below (Keshavarz & Bell, 2016, p.11).



Country	Year	Major event
United Kingdom	1795	First allotment site was probably at Long Newnton, on the Gloucestershire and Wiltshire border.
Germany	1814	First allotment garden was established in Kappeln.
Denmark	1821	First modern allotment gardens were created near the town of Aaberna.
Netherlands	1838	Association for Knowledge and Social Development leased land to the poor.
Luxembourg	1886	The first allotment garden associations was founded.
Sweden	1895	The first allotment garden was established in Malmö.
Belgium	1896	Developed Allotment Garden League.
France	1896	French Federation of Allotment Gardens was founded by a philanthropic priest.
Poland	1897	Dr Jalkowski founded the first allotment garden in Grudziadz.
Finland	1900	The first allotment garden was established in Helsinki.
Austria	1904	The first allotment garden was founded on Vienna's outskirts because of severe food shortages.
Switzerland	1907	The first allotments were established in Zürich by the Zürich Naturopathy Association.
Norway	1908	Kolonihage or allotments were first established in Oslo.
Ireland	1910	The Vacant Land Cultivation Society (VLCS) in Dublin was founded.

Table 1: The emergence of first allotment gardens and supporting laws and associations in fourteen pioneer countries (Keshavarz & Bell, 2016, p. 13)

The table above shows the chronological order of how leading countries in Europe paved the way for urban gardening, its practices, laws and supporting institutions. The approaches of these pioneers were all similar following the rapid urbanization of cities (Keshavarz & Bell, 2016, p. 12). The common idea lay in “[...] allotting small pieces of land to the poor for their survival prior to and during the industrialization, as an emergency food-producing mechanism during the Depression and the two world wars, to the more recent trend in environmentalism and rediscovery of the value of growing one's own food” (Keshavarz & Bell, 2016, p. 29).

With Europe being the paradigm in the history of urban greening, the phenomenon slowly spread around other territories, amongst others to North America (McFarland, 2016, p. 243). Clearly, the practice of urban gardening and the cultivation of greening in cities did not happen simultaneously in all areas of the continent, resulting in a mutual influence of greening urban areas of some pioneering countries to other locations and vice versa. Looking at the United States, immigrants to that country introduced the building of green spaces with the aim of projecting some majestic dignity to the common folk while emphasizing their attained freedom from the late feudal times in Europe (McFarland, 2016, p. 243). Thereafter, some particular movements and events found their way back to Europe and as a consequence impacting European urban planners to redesign cities by establishing garden sites and the like (Keshavarz & Bell, 2016, p.9).

In the view of the rich and long historic development over the last centuries and decades of urban gardening and green cities worldwide and especially in Europe, it is uncontroversial to state that these events paved the way for shaping the future of cities even further and turn this trend into a permanent practice.

#### b) Development and Trends

##### Demographic influences on urban farming:

Estimates show that the population figures for all countries worldwide amount approximately to 7.5 billion people today (United States Census Bureau, 2018). More importantly, by the middle of the twenty-first century nearly two thirds of the total population will be situated in urban environments which lastly in 2016 exceeded the fifty percent threshold (Miccoli et al., 2016). Additionally, the shift of population concentration towards mega cities, meaning developing city hubs with over ten million inhabitants becomes stronger and more evident / present. For instance, it is predicted that by 2030 the number of mega cities globally will rise to forty or more (UN, 2014 cited

from Miccoli et al., 2016). The chart below shows the development of the urban and rural population figures worldwide from 1950 to 2050.

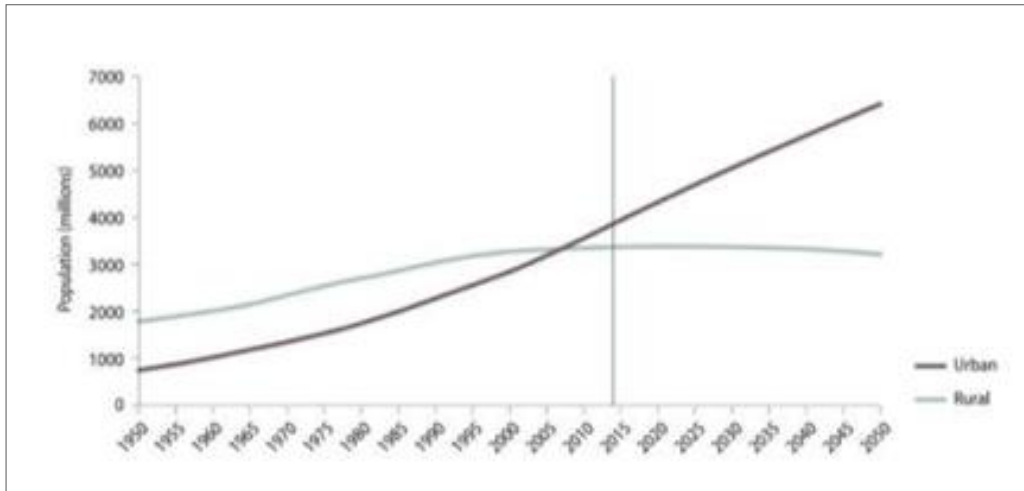


Figure 1: Urban and rural population of the world 1950 - 2050 (UN, 2014 cited from Miccoli et al., 2016)

It is clearly demonstrated that the predicted population numbers for inhabitant density in urban areas will rise tremendously, leading to a wider discrepancy between the rural and urban. To be more precise, Miccoli et al. (2016) point out that these continuous rising numbers of inhabitants living in urban environments create an imbalance between the availability of natural resources provided and the desired amount of consumption. Moreover, with this trend, not only will the citizen's disposable income grow, but also their demand for food, hence creating more challenges for the general food supply sector.

Hand in hand with this challenge goes the difficulty that arises with the necessary increase in food production in cities, namely that in 30 years cultivable land will be possible to grow by only a little more than ten percent in comparison of today (IFAD, 2011 cited from Miccoli et al., 2016). Moreover, according to UNFPA and Perfetti (2010), cited from Miccoli et al., 2016, the discrepancy between world population and arable land per capita over the years has significantly deepened. To be more specific, "in 1950 every person had 5,600m<sup>2</sup> of the planet's land available for food production; the early third millennium this figure dropped to 2,300m<sup>2</sup> and in 2050 the living space, according to UNFPA, estimates will be only 1,500m<sup>2</sup> per person" (Miccoli et al, 2016). The figure below demonstrates this development visually.

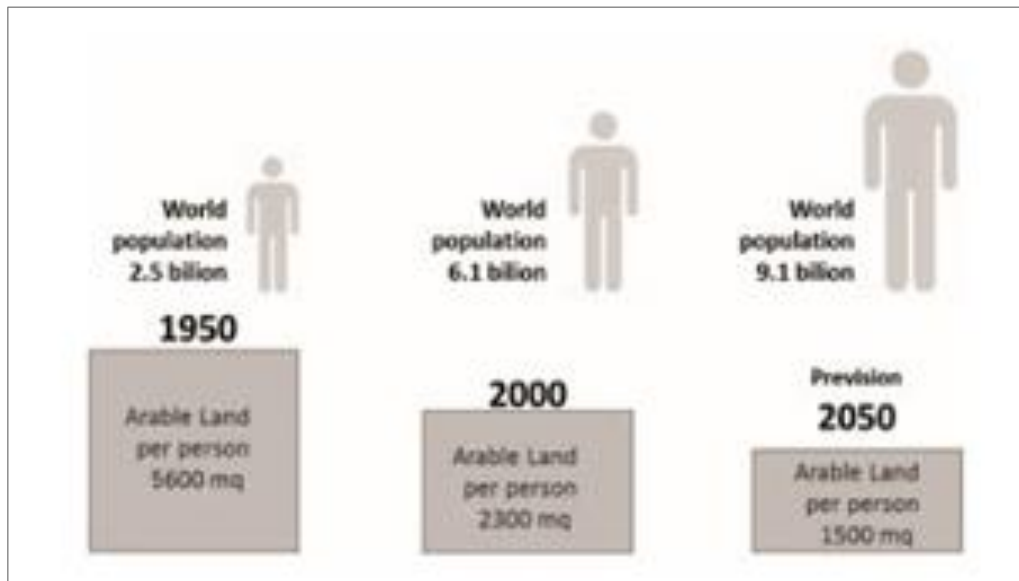


Figure 2: Arable Land for Person 1950 - 2050 (Perfetti, 2010 cited from Miccoli et al., 2016)

In addition to the insights mentioned above, when looking at the current state of production mechanisms in the agricultural sector, Miccoli et al. (2016) detect that the systems are rather environmentally unfavorable due to the excessive amounts of fossil fuels used as well as the augmented greenhouse gas emissions. Supporting these issues, it is without controversy to state that the existent food distribution systems which mainly rely on distance-intensive transportation means via air or road traffic do not benefit the current dilemma (SAFE Alliance, 1994 cited from Miccoli et al., 2016). Also, as the illustration above shows as well, for traditional farmers, the ability and capacity of keeping up with the urban population boom and the connected augmenting food demand is slowly reaching its limits.

Furthermore, even more critical is the fact that “the industrial food system is estimated to generate one calorie of food by consuming about ten to fifteen calories from non-renewable energy sources” (Martinez-Alier, 2011 cited from Miccoli et al., 2016). More importantly, measures which are neither unsustainable for the food produce itself nor harmful for the environment and resources have to be introduced and implemented. Thus, Miccoli et al. (2016) suggest that these current challenges need to be addressed from all sides, namely changing and correctly shaping the existing practices and techniques of the whole agricultural production sector while at the same time ensuring to establish farming sustainability in urban areas by cultivating necessary quantities,

guaranteeing short food supply chains and enhancing the appropriate infrastructure to conduct urban farming on both an individual and business level (Miccoli et al., 2016).

Similarly, Ohngren (2011) argues that urban farming's spreading in cities already created a huge hype in the early 2000s, after suggesting that citizens located in urban areas transform their backyards into green gardens and vegetable oases. Moreover, as already discussed earlier, it is stated that due to the fact that today 80 percent of the land usable for agricultural purposes is already occupied, the shift from traditional agriculture production to food provision from urban farming is inevitable. Furthermore, as of 2011, the Worldwatch Institute stated that one quarter of the global food supply is cultivated and grown in cities.

Thus, the movement for local and regional food in metropolitan cities is becoming a necessity. Although sustainable food production practices in urban areas firstly originated in North America, Australia and in some Asian countries, they quickly spread to Europe as well. Nowadays this phenomenon is often times referred to as a young but fast growing creative food economy.

#### Development of the city as nature:

A more concrete point of view on the trend towards greening cities is provided by Angela Bezenberger from the institute of landscape architecture and ecology in Darmstadt, Germany, where she highlights that due to the increasing density in European cities, the focus of new urban planning lies in seeing the "city as nature". More precisely, "balconies, terraces, and roofs become 'agricultural' areas of a new kind" where the increased desire of nature and the urge to maximize economic benefits are "no longer contradictions in the city" (Bezenberger, 2014, p.73 cited from Louafi, 2014). Many different facets of green spaces will form the new city of the future, aiming at creating as much green variety as possible. Here, Mrs. Bezenberger argues that soon "biodiversity will be greater in the cities than in the countryside," which certainly can be traced back to the fact that with the shift to a new green diversity in cities, a new form of living quality in urban environments is created. Emphasis is put on the different changes in terms of ecology, socialization, economy, demographics and aesthetics that help establish the "city of nature" on the long run (Bezenberger, 2014, p. 73 cited from Louafi, 2014).

Together with the statements given by Bezenberger on the current trend of designing cities differently, Van Veenhuizen determines urban agriculture as a necessary tool for

developing and planning cities sustainably. Moreover, already in 2006, he highlighted that city greening and urban agriculture highly contribute to urban challenges and issues such as integrating food cultivation into the city planning (Van Veenhuizen, 2006).

Another contribution to the important issue of greening cities and enabling urban agriculture is given by Wolch et al. (2014). They highlight that, in order to overcome the challenge of population booms in cities, it is necessary to make urban areas more qualitative and livable since not only enhancing a city's attractiveness but also its long-term sustainability is crucial. Furthermore, the authors argue that today's urban congestion leads to the general need of protecting and preserving public health. Here, green spaces such as parks, small gardens, green roofs and the like help to lower air pollution, to regulate temperatures, as well as to improve the living standards of urban residents. According to Wolch et al. (2014), the feasibility of implementing urban agriculture within cities also highly depends on the green space strategies to be developed by urban designers and planners that emphasize on ensuring ecological sustainability as well as social benefits for inhabitants. Hence, ultimately the current direction that this trend is heading to will lead to an efficient ecosystem within cities (Wolch et al., 2014). Thus, nowadays, it is evident that it is not sufficient to be climate-neutral, to improve transportation means or to take pollution seriously, rather, more focus should be laid on creating urban green spaces with different purposes such as recreation, health, food supply, and so forth. Here, Forster (2014) cited from Louafi (2014) introduces an "urban open space" approach which can significantly contribute to a long-term sustainable development in cities. He argues that there are various benefits of urban green space such as promoting "health and social contact," having "positive effects on the climate," improving "the quality of life and biodiversity," as well as contributing "to sustainable development" (Forster, 2014, p. 61 cited from Louafi, 2014)).

#### Smart food city development:

Another important and more concrete approach of urban greening, food issues and sustainability awareness lies in connection to the phenomenon of smart cities.

To begin with, the concept of smart cities and the different dimensions it incorporates has a rather long background especially in European metropolitan areas. The relevant aspect here is the link to the creation of urban food systems in those cities, which has increasingly become important. Maye (2017) defines the development of urban food systems in smart cities as "smart food city" concepts which on the one hand involve

ICT innovations and on the other hand social innovations and practices. Here, he highlights that although these technological advances given by the ongoing improvement in the ICT sector seem to positively contribute to the smart food city development, there is no direct correlation between technological progress and solving urban food challenges in smart cities. The reason here is because urban food systems nowadays try to address the question of “how to feed cities in a just, sustainable and culturally appropriate manner when faced with looming climate change, widening inequality and worsening world hunger problems” (Morgan, 2015 cited from Maye, 2017). Consequently, these challenges form part of bigger economic and socio-cultural issues which smart technology enhancements fail to solve. With this being said, urban food research does not necessarily contain references towards smart city concepts. Accordingly, Maye (2017) states that in current literature, there is no defined link to food in the context of the topic around smart cities.

Nevertheless, the author stresses that “the rise of food insecurity in cities [...], raises important questions about the availability of infrastructures and adequate technologies to respond to the challenge”, hence connecting city developments and urban food issues (Maye, 2017). Moreover, it is known that consumers become increasingly conscious and critical when it comes to the question of how their food is produced (Philips Lighting Holding B.V., 2017). With this being said, the urban agenda nowadays should not only focus on how cities can be transformed in terms of technology and infrastructure, but also on quality of living, social well-being, health as well as nutrition questions and the like. Here, Wiskerke (2016) cited from Maye (2017), mentions the “public health challenge” which increasingly comes to surface and acts as a driver of change in today’s smart cities since the topics like malnutrition, obesity, hunger and so forth are still, as ever omnipresent (Maye, 2017).

Given these points, it can be concluded that cities today are slowly but increasingly dealing with food and agricultural practices since a shift towards the important role that cities have in the food system occur. Here, current urban food systems usually stem either from production within industrial processes, cultivation around the city, or production on behalf of urban agriculture within the city. Speaking of the latter, urban agriculture is determined as one of the major movements in smart cities, as it involves creating a significant level of plant and vegetation carpets, as well as green areas albeit on roofs, ground or building facilities (Dubbeling, 2014 cited from Maye, 2017). Furthermore, an important requirement for enabling urban agricultural practices and assuring optimal food provisioning in urban areas, is to address the issues of

energy and water resources, as well as the use of land especially in dense cities (De Zeeuw & Drechsel, 2016 cited from Maye, 2017).

Another input on the current practices of urban farming is given by Ohngren (2011). The author mentions that the next step of urban farming ventures is the growing phenomenon of indoor vertical farming where she argues that “1 acre is equivalent to 4 to 6 outdoor acres”, hence providing a significant and efficient high-value crop production (Despommier, n.d. cited from Ohngren, 2011). Furthermore, another interesting novelty to urban food systems is the concept of ‘agritechture’ introduced by Plantagon (Lutkin, 2018). Here, agriculture, technology and architecture are combined with the aim of creating benefits for various stakeholders at the same time. On the one hand people’s lives are positively affected by profiting from fresh food produce, saving time and energy resources, and on the other hand real estate developers and urban municipalities can contribute to redesigning cities in a sustainable way (Lutkin, 2018)

Another essential remark in alignment to technology and agriculture is given by Maye (2017). The author highlights that urban food concepts and smart technologies in cities have not received much attention in literature yet, however, can already be found in practice in specific urban areas worldwide. “Smart agriculture” stems from the terms smart city and urban agriculture, and is mostly practiced in the form of vertical farming. In the urban farming sector, this method is very popular and known as utilizing LED lights to grow plants in slender beds, applying nutrient-rich spraying (Rose, 2015 cited from Maye, 2017). By means of smart technology monitoring that these systems make use of, resources like water can be reduced, as well as pesticides are minimized compared to traditional farming methods. More on smart agriculture technologies and vertical farming will be explained in the following sections.

#### Current trends and challenges of urban agriculture:

It is without doubt to state that urban agriculture slowly but surely takes over cities, especially in Europe. As previously described by other authors, Duzi et al. (2017) also highlight the dynamics of the shift happening in cities currently as well as before, describing it as follows: “times have changed and recently the whole agro-food system has undergone unprecedented changes, shaping both urban and rural realms”. Moreover, the terms “food” and “urban” strongly merge into a new phenomenon, giving urban planners, city governments, researchers and the like new challenges to face and handle. Here, Duzi et al. (2017) refer to recent research undertaken in the field of urban food production potential, stating that municipalities “explore what kinds of



foods, where, what methods and how much food can be grown” in urban areas, as well as questioning if and to what extent it would be possible for metropolitan cities to reach a certain level of self-reliance in terms of food provision and production. However, concerns lay in the areas of infrastructure and environmental capabilities. (Duzi et al., 2017). Nevertheless, the authors argue that the current state-of-art and trends of urban agriculture bring new room for innovation as well since facing the challenges of space and other forms, more “innovative agricultural approaches, starting from the application of soilless or the intensified plant growing technologies, to the identification of new places for production, such as vacant lots, roofs, walls, brownfields, idle or underutilized land or even underground under artificial lighting” (Opitz et al., 2016 cited from Duzi et al., 2017) can be discovered. There are many examples especially in European cities where innovative initiatives in the field of urban agriculture have been launched such as “Urban Green Train” which focuses on establishing small businesses and educational projects around urban greening and agriculture; “FOODLINK” which looks into the sustainable component of the consumption and production of food in urban areas; as well as other projects in Europe like the “COST-Action Urban Agriculture” which encompasses various examples of large and well-established projects, featuring case studies in European cities, looking into different layers of urban agriculture such as economic, spatial, political, socio-scientific and ecological premises (Duzi et al., 2017).

## **2.2 Urban Farming**

In order to give the reader a thorough understanding of the term urban farming, a clear definition as well as an idea of what the concept comprises, it is necessary to start off with comparing the various definitions that exist, as well as to later on mention and contrast all the different conceptions of urban farming and similar terms.

To begin with, the Food and Agriculture Organization of the United Nations determine urban agriculture in connection with the term peri-urban agriculture, commonly stated as urban and peri-urban agriculture (UPA) since the practice of urban agriculture cannot be found exclusively in the center of metropolitan cities but also in the outskirts of large cities, especially in America. The FAO argues that “[...] locally produced food requires less transportation and refrigeration, it can supply nearby markets with fresher and more nutritious products at competitive prices.” (FAO, 2018). Moreover, urban agriculture involves the cultivation of plants, crops, fruits, vegetables and animals for economic reasons since urban farmers primarily produce fresh food for commercial

use. Furthermore, urban agriculture initiatives can help improve access to fresh, locally harvested produce as well as offer job positions and provide programs or training in sustainable food production. Additionally, the conduction of urban agriculture may include a number of purposes namely educational training, economic value, recreational or leisure aims as well as landscape improvement. Also, urban agriculture may use abandoned farmland and consequently enhances quality of life in that area. FAO (2018) highlight a few key facts of urban agriculture such as “800 million people worldwide” engage in farming food in urban areas, as well as that “it helps low-income urban residents save money on food purchases” (FAO, 2018).

Similarly, in the “Urban Farm Business Plan Handbook” published by the U.S. EPA (2011), urban farming is described as a local food production in urban territories aiming to supply the respective produce to consumers in that same urban area. Moreover, the distinctive feature as opposed to other farming practices, is the “geographic proximity of a producer to the consumer” as well as the “sustainable production” of food (U.S. EPA, 2011). Although, the output of urban farming usually consists of food elements such as vegetables, fruits, fish farming, beekeeping and the like, also “non-food products such as producing seeds, cultivating seedlings, and growing flowers” (U.S. EPA, 2011) forms part of this phenomenon.

Another insight into urban farming is given by Greensgrow Farms (n.d.), where it is highlighted that the sector of growing food in urban areas is highly influenced by the general awareness of today’s food system, the long food travelling routes as well as how the fresh produce is handled as soon as harvested. Hence, with this perception in mind, consumers nowadays found new means of controlling this sector by engaging in urban farming, knowing “how food grows, what grows regionally and seasonally” and especially how health and the right nutrition play a major role in the whole food industry (Greensgrow Farms, n.d.). Furthermore, most urban farms are located in the inner parts of a city although depending on the infrastructure of the respective cities, some agricultural projects are situated on the perimeter of urban areas thus accounted for ‘peri-urban farming or agriculture’ (Greensgrow Farms, n.d.). Additionally, it is stated that there are no restrictions in terms of where the farm itself can be built, meaning that whether on rooftops, on the underground, on landfills, inside buildings or even at industrial quarters of cities, urban farming can be found at any place with any size.

Likewise, already in 2006, on behalf of his book on ‘Cities Farming for the Future: Urban Agriculture for Green and Productive Cities’, René van Veenhuizen formulated a simple

definition of the concept of urban agriculture, stating that it comprises the cultivation of plants, food, animals “and related activities such as the production and delivery of inputs, and the processing and marketing of products” (van Veenhuizen, 2006). Furthermore, the author also mentions that the distinctive feature of the concept is not necessarily the location as a factor, but rather the fact that it forms an essential part of the “urban economic, social and ecological system” as “urban agriculture uses urban resources (land, labor, urban organic wastes, water), produces for urban citizens, is strongly influenced by urban conditions (policies, competition for land, urban markets and prices) and impacts the urban system (effects on urban food security and poverty, ecological and health impacts)” (Mougeot, 2000 cited from van Veenhuizen, 2006). More precisely, he highlights that the food items produced as part of urban agriculture are considered as perishable produce since the output usually mainly includes vegetables, herbs, fruits, milk and animal products hence contributing to a city’s “efficiency of national food systems” (van Veenhuizen, 2006).

What can be concluded from the inputs given by the various authors mentioned above, is that urban agriculture in general has the following characteristics: “closeness to markets, high competition for land, limited space, use of urban resources such as organic solid wastes and wastewater, low degree of farmer organisation, mainly perishable products, high degree of specialisation” (van Veenhuizen, 2006) and many more. Given these attributes, it is clear that the trend for successful policies and programs in cities is strongly increasing and so is the demand for launching innovative showcases in urban areas. Van Veenhuizen (2006) lists a few factors that have triggered the development of urban agriculture practices to a high extent. For instance, he states that “the fast urbanization process and the discovery that both urban poverty and urban food insecurity are rapidly increasing” (van Veenhuizen, 2006) which leads to inhabitants’ needs for finding ways to counteract food issues. Next, the author refers to “the growing capacities at regional and local levels regarding urban agriculture” (van Veenhuizen, 2006), as well as “the growing attention to urban agriculture and urban food security by international organisations such as FAO, UNDP” (van Veenhuizen, 2006) and the like, hence indicating that cities actively work towards including urban agriculture into urban policies and sustainable planning.

Another well-described definition of the concept of urban farming is provided by Duzi et al. (2017), where the authors emphasize on the fact that urban farming is usually “practiced by various stakeholders under different backgrounds, motivations and socio-economic conditions” (Simon Rojo et al., 2015 cited from Duzi et al., 2017). Here,

the author points out that these practices most commonly involve urban agriculture initiatives on an individual, small-scale basis aiming to solely meet self-provisioning needs, harvesting food on seasonal terms, sometimes also referred to as urban gardening. On this level, the urban food gardening is usually non-profit orientated, focusing on the health and community spirit of the neighborhood. Furthermore, the other main direction of urban agriculture goes towards large scale farms typically set up as commercialized businesses where the goal is to make profits and sell nationally as well as internationally (Duzi et al., 2017). Likewise, other literature sources point out that farms who have been established and registered as urban agriculture institutions most commonly presume a certain “level of commerce” (Greensgrow Farms, n.d.), implying that their business model is market orientated, set-up as for-profit firms, the food produce is entirely sold and no elements are harvested for personal use or community sharing.

On the contrary, as already highlighted above, urban gardening projects usually found in form of community gardens cultivate food for private consumption and share their harvest without any commercial activity (Greensgrow Farms, n.d.). More on these term differentiations will be explored in the next section.

In addition, based on empirical research, Duzi et al. (2017) mention that with the strong rise of the urban food cultivation sector, many mixed forms of urban agriculture emerged, stating that “farms report a high diversity and complex patterns of farm production and output-related linkages, depending on different factors than just location near city” (Pangbourne and Roberts, 2015 cited from Duzi et al., 2017).

Some of such examples as well as more detailed literature insights into various urban farming models will be presented in subsequent chapters.

### **2.2.1 Terms and Definitions**

As previously described, the urban farming sector encompasses a rather large spectrum of different kind of initiatives, depending on the respective project characteristics and systems. Also, there exist various distinctive forms, motivations, business models, stakeholders, objectives and backgrounds in the whole field. Therefore, with this significant increase of diverse urban agriculture projects and concepts, it is rather difficult to find a uniform, holistic definition for the phenomenon of urban agriculture since a lot of different definitions can be find in literature. Pölling et al. (2016), however, emphasizes a common cited definition of urban agriculture (UA) as being “a permanent and dynamic part of the urban socio-economic and ecological system, using typical

urban resources, competing for land and water with other urban functions, influenced by urban policies and plans, and contributing to urban social and economic development” (FAO, 2007 cited from Pölling et al., 2016). This definition mainly highlights the distinction of urban versus rural agriculture, given that UA supports the local food provision in cities and highly contributes to the urban economy. In other respects, this common cited definition is very broad and does not specify any clear features of UA. Based on the investigation of Pölling et al. (2016), one can distinguish between professional urban agriculture and urban gardening. While urban agriculture can be best differentiated from urban gardening due to its commercial objectives, in most cases it also requires the feature of growing edible aliments and can also comprise animal husbandry, urban beekeeping, horticulture, aquaculture and agroforestry (Greensgrow, n.d.). Urban gardening on the contrary, is significantly more limited as it is usually practiced in smaller and narrowed harvestation areas (Pölling et al., 2016). Moreover, there are other terms which are classified in the same category and context as urban gardening, namely community gardening, urban allotment gardening and the more general term, urban horticulture. These are all used for describing the same concept which is engaging in a form of gardening on a micro level, connecting plants and people “whose active and passive involvement with gardens and green spaces brings benefits to them as individuals and to the communities and cultures they comprise” (Waliczek & Zajicek, 2016). Here, the focus is put on exploring the numerous advantages urban gardening provides to the urban environments and the community it reaches such as social, recreational, educational and health benefits (Keshavarz & Bell, 2016).

Hence, professional urban agriculture offers many more attributes, “plays a more important role in terms of food provision and food security than urban gardening” (Pölling et al., 2016) and therefore, is sometimes also called commercial urban farming, metropolitan agriculture or peri-urban agriculture (Pölling et al., 2016). The author also highlights the fact that “in order to be sustainable, UA should be profitable and economically viable, environmentally sound, socially just and culturally acceptable” (FAO, 2007 cited from Pölling et al., 2016).

With these differentiations being made, throughout the course of this thesis, the terms urban agriculture, urban farming and peri-urban agriculture will be used interchangeably and are mutually valid in describing the phenomenon this paper work explores.

### **2.2.2 Worldwide Implementation of Urban Farming**

Generally speaking, urban farming is most prevalent in the Western world where cities and economies allow for urban food systems to be built and implemented. However, according to the UN Food and Agriculture Organization urban farming became a global movement, stating that “800 million people around the globe grow their own fruits and vegetables, or raise animals in cities, accounting for 15-20 percent of world’s food production” (Ngumbi, 2017). Additionally, due to rapid urbanization developments especially in countries where urban poverty and food insecurity are heavily increasing, a trend of urban agriculture activities is starting off. Organizations in continents like Africa or Latin America are seeing the important role of urban agriculture “in improving the economy, environment, and health of cities” (Rosenberger, 2016). Some examples of organizations engaging in urban farming around the globe are ‘Camp Green’ in Uganda which is an educational urban farming institution teaching the city residents how to grow their own food and so forth; ‘City Farm Project’ in Thailand where the urban farmers offer workshops; ‘Green in the City’ in Israel which enables urban farming on top of a shopping mall; or ‘Whitelock Community Farm’ in the United States which focuses on community farming and the provision of urban farming learning programs (Rosenberger, 2016). As a matter of fact, even in Iceland, urban farming exists - here, the largest vegetable farm run by the farmer Pall Olafsson cultivates a variety of vegetables inside a geothermal energy supplied greenhouse. This kind of renewable energy resource is not affected by any weather conditions, and therefore is one of the main sources of the country’s electricity (Lei Win, 2018).

### **2.2.3 Urban Farming in Europe**

Considering the global urban farming development in general, it can be detected that, as already mentioned previously, the Western countries of the world have had significantly larger changes towards the awareness for sustainability in a city, local food production and farming benefits for cities. Although the U.S. market is considered a pioneer when it comes to cultivating food in peri-urban and urban areas, European countries have actively started seeing the potential of greening urban spaces and harvesting their own local food in the early 2000s. Here, the following chart depicts that the development towards creating urban green spaces in Europe in the past years has been enormous.

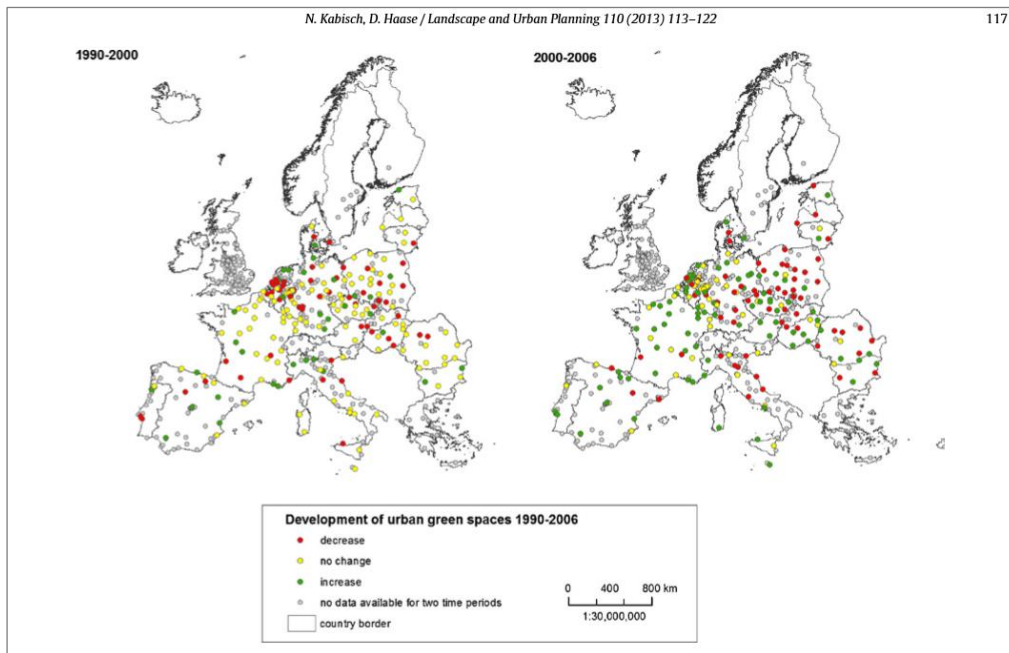


Figure 3: Development of urban green spaces 1990 – 2006 (Kabisch & Haase, retrieved from GISCO Eurostat, 2012)

To be more precise, between 2000 and 2006 urban green areas have spread to a much greater extent than in the years 1990 to 2000. Although, there is no significant correlation between population density and per capita urban green environments, it is clear that in Europe, the general trend to create natural spaces in cities becomes more and more present (Kabisch & Haase, 2012).

Furthermore, to name an example, the European Commission started an initiative called the “European Green Capital Award” to properly recognize the specific levels of commitment towards creating green spaces and enhancing the environment of cities. Here, since 2010, twelve European cities in total were awarded, amongst others including Copenhagen, Ljubljana, Lisbon and more (European Commission, 2018).

In his book “Green Cities of Europe”, Beatley (2012) also highlights that Europe accounts for a leading force globally when it comes to directing cities to engage in green and sustainable actions. Furthermore, he mentions that in comparison to the U.S., European countries have the relevant qualities to actively implement urban sustainability projects. This is also due to the fact that unlike American cities, urban areas as well as urban cores in Europe have been designed much more compact and dense resulting in problem of space, hence creating green rooftop, underground farming and so forth (Beatley, 2012). The author summarizes and compares the two continents and their

diverse perspectives on life. Here, the following table shows that Europe is more keen to ensure a certain level of welfare of the planet, envisions sustainability as a global goal and highly values quality of life. The U.S., on the contrary, supports economic growth, focuses on individual development and is more reluctant to the collective thinking and caring of the planet. This may be seen as a bit too exaggerated, however, looking at European practices, one can detect similarities to these statements.

<b>U.S.</b>	<b>Europe</b>
Autonomy	Embeddedness
Self-reliance	Inclusive relationships
Risk-takers	Risk-averse
Personal wealth	Quality of life
Private property	Collective responsibility
Nature: to be conquered	Nature: "indivisible web of life"
Economic growth	Sustainable development
Emphasis on work	"Leisure and deep play"

Table 2: Summary from Rifkin 'The European Dream' cited from Beatley (2012, p. 6)

Hence, although North America and some parts of Asia nowadays are very well advanced in the fields of greening mega cities and enhancing sustainability in dense urban areas, Europe still has a lot of history in transforming cities into greener places and more importantly, strongly aims to sustainably produce food on a local level.

### **2.3 Theoretical Framework**

With the literature aspects mentioned previously, one can see that the need for supporting successful and significant urban farming initiatives especially in Europe becomes an important issue. To clarify the general framework of urban farming and its different characteristics, it is essential to point out that urban agriculture or farming



can occur in various dimensions, depending on the means of production, types of food produced, locations of the farming facility, the business objectives and the extent towards its' market orientation. (Cabannes, 2006 cited from Liu, 2015). The reader was already given a rough overview of the basic urban farming dimensions prior, however, the following describes the various farming possibilities in cities in more detail. Cabannes (2006) argues that, in general, urban farming can be distinguished into three classification areas.

First, as mentioned in chapters before, urban farming can be practiced on an individual and family-based scale where people involved exclusively seek their own subsistence without making profits. The most common term found for this classification is "urban gardening" as the generic umbrella term which in the case of this thesis will not be further explored.

Second, the purpose of an urban farm could be for recreation and leisure activities where educating citizens and connecting them to agriculture are the main goals. Here, examples are community gardening both in neighborhoods and as part of schools, universities and so forth, guerilla gardening, urban allotment gardening and basic city gardening projects, which all aim at serving the cities' prosperity, environment and the wellbeing of its inhabitants. This type of urban agriculture is the most popular one and can be found in any developed city especially in European smart cities. Similarly, this category does not fit to the research aim of this thesis and thus, will not feature projects of this kind in the methodological part of the work.

Third, the concept of urban farming can be applied on a market-orientated and corporate-focused base where products are either sold directly to customers or companies, or through intermediaries. Most commonly, the third type is organized by micro-enterprises or larger cooperatives (Cabannes, 2006 cited from Liu, 2015). Here, farming initiatives usually assign themselves to the categories of commercial businesses, applying various different types of farming methods. A detailed insight into these methods will be provided at a later stage of the literature review.

The focus of this study is mainly laid on the third urban farming type since the development of urban farmers becoming commercial and revenue-driven is increasingly emerging (Liu, 2015). Thus, the selected urban farming initiatives which will be introduced in subsequent chapter are mostly large-scale projects with clearly defined business models and clear economic and environmental effects.

### 2.3.1 Theory of Business Models

Considering the chosen case study set of urban farming companies, it has to be mentioned that these commercial, large-scale projects are normally thoroughly structured and organized according to certain business models. Having an appropriate business model is an essential precondition for a successful operation and feasibility of companies. Rouse (2013) defines a business model as “the conceptual structure supporting the viability of a business, including its purpose, its goals and its ongoing plans for achieving them”. Differentiating itself from a regular business plan, a model determines the core attributes “that make an existing business work successfully” (Rouse, 2013).

To be more precise, relating this to urban farming businesses, Pölling et al. (2017) declare that based on various other literature insights, there are three business model classifications also applicable to urban farms which are ‘low-cost specialization’, ‘differentiation’ and ‘diversification’. Also, the authors mention that city farms are often built based on strategies from more than one exclusive model.

First, ‘low-cost specialization’ implies that the company reduces its product variety to one or very few product types, thereby reducing unit costs. It is very popular especially in high-dense cities to focus on high-value crop production as when considering prices for urban land markets, farmers are forced to maximize profitability per crop area and stay competitive in order to have a comparative advantage compared to other farms (Pölling et al., 2017).

Second, ‘differentiation’ is defined as centralizing the company on a specific niche product or market or for instance laying out the company’s core solely on organic farming. Another common example is having short supply chains by focusing on direct selling and thereby enhancing the connection to consumers (Pölling et al., 2017).

Third, ‘diversification’ as a business model can often be found where farms not only concentrate on food cultivation but also act in agri-tourism hence having a bistro or restaurant as well, or in social activities such as offering workshops, educating students and the like. Here, the “on-farm multifunctionality” (Pölling et al., 2017) is of importance, either in form of product diversification or the provision of multiple services as an add-on, and is mostly implemented by larger farms. The main reason for engaging in diversification is the access to a significantly larger number of customers (Pölling et al., 2017).

Based on the findings of the study conducted on business models of city-adjusted farms in Germany, Pölling et al. (2017) highlight that urban farms in cities find it best working for them if they adopt the model of 'differentiation' and 'diversification', hence either narrowing their business concept down to short supply chains, direct sale, or having a variety of services provided helping them to optimize their potential. Also, many successful city farms prefer setting up their model based on merged business approaches (Pölling et al., 2017).

Next to the identification of the existing business models in the urban farming sector, it is equally important to give the reader an outline on how success can be derived in this field and on the basis of theoretical evidence, explain what steps lead to success. This will be summarized in the following section.

### **2.3.2 Theory of Success and Business Goals**

In the first part of the thesis, the main aim of this research namely the identification of success factors of urban farming initiatives was already mentioned. It was described that in order to identify key success factors, it is necessary to measure certain aspects of the business' performance against the defined business goals. However, to facilitate this subject to the reader and to give a better understanding of what is actually meant by success as well as business goals and models of urban farming, the topic will be depicted even further.

First, the term success is determined as an "achievement of an action within a specific period of time or within a specified parameter" as well as in the sense of "completing an objective or reaching a goal" (Web Finance Inc., 2019). Hence, this definition contains the essential information namely the state of achieving a certain business goal.

In general, successful businesses characterize themselves in terms of earning profits, having high quality products or delivering high quality services, building customer relationships, brand awareness as well as doing good for the community (Suttle, n.d.) More precisely, Pölling et al. (2017) argue that there are different point of views of what business success incorporates, though usually being based on financial and economic performances such as turnover, return on investment, profitability, market share, production figures and the like (Pölling et al, 2017). Furthermore, as already mentioned above, in the article by Pölling et al. (2017), it is stated that success is defined "as the extent to which the business goals set by the business owners has been achieved" as well as that success is hardly ever reduced by financial aspects of a business (Rantamäki-Lahtinen, 2009 cited from Pölling et al., 2017). More precisely, for the

case of this thesis and urban farming businesses in general, success most commonly depends on the longevity of the farm as well as its succession in terms of if there is an opportunity to perpetuate the operation of the farm. Hence, first and foremost, the characterization of an urban farm of being successful has more depth than the classic financial and economic aspects, and ultimately “is self-assessed by the farmers with regard to farms’ business situations, development prospects, and successions” (Pölling et al., 2017).

Consequently, as already described in the first chapter of this thesis, based on the hypotheses stated, some assumptions on the expected success factors can be made before starting the actual methodological research. Here, the importance of presumed factors leading to the desired success were evaluated and estimated based on study insights of different literature sources. Throughout the methodological procedure, these hypotheses will be tested and reviewed for their validity.

Second, goals are defined as “what is to be achieved by the business in the future” (U.S. EPA, 2011) and based on the ‘Urban Farm Business Plan Handbook’, these business goals are normally determined by means of time, either being short- or long-term. Every company sets goals both for the short term, for example reaching a specific amount of sales, and for the long term such as increasing market share or adding new farming techniques into the production operations. Furthermore, the handbook describes that in the case of urban farms, goals are usually formed around the potential cultivation products, the design of the farm in the future, thresholds of how many people can be targeted, what more can be achieved in certain periods of time and so forth (U.S. EPA, 2011). Goals should also be aligned to the values the respective urban farm wants to communicate as these are equally important to the success of the company.

## **2.4 Urban Farming Methods**

To start with, it needs to be mentioned that originally, farming was exclusively practiced on a soil-basis, as in traditional crops for instance. However, over the years other more innovative and advanced methods have spread. Amongst the most popular urban farming methods are the usage of water or air as the main basis for cultivating the crops. A thorough overview of every installation method existing in European urban farms will be provided later in this chapter.

Additionally, the reader will be given an insight into the the various advantages and disadvantages of the farming methods. This list will be outlined in the following paragraphs and is only partly evidenced by scientific sources. Some of the claims made are based on opinions of farmers who have professional experience in urban farming and the practical application of the respective techniques. Although, these claimed advantages and disadvantages are not fully unbiased assessed and therefore cannot be generalized, there is still high validity in the expertise statements given by various farming sources in Europe (McCarthy, 2011).

Generally speaking, urban farming and its different growing techniques have many economic and environmental benefits.

For instance, it is known that urban farming supports communities and offers “job and volunteer opportunities in big cities, where poverty and hunger are often persistent issues” (The Ecology Center, 2016). It not only connects people living in communities and neighborhoods but also establishes a friendly environment with less risk of violence (Urbanvine.co, n.d.). Furthermore, urban farms produce additional healthy sources of food, while providing a learning environment for both young and old (PowerHouse Hydroponics, 2018). Urban farming initiatives improve a community’s health overall by producing fresh organic crops with less use of fertilizers and pesticides. When growing indoors, complete independence of any weather condition represents another important benefit (Urbanvine.co, n.d.). The different methods of urban farming namely vertical farming, rooftop farming and the like use limited or unused arable land as growing space (PowerHouse Hydroponics, 2018).

Urban farming also contributes to the quality of life in cities by reducing carbon emissions and pollution (The Ecology Center, 2016). Additionally, “greenery adds aesthetic appeal, reduces runoff from precipitation, provides restful spaces for the community, and counters the heat island effect by fixing carbon through photosynthesis” (The Ecology Center, 2016).

Furthermore, local produce requires little to no transportation and therefore, reduces food miles while providing fresh food quality (Junge, 2014).

For the purpose of this thesis the following types of urban farms were identified: aquaculture, hydroponics, aquaponics, vertical farming, rooftop farming and various sub-categories.

The latter serves as an overview of the urban farming types just mentioned. These will be outlined in further detail below.

### 2.4.1 Aquaculture

Aquaculture describes the process of cultivating organisms living in water-based controlled environments namely “fish, shellfish or plants” (NOAA, 2018). To be more specific, it is a “method used to produce food and other commercial products, restore habitat and replenish wild stocks” as well as to save certain species from extinction (NOAA, 2018). Moreover, it can be differentiated between two types of aquaculture, namely the marine - raising marine species living in the ocean, and freshwater- referring to producing organisms in watercourses (Ayres, 2016). Aquaculture compasses artificial reproduction as well as breeding. Propagation is based either on a parent stock kept under controlled environmental conditions or on trapped animals (Waller, n.d.). “Seedlings are raised to a marketable size and later, the production process is optimized by improving growth through feeding and preventing disease and loss (Waller, n.d.).

While aquaculture can be practiced for aesthetic reasons such as managing water gardens and aquariums, it is most commonly applied for the purpose of feeding the people. Here, the goal is to enhance domestic and international fish trade (Boyd, 2013).

According to Rinkesh (n.d.), the most frequent types of aquaculture are: mariculture, fish farming, algaculture and integrated multi-trophic aquaculture. The former requires the use of sea water to produce seafood as well as sea plant. Fish farming counts as one of the main aquaculture practices and is the easiest method to maintain. This type of farming is either implemented in sea water or fresh aquatic reservoirs. Algaculture is determined as the production of algae which are microbic plants with animalistic components, usually cultivated in high quantity. Integrated multi-trophic aquaculture (IMTA) represents a highly efficient method assuring “maximum resource utilization by using the waste of larger organisms as food sources for the smaller ones” which ultimately guarantees full recycling and little waste (Rinkesh, n.d.).

The following serves as an overview of the benefits and drawbacks of aquaculture.

Aquaculture farms are highly economical urban farming initiatives as “fish convert feed into body protein more efficiently than cattle or chicken production” (Rinkesh, n.d.). Hence, even with little “food and energy” input, production flourishes while reducing the cost of cultivation and conserving natural resources (Rinkesh, n.d.). Furthermore, the outcome of these urban farms are steady and predictable (Souza, 2019).

Depending on what techniques are applied, the environmental impact can be decreased and in some cases, the “water quality in ponds and lakes” may even be improved (Souza, 2019). “Aquacultures also protect biodiversity by reducing the fishing activities on wild stock in their ecosystems” (Rinkesh, n.d.).

Nevertheless, aquaculture also has negative consequences such as water pollution due to fish effluent resulting in a high level of ammonia (The Aquaponic Source, n.d.). When discharging the polluted water into natural waters, these are then contaminated as well. Thus, water consumption is very high (The Aquaponic Source, n.d.). Due to high risk of disease, fish growing up in aquaponic farms require regular medical treatments (The Aquaponic Source, n.d.).

The most important advantages and disadvantages mentioned above are summarized in the table below.

<b>Advantages</b>	<b>Disadvantages</b>
“More food for less feed” (Rinkesh, n.d.)	Water pollution due to fish effluent resulting in a high level of ammonia (The Aquaponic Source, n.d.)
Low impact on the surrounding area (Souza, 2019)	High water usage since the water has to be discharged daily (The Aquaponic Source, n.d.)
“Large and consistent quantities of fish and seafood” (Souza, 2019)	Medical fish disease treatments necessary due to high risk of disease (The Aquaponic Source, n.d.)
“Conservation of biodiversity” (Rinkesh, n.d.)	

Table 3: Advantages and disadvantages of aquaculture (author’s own)

## 2.4.2 Hydroponics

Hydroponics is the process of harvesting plants in nutrient rich water rather than soil. Consequently, “the root system is supported using an inert medium such as perlite, rockwool, clay pellets, peat moss, or vermiculite” (Fullbloom Hydroponics, 2019). Above all, feeding the roots directly with nutrients whilst providing plenty of oxygen is fundamental for a functioning hydroponic system (Fullbloom Hydroponics, 2019). Moreover, “[...] the nutrient concentration (EC - electrical conductivity) and the acidity level (pH) of the nutrient solution [...] must be consistently balanced over time to insure plants have what they need, when they need it” (Easy Hydroponics, 2018). “The nutrients/fertilizers [...] are available in both liquid and dry forms and in both organic and synthetic types” (D’Anna, 2018).

Furthermore, “hydroponics is unique in that there are multiple techniques you can use to get the nutrient solution to your plants” (Fullbloom Hydroponics, 2019). The following illustrates the “basic hydroponic parts” (Payne, 2019).

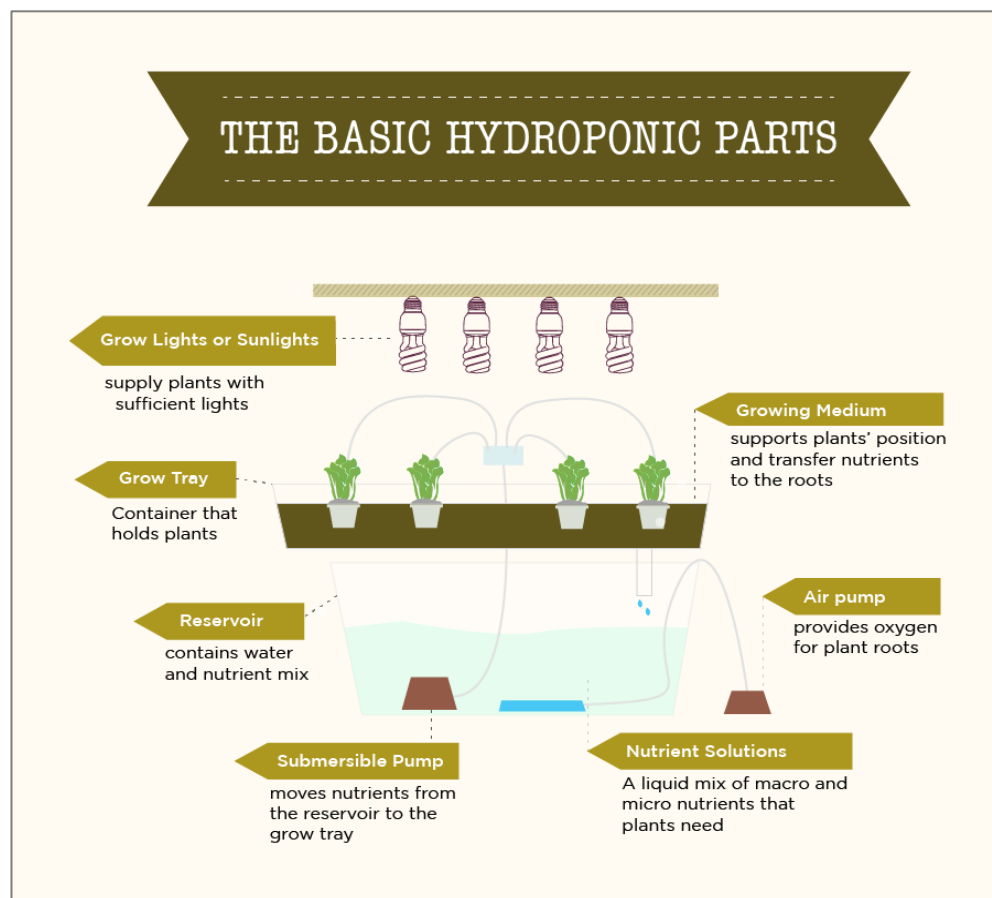


Figure 4: The Basic Hydroponic Parts (Payne, 2019)



Taking a closer look at this urban farming tool, it is known that “[..] there are many different types of hydroponics systems available” (MaximumYield Inc., n.d.), namely methods such as the “wick system, deep water culture (DWC), nutrient film technique (NFT), ebb and flow (flood and drain), drip system and aeroponic system” (Fullbloom Hydroponics, 2019). To be more concrete, within hydroponics, the three fixed components “water/moisture”, “nutrients” and “oxygen” are needed for plant roots to grow (Payne, 2019). Each hydroponic method transfers these three elements differently to the plants’ roots (Payne, 2019). The following paragraphs describe each type shortly and offer a visual representation of each of the processes.

#### a. Wick system

The wick system, also known as wicking represents the simplest form of cultivating plants hydroponically. It requires a supporting tool namely a wick out of cotton which is put into a “growing medium with one end of the wick material placed in the nutrient solution”, inside a reservoir beneath the growing tray (Fullbloom Hydroponics, 2019). The wicks in the container are responsible for the process of transmitting the nutrients to the roots (Fullbloom Hydroponics, 2019).

A functioning wick system requires the following elements: “a large container of fertilized water that sits below the grow tray and supplies water and nutrients to the plants” (D’Anna, 2019). The grow tray is filled with a growing medium such as vermiculite, perlite, and soilless mixes in which the plants are implanted (D’Anna, 2019). “The reservoir is connected to the grow tray by two or more wicks” (D’Anna, 2019).

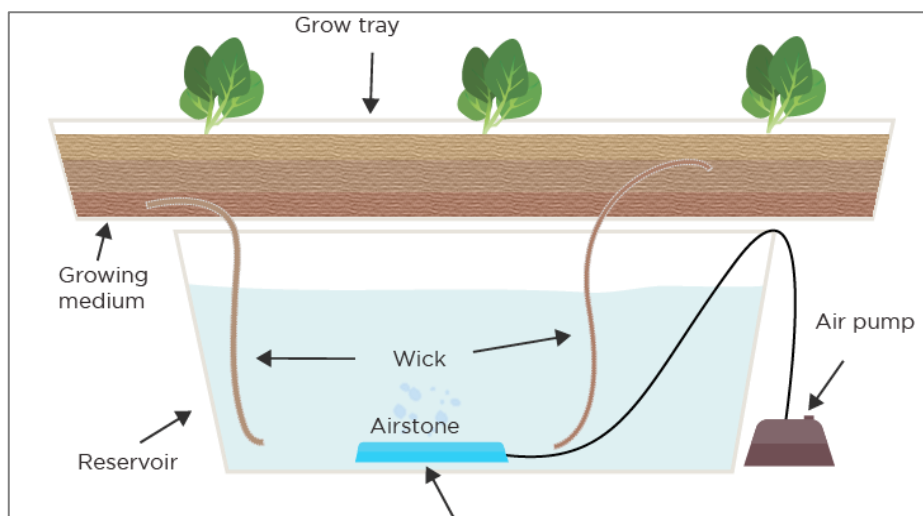


Figure 5: The Wick System (Payne, 2019)

### b. Deep water culture (DWC)

In a “deep water culture or direct water culture (DWC)” (Max, 2019), plants’ roots are fully submerged into a mixture of nutrients at all times. However, it is important to ensure that “the stem and foliage are exposed to the air” (Smart Garden Guide, n.d.). The following describes the process of a DWC as it is illustrated below.

Building this system requires certain tools such as a “water container or reservoir”, an “air pump”, an “air hose and air stones for bubble formation”, “grow nets or baskets to hold the plants”, “growing media to support the plant in the basket”, “hydroponics nutrients” and “equipment to monitor pH and EC of the nutrient solution” (Smart Garden Guide, n.d.). First, an airline connects the airstone to the air pump, the former is placed inside the container and the latter must be positioned near the water tank (Smart Garden Guide, n.d.). Both “are used to create air bubbles to the nutrient solution” (Payne, 2019). Furthermore, “an aquarium air pump oxygenates the nutrient solution, this keeps the roots of the plants from drowning” (Fullbloom Hydroponics, 2019). Second, a styrofoam sheet with pre-cut holes in the size of the grow baskets are put on top of the water container. It holds these baskets firmly and now the plants and the growing medium are put in. Third, the nutrient solution has to be prepared and mixed with the water inside the tank (Smart Garden Guide, n.d.). It is important to keep an eye on the system during the first few days to “ensure that the roots are receiving sufficient water, and the pH and EC of the nutrient solution will need to be monitored carefully and adjusted as necessary” (Smart Garden Guide, n.d.).

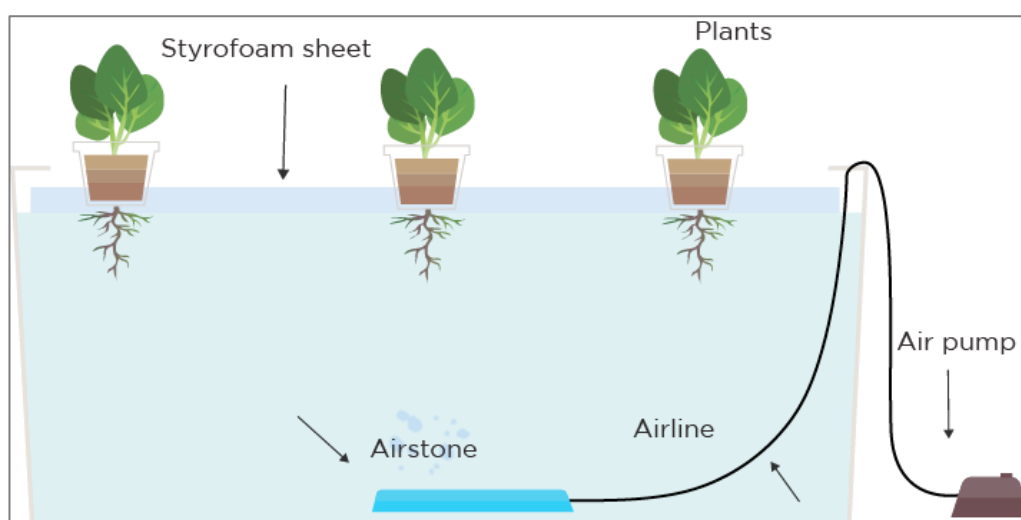


Figure 6: The Deepwater Culture System (Payne, 2019)

### c. Nutrient Film Technique (NFT)

“Nutrient Film Technique or NFT is a type of hydroponic system where a continuous flow of nutrient solution runs over the plants roots” (Fullbloom Hydroponics, 2019). It primarily consists of two segments, an inclined growing tube which helps the roots absorb all the nutrients from the water as well as a “reservoir that contains water and nutrients” (Val, 2018). This method allows plants to “absorb more oxygen from the air than from the nutrient solution itself” (Fullbloom Hydroponics, 2019) while speeding up the growing process.

The illustration below shows the process behind this technique.

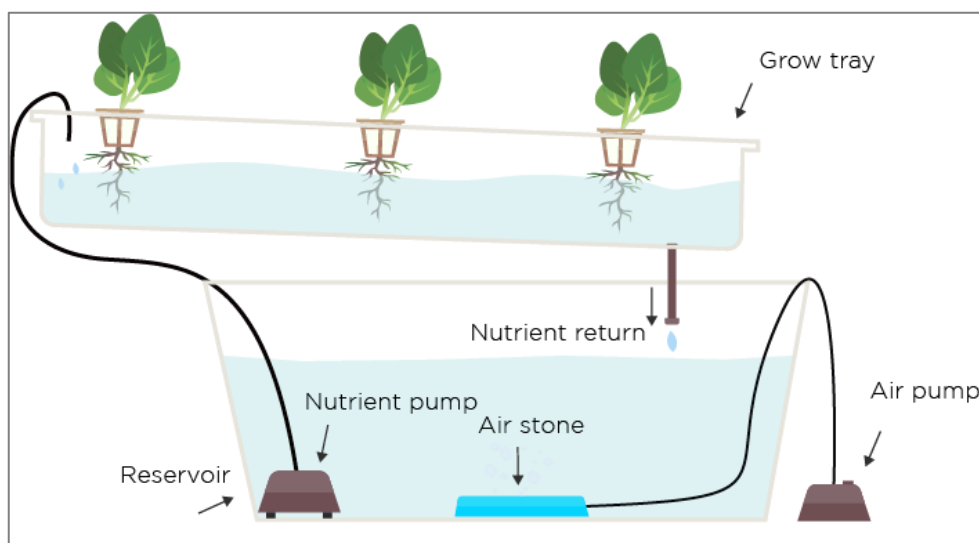


Figure 7: How does the Nutrient Film Technique work? (Val, 2018)

#### d. Ebb and flow system

The ebb & flow system (flood & drain) is achieved by inundating the root system with nutrient solutions followed by emptying the growing tray on a regular frequency. “The nutrient solution then slowly drains back into the reservoir” (Fullbloom Hydroponics, 2019). To ensure that all roots receive the appropriate quantity of nutrients, the process of pumping may be automated by connecting the pump to a timer (Fullbloom Hydroponics, 2019).

This type of hydroponic growing system is especially suitable “for plants that are accustomed to periods of dryness” (Fullbloom Hydroponics, 2019). During a dry period, the size of the roots increases in order to absorb the required amount of nutrients (Fullbloom Hydroponics, 2019).

The figure below demonstrates the system described above.

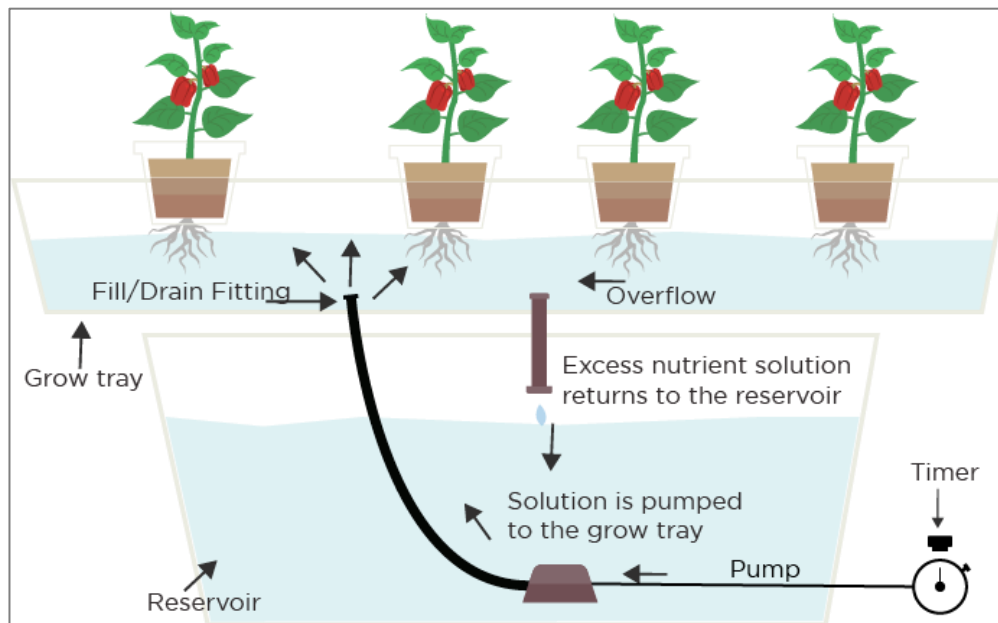


Figure 8: Ebb and Flow System (Flood and Drain) (Payne, 2019)

e. Drip system

“A drip system works by providing a slow feed of nutrient solution to the hydroponics medium” (Fullbloom Hydroponics, 2019). The solution is pumped into a drip manifold and ultimately reaches each root through individual drip lines. Hence, it is possible to modify “the amount of solution per plant” by using separate line emitters for all plants and schedule a timer ensuring that the intervals of feedings are regular (Payne, 2019).

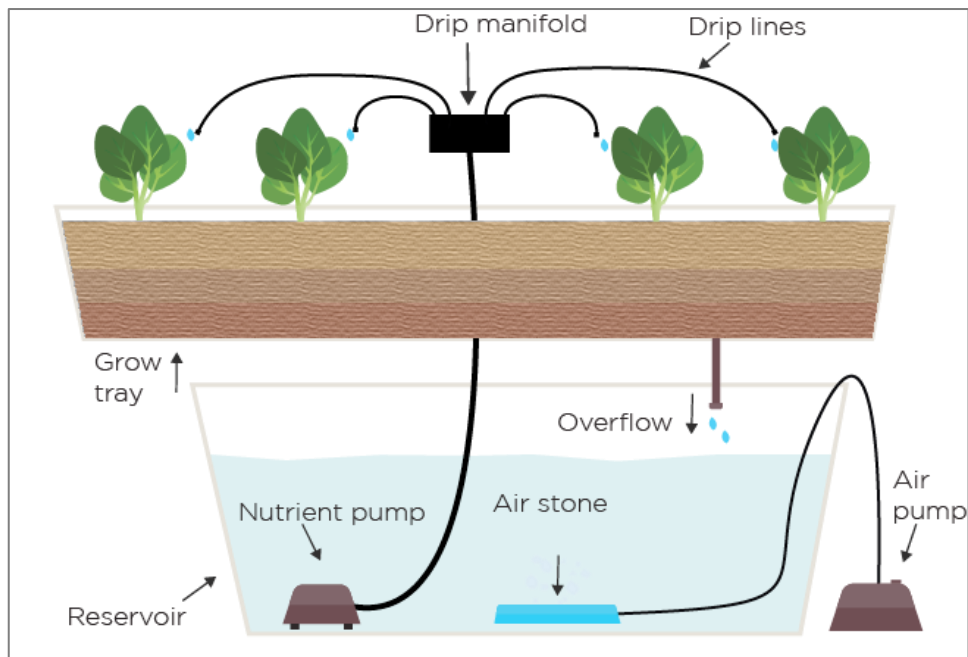


Figure 9: Drip System (Payne, 2019)

#### f. Aeroponics

Aeroponics does not involve “any solid material such as Rockwool or soil” (Payne, 2019) instead the plants are “suspended in the air” (Fullbloom Hydroponics, 2019) in a “closed-loop system” (Payne, 2019). Within this system there are two different approaches to nourish the plants roots with the necessary nutrients. They may be “sprayed with nutrient-rich water or fine, high-pressure mist containing nutrient-rich solutions at certain intervals” (Payne, 2019).

The following illustration shows the detailed set-up of such a system.

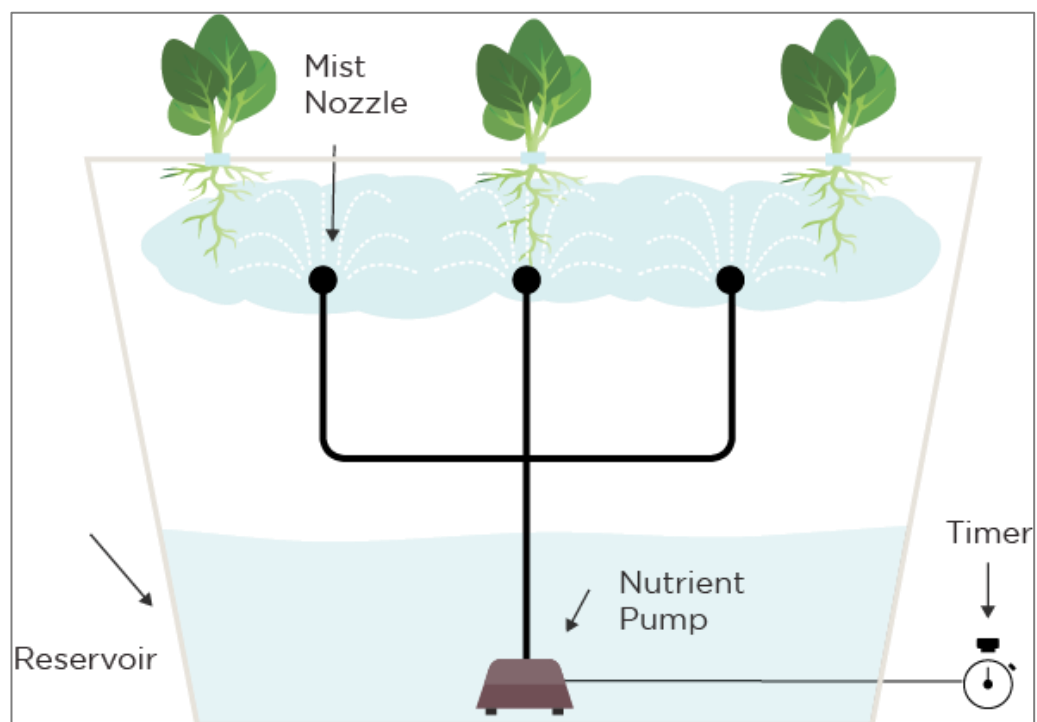


Figure 10: How does the Aeroponic system work? (Payne, 2019)

The following paragraphs explore the various advantages and disadvantages of hydroponics. Subsequently, the listed advantages and disadvantages will be summarized in a table for easier understanding.

First and foremost, a significant element of hydroponic systems is the elimination of any redundant obstacle in the process of growing plants (Espiritu, 2018).

One of the main benefits of growing hydroponically is the rapid growth rate, more precisely, plants cultivate substantially faster than they would in any soil-based growing system (Fullbloom Hydroponics, 2019). Furthermore, if set up accordingly, plants no longer have to invest their energy in finding water and nutrients since the roots are

directly submerged in a container filled with minerals, “a concoction of chemicals, salts and trace elements” (The Aquaponic Source, n.d.). Therefore, “plants grown in a hydroponic system do not need to develop extensive root structures to search for nutrients” (Maximum Yield Inc., n.d.).

Also, applying the hydroponic harvesting method requires little space and enables the farmers to grow more plants while minimizing the growing area (Payne, 2018). Equally important is the fact that the plants are less exposed to “soil-borne pests like birds, gophers, groundhogs; and diseases like Fusarium, Pythium, and Rhizoctonia species” (Payne, 2018). Fighting disease proves to be less complicated as the growing “environment is often times portable and raised off the ground” (Espiritu, 2018).

Furthermore, this technique reduces the use of water as “the reservoirs used in hydroponics are enclosed to prevent evaporation, and the systems are sealed” (D’Anna, 2018). Consequently, resources are efficiently used as this system “allows plants to take up only the water they need” (D’Anna, 2018). Moreover, keeping the water tank oxygenated at all times allows the plants to maintain a continuous and steady intake of oxygen (Espiritu, 2018). Additionally, the water inside the system is always being recirculated in order to prevent any waste (Payne, 2018).

Along the reduced use of water, cultivating plants without soil enables all year around growing and eliminates weeds (Payne, 2018).

However, looking at the negative attributes, it is known that setting up this growing technique is time-consuming and expensive (Fullbloom Hydroponics, 2019). Consequently, hydroponics requires a certain level of knowledge and regular monitoring, particularly in the early stages of growing (The Aquaponic Source, n.d.). To be more specific, “water in hydroponic systems needs to be discharged periodically, as the salts and chemicals build up in the water, becoming toxic to the plants” (The Aquaponic Source, n.d.). Here, a proper site of disposal has to be well-considered (The Aquaponic Source, n.d.). Therefore, a steady access to fresh water is necessary (Fullbloom Hydroponics, 2019). Additionally, in case of a single growing error, the entire crop bears the consequences and is ruined making the damage much more expensive. Furthermore, hydroponic systems are prone to fungi and mold due to its humid environment (Espiritu, 2018).

As a final remark, hybrid hydroponic systems are the result of mixing and applying two kinds of hydroponic methods at the same time (Fullbloom Hydroponics, 2019).

Below the summarized advantages and disadvantages are visualized.

<b>Advantages</b>	<b>Disadvantages</b>
Higher growth rate (Fullbloom Hydroponics, 2019)	Requires knowledge and expertise (The Aquaponic Source, n.d.)
“Reduction of waste and pollution” (Fullbloom Hydroponics, 2019)	Needs to be monitored, especially in the beginning (The Aquaponic Source, n.d.)
Little space is required (D’Anna, 2018)	Water has to be discharged regularly (The Aquaponic Source, n.d.)
No risk of soil-borne pests and the like (Payne, 2018)	Expensive (Fullbloom Hydroponics, 2019)
Efficient use of water (D’Anna, 2018)	Time consuming while setting up and managing a hydroponic system (Fullbloom Hydroponics, 2019)
Growing is possible without the use of soil (D’Anna, 2018)	“Fresh supply of water is required” (Fullbloom Hydroponics, 2019)
All year around growing (Payne, 2018)	Prone to fungi and mold (Espiritu, 2018)
No production of weeds (Payne, 2018)	

Table 4: Advantages and Disadvantages of Hydroponics (author's own)

### 2.4.3 Aquaponics

Aquaponics is the “combination of aquaculture and hydroponics” integrating both the cultivation of aquatic organisms and the technique of growing plants without soil. Any waste produced while farming fish is used for soilless plant production (The Aquaponic Source, n.d.). “The nutrient-rich water from raising fish provides a natural fertilizer for the plants and the plants help to purify the water for the fish” (Nelson and Pade, Inc.,



2018). Furthermore, fish waste serves as an organic food source for plants which naturally filter the water for the fish (Rinkesh, n.d.). Microbes also known as nitrifying bacteria accumulate between the root system and convert ammonia, which is a result from fish waste, into nitrites which are then turned into nitrates. Plants can absorb nitrates in form of nitrogen and use it to grow (Rinkesh, n.d.). Additionally, microbes can “convert the solid fish waste into a form called vermicompost that acts as food for the plants” (Rinkesh, n.d.).

To get a deeper insight into this urban farming technique, the following paragraphs will specify on the advantages and disadvantages of aquaponics.

To start with, an aquaponic setup forms its own “natural ecosystem” and is a scalable method, implying that it can be used in any environment and may be adjusted accordingly to the available budget (The Aquaponic Source, n.d.). Hence, it allows developing communities to produce food while preventing an overuse of scarce resources, for instance utilizing and recycling water. Areas with little land, limited fresh water or extreme weather conditions are able to produce food, resulting in an increased food supply, promoting urbanization and raising population density. Additionally, the recirculating food production system ensures a high level of food security as the use of chemical substances such as pesticides or antibiotics is eliminated (The Aquaponic Source, n.d.). Furthermore, this food production system removes weeds on the whole (The Aquaponic Source, n.d.). Another benefit of “making food ‘local’” resulting in “zero food miles” is the reduction of the carbon footprint (Junge, 2014).

When managing an aquaponic system, bearing responsibility for the fish as well as for the plants is very important. Especially when running a project in a less developed country, support in training is essential to prevent failure of the system. Normally, aquaponic installations are mainly sourced from energy in varying quantities. If set up accordingly, energy usage may be replaced through alternative sources of energy such as wind or solar power reducing the ecological footprint. However, at the same time, there is a potential risk of electrical failure which might cease the system’s operation and eradicate fish and plant stock. Furthermore, this type of farming can exclusively only grow a certain variety of fish and plants. Moreover, hygienic control in all stages of production from cultivation to harvest and transportation is highly recommended. Another important factor is that fish are perishable goods and therefore, need to be consumed accordingly (Ter Morshuizen, L., n.d. cited from Seager, 2014). The table below concludes the advantages and disadvantages stated above.

<b>Advantages</b>	<b>Disadvantages</b>
Ability to cultivate both fish and plants (The Aquaponic Source, n.d.)	A certain level of expertise and competence is required (Junge, 2014)
Scalable system (The Aquaponic Source, n.d.)	Technical training necessary (Ter Morshuizen, L., n.d. cited from Seager, 2014)
Elimination of weeds (The Aquaponic Source, n.d.)	Access to electricity is needed (Ter Morshuizen, L., n.d. cited from Seager, 2014)
Little water usage (The Aquaponic Source, n.d.)	Risk of electrical failure (Ter Morshuizen, L., n.d. cited from Seager, 2014)
Independent of weather conditions (The Aquaponic Source, n.d.)	Small variety of fish and plants to grow (Abuta, T., n.d., cited from Seager, 2014)
All year around cultivation possible regardless of location or climate conditions (Nelson and Pade, Inc., 2018)	Hygiene control (Abuta, T., n.d., cited from Seager, 2014)
No use of pesticides, hormones and herbicides (Nelson and Pade, Inc., 2018)	Perishable goods (Ter Morshuizen, L., n.d. cited from Seager, 2014)
Reduction of carbon footprint (Junge, 2014)	

Table 5: Advantages and Disadvantages of Aquaponics (author's own)

There are a number of different aquaponic growing methods which will be introduced in the following section. It has to be said that the methods deepwater culture (DWC) and nutrient film technique (NFT), which have already been described earlier in the

section of hydroponics, also exist within aquaponics and share the same characteristics. Hence, these two urban farming tools will not be repeated here.

Next to DWC and NFT, there is the media-based aquaponics technique and vertical aquaponics. Media-based aquaponics is the opposite growing method from the deep-water culture. It uses a certain kind of inert media to secure the plants' roots and prevent them from floating in the water (Maximum Yield Inc., n.d.). Examples for the material used as media are "expanded clay", "gravel" or "perlite" (Maximum Yield Inc., n.d.). "The media provides both the biological filtration, namely the conversion of ammonia to nitrates and mechanical filtration – the removal of solid wastes, in the same system" (The Aquaponic Source, n.d.).

Next, vertical aquaponics makes efficient use of any growing space available by stacking plants on top of each other. Generally, the idea "is to use tubing to create lots of small pockets where plants can grow" (Brooke, n.d.). Here, the most frequently used tubing is PVC, short for polyvinyl chloride, "which is why vertical aquaponics is often referred to as PVC aquaponics" (Brooke, n.d.). This type of aquaponic setup does not need soil, instead, water circulates through the tubings feeding the plants with nutrients (Brooke, n.d.). Additionally, "air will flow through the pipes providing the plants with the oxygen they need directly to the roots as well as via the leaves" (Brooke, n.d.). More precisely, "the air will flow around the tubes as the water will not fill the tubes completely" (Brooke, n.d.). Usually, the fish tanks are placed below the tubing. Before the water circulates back into the fish tank, the crop will clean the water properly, requiring little monitoring (Brooke, n.d.).

#### **2.4.4 Vertical Farming**

Vertical farming also known as vertical agriculture follows the concept of urban agriculture and allows growing plants as well as fresh produce in urban areas. The name vertical farming derives from its vertical growing technique which is mostly "used to facilitate sustainable agriculture and the mass production of vegetable products inside of buildings" (Vertical Farm Institute, 2018).

The main characteristics behind a successful vertical farming project include the following: "physical layout", "lighting", "growing medium" as well as "sustainability features" (Leblanc, 2019). Specifically, "it primarily involves the practice of producing food in vertically stacked layers and inclined surfaces, or in structures such as warehouses and buildings or skyscrapers" (Baranski, 2018). Respectively, ideal lighting conditions

are achieved by combining both “natural and artificial lights” (Leblanc, 2019). In general, similar to aquaponic and hydroponic systems, soilless resources like rockwool, peat moss and the like serve as a growing medium (Fullbloom Hydroponics, 2019). At the same time, this method compensates for the arising “energy cost of farming” by integrating sustainable elements (Leblanc, 2019). For instance, this form of cultivation uses recycled water and therefore, requires less of this resource (Vertical Farm Institute, 2018). Above all, the main incentive for vertical agriculture is “maximizing the use of the location’s square footage” (Maximum Yield Inc., n.d.).

Generally, the overall goal is to promote “optimal plant growth while maximizing the use of natural resources, such as the sunlight” (Vertical Farm Institute, 2018). The following sums up advantages and disadvantages of vertical farming. First and foremost, the vertical farming technique “makes cultivation possible, independent from weather conditions and season”, helping to “ensure the food supply for rapidly growing world populations” (Vertical Farm Institute, 2018). In addition, the use of artificial light enables crops to grow on a 24/7 basis, allowing to fasten the process of growing plants via photosynthesis continuously (Vertical Farm Systems, n.d.). “Artificial light, as opposed to natural light, refers to any light source that is produced by electrical means” (Maximum Yield Inc., n.d.).

Another benefit of growing crops vertically under a controlled environment is the absence of pesticides, herbicides or any other chemicals (Bareja, 2010). Moreover, “every land area that will be developed for this farming technology will reduce by a hundred fold the necessity of utilizing land for food production” (Bareja, 2010). Additionally, crops which are directly grown where they will be consumed do not need to be transported. Therefore, fuel usage is reduced, transport costs are low, the air is less polluted, and more importantly, the food is fresh and safe (Bareja, 2010).

However, there are challenges concerning the financial feasibility because of all necessary expenditures as “this modern type of farm depends heavily on modern engineering and architecture, as well as the application of different technologies” (Baranski, 2018). Considering the technical advances of this farming method, it may cause conventional farmers to become redundant (Baranski, 2018). Moreover, only a single day of electrical failure could have fatal consequences and lead to tremendous losses (Leblanc, 2019). Furthermore, setting up and managing a vertical farm proves to be more difficult than conventional farming (Baranski, 2018). Additionally, a greater demand for higher qualified personnel will lead to extra costs for vertical farms (Leblanc, 2019). Pollination represents another challenge as vertical farms are often indoor

farms and therefore, the crops cannot be pollinated naturally and mankind has to take over (Leblanc, 2019).

The table provides the reader with an overview of the above mentioned advantages and disadvantages of vertical farming.

Advantages	Disadvantages
“Independent from weather conditions and season” (Vertical Farm Institute, 2018)	High expenditures for modern technology (Baranski, 2018)
Artificial light enables crops to grow day and night (Vertical Farm Institute, 2018)	Redundancy of conventional farming (Baranski, 2018)
Absence of chemicals (Bareja, 2010)	Need for higher qualified personnel (Leblanc, 2019)
Food is fresh and safe due to no transportation means (Bareja, 2010)	Pollination needs to be done manually (Leblanc, 2019)

Table 6: Advantages and Disadvantages of Vertical Farming (author's own)

### 2.4.5 Rooftop Farming

In general, rooftop farming is seen as an optimal solution to make use of unutilized spaces in cities, more precisely, on roofs of buildings. Especially with the current issue of the spread of densely populated cities in Europe, the possibility to green urban roofs and cultivate vegetables, fruits and herbs offers many benefits to the environment and economy of smart city hubs. Furthermore, rooftop farming has many advantages for both the citizens and the city itself. For instance, it is known that greening the overall urban landscape and making architectural designs more sustainable is one of the major benefits of installing farms on roofs. Additionally, cities become more eco-friendly by ensuring to “cool buildings” and to thereby also decrease “carbon emissions” (Coffman, 2018). Also, this method helps feeding citizens in a more efficient way, reducing means of transportation by producing fresh and healthy food directly in the city. When it comes to operating a rooftop farm, one negative aspect can be that the room

to grow is limited as potentially extending respective farming facilities can be an issue in the long run.

### **2.4.6 Greenhouse Horticulture**

Another urban farming method that has already existed for a much longer time than any other urban farming technique is the food production in greenhouses. Here, the most essential characteristic of a greenhouse is the ability “to cultivate food-producing plants in locations and at times when climatic conditions would adversely affect them or even prevent them from growing” (Encyclopedia of Food and Culture, n.d.). The technology of greenhouses nowadays usually features “high-tech climate controls” (Encyclopedia of Food and Culture, n.d.) with sophisticated systems for heat, lights, CO<sub>2</sub> and other controlling tools. The well-advanced greenhouse systems can be found in developed countries, especially research institutions are most present in northern Europe such as the Netherlands (Encyclopedia of Food and Culture, n.d.).

The respective farming method used to be growing plants and vegetables in soil, utilizing manure to fertilize the produce. However, although soil-based farming is still very common, the trend of soilless food cultivation where either water forms the basis for harvestation or artificial substrates. More importantly, as these two forms are widely popular amongst the greenhouse horticulture and are officially referred to as hydroponic systems, the phenomenon is also called greenhouse hydroponics. The next paragraph will give the reader an insight into the latest trend in urban farming especially in smart cities in Europe, namely the installation of rooftop hydroponic greenhouses.

### **2.4.7 Rooftop Hydroponic Greenhouse**

The combination of the previously described urban farming methods namely rooftop farming and greenhouse horticulture forms a technique on its own. As the name already reveals, this kind of greenhouse is located “on the roof of a building (usually a commercial building) that has been outfitted with a hydroponic system” (Maximum Yield Inc., n.d.). Usually, these urban farms utilize an existing water source such as “the building’s water supply” or “a rainwater collection system on the rooftop” (MaximumYield Inc., n.d.). One of the main advantages of having access to a rooftop hydroponic greenhouse is the possibility of independence from any “supply chain that delivers food from hundreds or even thousands of miles away” (MaximumYield Inc., n.d.). Hence, this implies that all people living inside and around the building are able to

produce and consume their own food. Other advantages are the fact that the greenhouse enables cultivation of food all year-round, “control over growing conditions”, as well as “pesticide-free products” and “shorter supply chains” (VerticalFarming.com, n.d.). Amongst the drawbacks of this method are “higher capital costs” and “high energy requirements for lighting, climate control, and motors” (VerticalFarming.com, n.d.) which especially in pricy urban areas can be a crucial factor. Nevertheless, many highly innovative programs operate their urban farms with rooftop hydroponic greenhouses.

## **2.5 Conclusion**

Although the phenomenon of urban farming is rather new, this chapter has shown that there are many literature sources already dealing with the theoretical insights into the history and development of urban farming. More precisely, it has been detected that Europe serves as a leading area to many urban farming practices which, on a global scale, are very much advanced and highly innovative. Even though, there is an “increasing interest in studies addressing the economic dimension” (Pölling et al., 2017) of urban farms in Europe, there is still a lot of room to investigate and explore the success factors and barriers of the farming situation in cities. In conclusion it can be said that there are hardly any scientific studies analyzing this subject matter in a systematic way by retrieving real-life data of experts in the industry.

The following chapter of this thesis will provide an in-depth insight into the methodological steps of the research as well as the chosen case study set.

## 3 METHODOLOGY

### 3.1 Introduction

This section of the thesis will provide the reader with a detailed insight into the methods that have been applied. As the generic purpose of the study is to investigate success factors as well as barriers of urban farming initiatives in European cities - hence conducting a thorough examination of the study set, the most appropriate research method will be a multiple case study design on behalf of a qualitative research process. More precisely, desk research of the chosen projects as well as expert interviews in form of a questionnaire serve as the basis for this thesis research. The detailed transcript of the performed interviews will be included in the appendix.

To better understand the methodological tools used in this academic paper, the following paragraph serves as a preface to briefly introduce the selected research approach.

### 3.2 Research Methods

Usually, the topic and the connected research problem form the basis of a thesis. Accordingly, a suitable research approach has to be selected. This procedure includes considering an appropriate design, a respective method of data collection, a detailed analysis, followed by an interpretation and validation of results and conclusions (Creswell, 2014, p. 3).

In general, a qualitative research is determined as an “approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (Creswell, 2014, p. 4). To be more specific, the reason why qualitative research is said to be the most optimal tool here, is because it is used when “a concept or phenomenon needs to be explored and understood because little research has been done on it” as well as when “the topic is new”, or “the subject has never been addressed with a certain sample or group of people” (Creswell, 2014, p. 20).

Moreover, qualitative research comprises different designs that can be applied depending on the desired outcome. Among the possible formats is for instance narrative research where focus is laid on obtaining true stories about the interviewee’s lives; and phenomenological research where emphasis is put on descriptions of participants about an experienced phenomenon (Creswell, 2014, p. 14). Here, the concrete chosen framework is a qualitative case study design where the investigator “develops an in-



depth analysis of a case, often a program, event, activity, process of one or more individuals” (Creswell, 2014, p. 14). More precisely, “cases are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time” (Stake, 1995 and Yin, 2009, 2012 cited from Creswell, 2014).

Consequently, considering the factors mentioned above, the most appropriate research tool for this thesis will be a qualitative case study design. More on the research instruments will be explained in the next section.

### **3.2.1 Case Study Design**

Using case study research as a methodological study tool gives us the possibility to understand and analyze comprehensive issues within a certain context, especially when the research area needs in-depth and intensive investigation (Zainal, 2007). In a case study design, both qualitative and quantitative data is collected in order to obtain a holistic and complete examination of the cases under investigation (Tellis, 1997 cited from Zainal, 2007).

Since this method allows the researcher to go beyond the classic quantitative methodological framework, case study designs are usually applied in fields such as education, management, sociology and law. The generic aim is to fully observe and analyze the respective interviewees and their cases, as well as to look at behavioral layers if applicable. More importantly, through case study research, it is possible to detect whether certain programs, projects or initiatives were effective as well as if the respective goals were reached hence, applied to this thesis, the goal is to carefully assess the effectiveness of the selected cases and their initiatives (Zainal, 2007). Furthermore, Zainal mentions another important attribute of case studies, namely that its real use is to “explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships” (Zainal, 2007). Additionally, on the contrary to quantitative studies which are used to analyze data on a macro level, this analytical research tool examines data and its context on a limited number of persons or small geographical areas (Zainal, 2007).

Depending on what the researcher strives to explore, the specific design of a case study can vary from a single-case to a multiple-case form. The latter will be applied within this thesis since it enables studying real-life events which, through showing multiple “pattern-matching” (Zainal, 2007) effects, ultimately give the possibility to conclude results with numerous sources of evidence (Zainal, 2007). Hence, choosing the right

design is essential due to various reasons such as proving that case study analysis “is appropriate to the research question”, “follows the set of procedures with proper application”, “allows a chain of evidence to be recorded and archived when interviews and direct observation by the researcher are the main sources of data”, and “is linked to a theoretical framework” (Tellis, 1997 cited from Zainal, 2007).

Moreover, case studies can be conducted based on various categories. Here, Zainal (2007) refers to two different authors who each state distinctive categories. Yin (1984) cited from Zainal (2007), argues that there are three main types, “exploratory, descriptive and explanatory case studies”. McDonough and McDonough (1997) cited from Zainal (2007) suggest that there are additional categories, namely evaluative and interpretive case study designs. Based on their categorization, the methodological instrument put into practice here will be a mixture of an explanatory and an exploratory case study approach, since the cases will be investigated on the whole as well as in detail in order to describe the essence of the data. Likewise, as multifaceted cases tend to be more complex, explanatory case studies help to measure causal connections where pattern-matching can be applied (Zainal, 2007). Also, considering the exploratory study design, research questions can easily be answered and explored through prior conducting fieldwork and later examine the objects of observation (Zainal, 2007). Therefore, selecting this study approach gives the advantage of investigating data in a real-life context, dealing with complexities in detail that other methodological designs like experimental or survey studies would not be able to cover (Zainal, 2007).

### **3.2.2 Implications and Methodological Steps**

Relating the theory on the research design explained in the paragraphs above to the methodological instruments used within this thesis, several implications can be made. First, the decision to undertake qualitative research is based on the nature of the topic, since urban farming is still an emerging phenomenon and little research has been done yet. Second, a multiple case study investigating seven projects requires for an in-depth analysis to capture the essence of these real-life phenomena, in order to ultimately assess their effectiveness. Third, the preconditions of a case study investigation are both a conformity to its research problem and questions, as well as a strong link to a theoretical framework, hence to evidence and findings in the literature. These requirements are fulfilled since the research problem of the topic lies in the increasing necessity of creating urban farming areas due to an elevating population issue in metropolitan cities. Also, the thereby resulting research questions such as studying the business

models of the case studies, exploring the motivation and objectives behind them, looking into how they promote their programs, questioning if their audiences are reached, investigating how much they can contribute to the urban area, determining how successful they are profit-wise, educational-wise and so forth, can be best answered through this methodological design. Fourth, within a case study design prior fieldwork has to be done which in this paper, was thoroughly conducted before starting the respective interview rounds. Therefore, considering the specific elements and completing each requirement, the actual methodological process can be started.

The steps in undertaking the data collection procedure is set to begin with detailed desk research on the projects based on the research questions, hereby already deriving essences to investigate during the forthcoming inquiry period. These will include all kind of retrievable information of the farm's website on their business activities, values, aims, service offers, customer bases and so forth. This preliminary information collection should provide the reader with an insight into each urban farming initiative in order to facilitate the understanding of the subsequent interview conduction. Here, for the questionnaire process, either Skype or telephone interviews are foreseen with the aim to verify the given desk research information, retrieve in-depth answers to the interview questions, give enough room to add any additional and useful insight into the topics as well as to being able to answer the main research question and sub-questions. Throughout this process it is important to assure full understanding of the content provided by the interviewees.

As a final remark, it has to be said that the research will be conducted on seven projects where either project initiators, persons closely involved with the respective program or responsible persons that are part of the working team, will be addressed. These seven projects have been selected based on defined criteria such as location, business model, business size and more. This criteria set should distinguish and frame innovative urban farming activities existing in European metropolitan areas. The involved decision-making process, final criteria choice as well as the background of the final study set will be presented in the following chapters.

### **3.3 Expert Interviews**

#### **3.3.1 Aim of Expert Interviews**

On behalf of the qualitative research of this thesis and the connected investigation of selected case studies, the concrete tool for the methodological analysis is the conduction of expert interviews. In general, expert interviews are performed when the overall goal is to retrieve information on a more holistic level, referring to get insights into the field behind the respective program or business project, as well as the current trends and industry developments that are relevant to the research topic. According to Tougas (2008), doing expert interviews “is an exploratory research technique used to gather specific information, known as primary data, in order to solve a particular problem”. Hereby, it is important to select a suitable interviewee who ideally possesses enough knowledge, expertise and experience in his or her field of study (Tougas, 2008). Moreover, Bogner et al. (2009) point out that the conduction of expert interviews has the advantage of retrieving information which is more concentrated and valuable than when applying other methodological tools. Furthermore, this research design is considered as an appropriate instrument when it comes to getting quick and firsthand access to an unknown area of investigation (Bogner et al., 2009). Ultimately, the aim of interviewing experts is to get in-depth information, explicit knowledge and a thorough understanding of the research problem and the related research questions (Bogner et al., 2009).

#### **3.3.2 Design of Expert Interviews**

As already mentioned at an earlier stage of the thesis, the concrete methodological tool for analyzing the findings of this study are qualitative interviews. In theory, these kind of interviews can be conducted either face-to-face, via the telephone or another medium, or by means of focus groups. Usually, the questions formulated are either unstructured or semi-structured, open-ended questions “that are few in number and intended to elicit views and opinions from the participants” (Creswell, 2014). The concrete procedure of this design includes having a clear interview guideline, recording the detailed answers and creating a protocol. More precisely, “researchers record information from interviews by making handwritten notes, by audiotaping, or by videotaping” (Creswell, 2014). The components of an interview protocol typically comprise information of the date and place of the interview, the nature of conduction, as well as the name of the interviewer and interviewee. Furthermore, the procedure as well

as the goal of the interview and the general research should be introduced. Finally, after the set of questions, a thank you note should be added (Creswell, 2014).

Creswell (2014) then highlights that in the process of evaluating and analyzing the retrieved information, the standard sequence of summarizing results and findings is to first “develop descriptions and themes from the data” and second “to present these descriptions and themes that convey multiple perspectives from participants and detailed descriptions of the setting or individuals” (Creswell, 2014). Throughout this in-depth analysis of the cases, visualization tools such comparison tables and diagrams should be used, as well as short or long quotes should be included to support the explanatory power of the content given by the interviewees (Creswell, 2014).

The following section will give the reader a clear insight into how the design of expert interviews has been applied for the purpose of this thesis.

### **3.3.3 Structure of Expert Interviews**

To start with, the reader was given a guideline on the design of expert interviews at the previous section of this chapter, which now will be outlined based on the case study set of this research.

On the average, the expert interviews were each conducted within a time span of 30 to 45 minutes, consisting of two parts, namely a basic questions and a central questions part. The first section of the questionnaire aimed at retrieving basic company information where the interviewee was asked to provide his name, his position and his contact details. Next, details about the company’s legal structure, number of employees and volunteers employed at the moment as well as the contract type of the urban farm location was requested. Furthermore, the concrete size of the farm, the amount of production per year as well as the target group of their products were investigated. The final questions of the first part aimed at exploring the financial structure in terms of starting capital, annual costs, turnover or profit, the provision of subsidies from the government or types of funding received. Here, not all companies could reveal exact figures and data, however, some answers could be gathered.

The second part of the questionnaire covers the main and essential elements of the research, incorporating the relevant topics which have to be explored in order to subsequently answer the research questions of this study. Here, the list of questions started with inquiring the initial drivers and motivations for starting the respective urban farming initiative as well as investigating what difficulties and risks the project leaders faced when starting their business. The following questions cover the topic of

the company's business goals and measurement of their success. Here, the questions were formulated as follows: *What business goals did you set for your business? As well as, to what extent could you fulfill them and turn them into success, and how do you measure your success?* Additionally, the interviewees were asked to give an insight into potential barriers they are currently facing regarding their general business situation and plans. Subsequently, the next questions were based on the interviewee's personal opinion and experience on stating the most important characteristics for being successful as an urban farm in this industry. Moreover, this question was combined with exploring the internal and external factors that might influence the practice of their urban farm. Hereafter, it was requested to elaborate on the values and benefits the farming initiatives deliver to their target audiences and community. Additionally, they were asked to answer the following question: *Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?* Then, the interviewees were asked to indicate if and to what extent their program is connected to tourism and whether they actively target tourists as part of their target groups. Also, it was requested to state whether they are planning on extending their current customer base by adding another group such as tourists or not.

The next section of this chapter will give the reader an overview of the sample of the case study set. Here, the interviewees will shortly be introduced as the detailed insight into each urban farming company will thoroughly be explored in section 3.5.

### **3.3.4 Sample of Expert Interviews**

With the objective of gaining a comprehensive insight into the urban farming industry in Europe, a total amount of 25 programs to be interviewed were initially approached. The aim was to obtain between seven to ten farming companies and receive expert knowledge of their businesses. Out of the initial case study set, seven cases could be gathered and interviewed for this thesis. These seven companies have been closely investigated by firstly doing desk research on their programs as well as by secondly selecting an adequate company team member who possesses sufficient knowledge and expertise to answer the questionnaire. Hence, the urban farming businesses and its interviewed respondents are listed below:

- a. Michael Berlin, Member of Founders' Team at Blün Farm in Vienna, Austria
- b. Wouter Bauman, Farm Advisor at DakAkker in Rotterdam, Netherlands

- c. Livia Urban Swart Haaland, Member of Founders' Team at OsterGro in Copenhagen, Denmark
- d. Fabian Schipfer, Member of Founders' Team at Ponix Systems in Vienna, Austria
- e. Mathias De Vos, Farm Manager at The Abattoir Farm in Brussels, Belgium
- f. Brecht Stubbe, Glocal Sales Director at Urban Crop Solutions in Waregem, Belgium
- g. Stephen Fry, Commercial Sales Manager at VydroFarm (V-Farm) in Coventry, United Kingdom

These seven interviews have been conducted either via telephone or Skype and on average took between 30 and 45 minutes. Besides taking detailed notes during the conduction of each interview, all interviewees were priorily asked for permission to record the interview in order for the interviewer to carefully summarize all answers as truthfully as possible, at a later stage. Although all respondents made an effort in answering and revealing as much information as possible, not all questions could fully be elaborated on due to internal business policies. The most important findings of these case studies will be explored and analysed in section four of this thesis. Additionally, the complete interview questionnaires of all seven experts are included in the Appendices section in Appendix 2.

### **3.3.5 Limitations of the Case Study Set**

For the purpose of completeness, it has to be mentioned that this thesis holds some limitations which have been detected throughout the methodological research process. The first obstacle which has been encountered while performing desk research on the case study set, was the availability of online information of each project. Here, the consistency and homogeneity of the insights available of each case can be seen as a limitation since some cases are presented with more and some with less information. Moreover, the selected case study set is rather small as it was fairly difficult to gather sufficient experts to conduct interviews with in this field. Hence, performing the research on a larger sample size would have been an advantage. Furthermore, it has to be said that although every interviewee strived towards giving as much information as needed, some were keen to reveal deeper insights into question areas while others were not able to elaborate on detailed information about a few topics. Lastly, as the number of European cities represented in the research design is quite small, significant

conclusions that are valid for the whole urban farming industry in Europe cannot fully be drawn from this thesis.

### **3.4 Criteria for Project Selection**

In the process of performing the research on the urban farming industry in Europe, it was important to, on the one hand, acquire an in-depth knowledge of the general developments of urban farming at the moment as well as to learn about the farming businesses which shape the industry, and, on the other hand, to select cases based upon a comprehensible and reasonable manner. Although the main goal was to collect a case study set which is fairly homogeneous and can easily be contrasted, the availability of urban farms currently operating in the European market did not allow for this to be fully implemented. Nevertheless, selecting the seven projects still involved certain preliminary defined criteria which have been carefully considered.

First and foremost, it was evident that all urban farms have to be located in Europe as this forms the basis of this thesis research. More precisely, as explored in the literature review at an earlier stage of this paper, the urban farming industry is most developed and advanced in Western and Central Europe where smart cities are prevalent and are already supporting the trend of urban farming. Furthermore, these urban farms are all located within the urban area of the respective city and therefore, important characteristics such as infrastructure of the location, available resources, potential customers within reach, favorable economic and environmental conditions are all fulfilled. Moreover, it was considered to choose the case studies based on the types of business models these farming companies focus on. Here, it was considered to select projects which are similar in how their business concept is designed such as either emphasizing on 'differentiation' or 'diversification' since these two models are best working in cities. Additionally, it was of importance to find businesses which engage in urban farming activities on a rather large-scale basis and being highly approved by the municipality of the respective city. Ultimately, the projects should also be connected to tourism or at least welcoming the idea of collaborating with the tourism scene in their specific area in the future.

The following section will provide the reader with an overview of the seven selected case studies.



### **3.5 Overview of the projects**

Based on the desk research performed for the purpose of this thesis, the most relevant information of the seven projects will be summarized in the following paragraphs. Each project section firstly introduces the project leaders and investors of the initiative, the farm type and size as well as the project status. Secondly, a basic introduction and insight into the companies' characteristics, farming nature, objectives and goals will be provided to the reader. The urban farming projects are listed in an alphabetical order.

### **3.5.1 Blün Farm in Vienna, Austria**

***Project leader(s) and investor(s):***

*Michael Berlin, Stefan Bauer, Bernhard Zehetbauer, Philipp Filzwieser, Gregor Hoffmann*

***Farm type and size:***

*Commercial aquaponic greenhouse with 400m<sup>2</sup> and fish farm*

***Project status:***

*introduced in October 2016*

The commercial aquaponic greenhouse Blün was introduced in 2016 by Michael Berlin, Stefan Bauer, Bernhard Zehetbauer, Philipp Filzwieser and Gregor Hoffmann and is the first aquaponic farm in Austria. The start-up's greenhouse covers a size of 400m<sup>2</sup> with an additional fish farm where they cultivate "fresh fish and fresh vegetables - completely without chemicals, genetic engineering or waste of resources" (Freudenthaler, 2017).

The company name Blün derives from the two colors blue and green, in German "blau" and "grün". "Blue stands for water and fish farming, green for plants and the cultivation of vegetables" (Freudenthaler, 2017). Their main aim is to produce more sustainable and resource-efficient products by following the subsequent criteria. Every product is local, transparent and eco efficient, consequently all products are produced in Vienna and follow a circular economic system reducing the waste of resources (Picker, 2018).

Blün harvests up to "12 tonnes of fish and 10 tonnes of vegetables" per year (Picker, 2018).

The aquaponic farm offers four distributions channels, namely direct sales from the production site, selected trading partners, selected gastronomy partners as well as via their webshop" (Picker, 2018).

### 3.5.2 DakAkker in Rotterdam, Netherlands

**Project leader(s) and investor(s):**

*Created by Binder Groenprojecten, initiated and developed by ZUS in collab. with Rotterdam Milieucentrum (Environmental Centre Rotterdam)*

**Farm type and size:**

*Urban rooftop farm 600m<sup>2</sup>*

**Project status:**

*introduced in 2012*

The Dutch project DakAkker was established in 2012 as the “first harvestable garden in the Netherlands, cultivating fruits, vegetable, herbs and even honey” (Luchtsingel, n.d.).

The following parties were involved in developing DakAkker (Luchtsingel, n.d.):

- Builder - Binder Groenprojecten
- Concept and design - ZUS (Zones Urbaines Sensibles)
- Development and collaboration - Rotterdam Milieucentrum, the Environmental Centre of Rotterdam

This urban rooftop farm represents a fraction of the initiative of Rotterdam, “Luchtsingel project” and serves as an experimentation site, located on the rooftop of the Schieblock building, for attempting various types of growing fresh produce (Luchtsingel, n.d.). Furthermore, for growing their plants DakAkker utilizes stored rain-water and supplies fresh fruits and vegetables to nearby “hotels and restaurants” (Green Destinations Foundation, n.d.).

Additionally, the “Bistro ‘Op het Dak’, located on the roof” benefits from DakAkker by making use of their output (Green Destinations Foundation, n.d.).

The major goal of DakAkker is to shape and transform the center of Rotterdam into a greener city hub where consumer goods do not represent the primary food source for the citizens (Ciovica, 2018). The rooftop farm is open to students and schools contributing to educating locals and spreading their mission (Green Destinations Foundation, n.d.).

The newest addition is the “smartroof on the roofpavilion” which “is a smart water-storage greenroof with a smartflowcontrol that is driven by the weather forecast” (DakAkker, n.d.). In case of severe weather disturbances, extra water is collected and stored up to 24 hours earlier (DakAkker, n.d.).

### 3.5.3 OsterGro in Copenhagen, Denmark

**Project leader(s) and investor(s):**

*Livia Urban Swart Haaland, Sofie Brincker and Kristian Skaarup*

**Farm type and size:**

*Organic rooftop garden with 600m<sup>2</sup>*

**Project status:**

*introduced in 2014*

The Danish project OsterGro was introduced in 2014 and is situated in the midst of the district Osterbro Climate Quarter which represents “the world’s first climate-resilient neighborhood” (Sustainia, 2018). Osterbro is adopting sustainable groundwork in the broader sense of expecting to save a third of natural rainwater from “ending up in the sewer system” (Sustainia, 2018). Simultaneously, this initiative aims to lower potential risks and consequences of severe meteorological disturbances within the city (Sustainia, 2018).

Being the first rooftop farm in Copenhagen, Denmark, OsterGro is a 600m<sup>2</sup> urban rooftop garden incorporating 40 members processing almost 100 tons of soil. The Community Shared Agriculture (CSA) farm consists of “a greenhouse and four beehives” (Clarke, 2017) and chicken.

The founders, Livia Urban Swart Haaland, Sofie Brincker and Kristian Skaarup have introduced OsterGro with the intent to spread the word and encourage the citizens of Copenhagen to use their backyards and balconies, as well as grow their own vegetables. Skaarup, who is a landscape architect, operates OsterGro on a full-time basis and sees the farm’s mission in showing members and visitors the process from growing to harvesting to finally consuming the produce. Furthermore, emphasis is put on helping to reveal the origin of the food on everybody’s plates as well as to spread basic knowledge about local produce (Sustania, 2018). Furthermore, OsterGro offers seasonal, directly harvested food at Gro Spiseri restaurant located on the rooftop farm. Nearby farmers provide additional, fresh produce for Gro Spiseri (OsterGro, n.d.).

Ultimately, this initiative is “serving as a link between Copenhagen and organic agriculture for the city [...]” (Copenhagen Green, n.d.).

Overall, the main aim of OsterGro is to enhance and support a green Copenhagen (Clarke, 2017).

### **3.5.4 Ponix Systems in Vienna, Austria**

***Project leader(s) and investor(s):***

*Mag. Alexander Penzias, Ing. Alvaro Lobato-Jimenez, Sebastian Babos, Patrick Diem, Fabian Schipfer*

***Farm type and size:***

*Providers of vertical farming solutions (indoor farming), 400m<sup>2</sup> production facility*

***Project status:***

*introduced in 2014*

Ponix Systems, the Viennese indoor vertical farm was introduced in 2014 with the aim to “minimise time, land, water, and energy used in food production” (Ponix Systems, n.d.) The two initiators of this project are Alexander Penzias and Alvaro Lobato-Jimenez, together with the help of other team members they have established a “hydroponic vertical garden” (Kickstarter PBC, n.d.) for every household.

The farm has established a vertical “patented hydroponic system” called Herbert which produces “vegetables, herbs and many more” (Ponix Systems, n.d.). Herbert is a “picture frame illuminated by LEDs” which grows fresh produce vertically and enables year-round harvesting. Furthermore, as it is an hydroponic system it does not require any soil (Ponix Systems, n.d.). The growth rate is “40% faster compared to traditional farming methods” (Kickstarter PBC, n.d.), implying that for instance, a lettuce can be harvested after four to five weeks leading to a cultivation of “80-90 lettuce heads each year” (Kickstarter PBC, n.d.).

### **3.5.5 The Abattoir Farm in Brussels, Belgium**

***Project leader(s) and investor(s):***

*founded by Steven Beckers, designed by ORG architects*

***Farm type and size:***

*2000m<sup>2</sup> greenhouse, 2000m<sup>2</sup> outdoor garden, fish farm*

***Project status:***

*introduced in 2016*

The Abattoir farm (Ferme Abattoir) in Brussels was established in 2016 and is situated on top of Foodmet, a local food market which is well-visited on a weekly basis (Visit Brussels, 2018). The BIGH Team who are known for “intensive, zero-waste, year-round urban agriculture” developed the Abattoir farm and has received approximately “4 million euros from several private and public investors” (Visit Brussels, 2018). The Belgian farm is part of the BIGH’s “network of sustainable aquaponic urban farms” which utilizes modern “sustainable technology”, absorb “building energy loss”, recover “rain-water” and work with “renewable solar energy” (BIGH, 2018).

Abattoir covers “a total surface of 4,000m<sup>2</sup> and combines a greenhouse, a fish farm and vegetable gardens” (Visit Brussels, 2018). The greenhouse, covering 2,000m<sup>2</sup>, utilizes both “hydroponics and aquaculture” to cultivate “vegetables and fish” (Visit Brussels, 2018). More precisely, “two closed-loop recirculating systems” connect “fish and plants” through the use of a “biological filter” (Visit Brussels, 2018). Thus, the water from the fish is cleaned and used for “the plants in the greenhouse and the outdoor garden” (Visit Brussels, 2018). The latter “currently uses 700m<sup>2</sup> but the full 2000m<sup>2</sup> will be developed gradually” (Visit Brussels, 2018).

The main aim is to offer “unique varieties and smaller volumes” (Visit Brussels, 2018) to the local community. Hence, its main customers are the following: “retailers, brick and mortar and online shops, restaurants and caterers in and around Brussels” (Visit Brussels, 2018).

### 3.5.6 Urban Crop Solutions in Waregem, Belgium

***Project leader(s) and investor(s):***

*Urban Crop Solutions*

***Farm type and size:***

*Provider of indoor vertical farming solutions, approximately 470m<sup>2</sup> of research facilities*

***Project status:***

*introduced in 2014*

Urban Crop Solutions also known as Urban Crops is a technology company which develops growth systems incorporating LED lighting especially for food, herb and livestock nutrition production. All systems “are automated and can be robotized and integrated in existing production facilities” (Urban Crop Solutions, 2018). Urban Crops’ systems offer “completely closed controllable” (Boy de Nijs, 2016), environmental cycles enabling them to be active in several industries namely the food production and processing sector, the retail industry, the medicinal market as well as urban agriculture. More specifically, within the retail industry, they provide “tailor-made solutions for caterers, restaurants, hotels, department stores, nursing homes and schools” and enable them “the option of producing yearlong, locally grown, healthy leafy greens” (Urban Crop Solutions, 2018). One of the main advantages of these systems is that their own installed LED lights are able to attain “shorter growth cycles, higher water efficiency, flexible but guaranteed harvests and safe and healthy crops (no pesticides or herbicides needed)” (Urban Crop Solutions, 2016). These solutions are installable not only in new buildings, but also in empty, yet unutilized properties of buildings and offices (Urban Crop Solutions, 2016).

Additionally, the company provides temporary solutions for emergency cases such as in sites with scarce food and water resources (Urban Crop Solutions, 2017).

The exclusive systems mentioned above offer the possibility to be incorporated in currently running production assets or automatized processing units. Furthermore, Urban Crops provides standard growth container products as well as “seeds, substrates and nutrients” (Urban Crop Solutions, 2017) for customers with little or no experience in this field.

In 2016, the largest automated organic farm with artificial lighting in Europe was introduced by the Belgian student Maarten Vandecruys, who is now the managing director

of Urban Crop Solutions. The project was financed by the Belgian entrepreneur Frederic Bulcean.

Back in 2012, the founder team already experimented with creating rooftop gardens and aimed to address rising food challenges globally thereby, however, eventually found their final business concept by developing “a product and service portfolio for integrated and automated vertical indoor farming” (Urban Crop Solutions, 2016).

Several plant factories in Asia as well as entrepreneurs in the United States have served as an inspiration for this system. In addition, Urban Crops has made use of the technology for LED lighting from the Far East and was assisted by Dutch specialists in designing the “water management, fertigation, irrigation and purification” for the plant (Boy de Nijs, 2016).

The indoor farm encompasses a surface of 90m<sup>2</sup> covering eight floors equaling to “a total growing space of 240m<sup>2</sup>” (Urban Crop Solutions, 2016), and is solely used for the purpose of research and development as well as testing of current crops for international customers. The potential harvesting output of the demonstration factory lies at 200 crops of salad per day. Furthermore, the fully automated installation allows “a separate steering of the lights and the irrigation per layer” (Urban Crop Solutions, 2016) which offers capacity to produce up to eight varied recipes concurrently.

In commercial productions, depending on the quantity demanded, it is possible to construct towers with up to 25 floors of production.

Their final goals are to introduce the systems worldwide, “to become the global independent reference of the fast-emerging vertical farming industry” (Urban Crop Solutions, 2018) and to eventually be able to provide food for people living on another planet namely Mars.

On October 26th, Urban Crop Solutions was awarded the FoodNexus Innovation Award and is therefore the most innovational organization in this industry. “Food Nexus is a European consortium of international food companies and leading knowledge institutions” (Urban Crop Solutions, 2017) attempting to create a long-term worthwhile European Food System.



### 3.5.7 VydroFarm in Coventry, United Kingdom

**Project leader(s) and investor(s):**

*HydroGarden Ltd.*

**Farm type and size:**

*Indoor vertical farm*

**Project status:**

*introduced in 1996*

V-Farm or VydroFarm, an affiliated company of HydroGarden Ltd., based in Coventry, UK is “a plant focused advanced horticulture company” (V-Farm, 2019) and was launched with the purpose of supplying the gastronomy and business sector in urban areas with “a reliable, clean and safe food production solution” (V-Farm, 2019). Their mission is characterized by finding new and innovative ways of harvesting food in the inner-city areas by focusing on providing indoor farming solutions where food is grown vertically. Additionally, they believe that in order to be successful as a business in the urban farming industry, it is important to provide solutions which are realistic to build on a mass level as well as sustainable and financially viable. (V-Farm, 2019). With the goal of decreasing the necessity for agricultural land and making use of unused urban areas, the company strives to improve the food production sector of today’s world and to set an example in the hydroponic vertical farming industry across Europe.

More concretely, V-Farm offers “mobile hydroponic racks fitted with irrigation trays offering flood and drain or NFT principles” (V-Farm, 2019). Furthermore, this urban farm integrates technical innovation as well as modern lighting tools to guarantee perfect growing conditions anywhere in the world (V-Farm, 2019). Additionally, a wide variety of crops can be grown as their growing technique “is non crop-specific” (V-Farm, 2019).

Besides producing and selling their technical solutions, V-Farm also engages in conducting research and offering demonstration facilities to show the newest developments in urban horticulture. This initiative was set up at their headquarters in the UK and is named ‘Project Urban Grow’ (V-Farm, 2019).

V-Farm’s main customer is the food retail sector, restaurants and caterers, each having the opportunity to buy tailor-made systems for their personal needs (Issuu Inc., 2017).

### **3.6 Conclusion**

Next to briefly outlining the methodological steps of this study, the main aim of this chapter was to introduce the seven urban farming projects which should provide the reader with sufficient information and know-how for this thesis matter. Based on desk research, each urban farming company was briefly presented in order to conduct an in-dept analysis in the subsequent section of this paper. This analysis includes, on the one hand, a summary of the basic questions of each interview as well as a brief analysis to detect similarities and differences of the investigated case study set, and, on the other hand, a careful examination of the main body of each interview, namely the central questions. Here, concrete insights into the answers will be collected and presented. Furthermore, the most relevant implications will be highlighted and as a final part, all of the research questions will be answered.

## 4 RESULTS AND ANALYSIS OF STUDY

Chapter 4 will give the reader a thorough insight into the answers obtained through the seven expert interviews.

First, a descriptive analysis of the basic part of the case studies will be provided where the objectives are to compare company structures, farming methods and farm sizes, distribution channels as well as financial structures. Here, the goal is to understand their basic business nature and the scope of operations. Also, the aim is to detect similarities and differences when allocating and categorizing the cases based on their characteristics.

Second, the principal part of the interview questionnaire will be discussed in detail where each question area will be individually presented. Hereby, the most important insights and results of each interviewee will be summarized and quotes will be extracted to enhance the analysis of each case.

Third, based on both the basic and the content analyses, implications will be formulated where relevant literature information will be used to support the key findings of the study. Additionally, conclusions will be drawn by answering the main research question of this thesis.

## 4.1 Case Study Analysis

### 4.1.1 Basic Analysis

In the following paragraphs, the answers of the seven interviewees concerning their company's legal structure, farming method, distribution channels, number of employees, farming size as well as their financial status will be discussed. Additionally, in order to provide the reader with a better overview of the basic company information, tables and figures will be used for visualizing some of the results.

#### 1. Company's legal structure

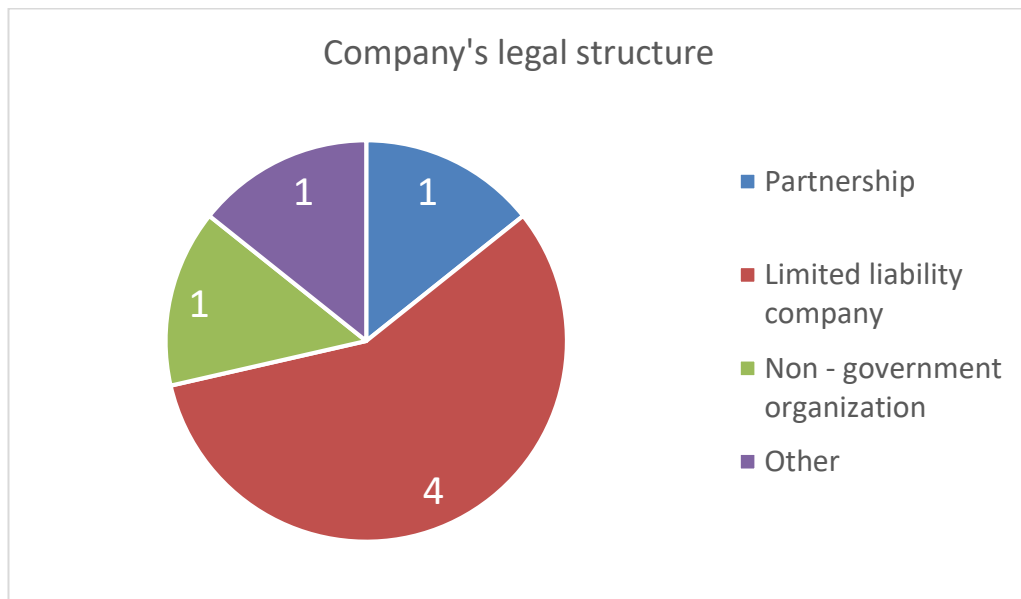


Figure 11: Company's legal structure (author's own)

As the pie chart above depicts, different company structures and natures can be detected from the sampling group of seven urban farming initiatives in Europe. More than half of the interviewed case study set are limited liability companies as they mainly focus on sales and financial viability.

The above mentioned majority of limited liability companies is represented by:

- Blün Farm in Vienna, Austria introduced in 2016
- Ponix Systems in Vienna, Austria introduced in 2014
- The Abattoir Farm in Brussels, Belgium introduced in 2016

- Urban Crop Solutions in Waregem, Belgium introduced in 2014

Within the remaining three urban farms, one can detect that V-Farm which is based in Coventry, United Kingdom, is a privately owned company (partnership) and is owned by HydroGarden Ltd. According to Stephen Fry (29 Jan. 2019), who is the Commercial Sales Manager of the farm, HydroGarden Ltd. was set up 23 years ago by Mr. Ean Reynolds in Coventry, United Kingdom. On the contrary, the project DakAkker Rooftop Farm in Rotterdam, Netherlands, introduced in 2012, is a non-government organization (NGO), and based on Wouter Bauman, the Farm Advisor of the program, “the farm officially belongs to the owner of the building which is the city government of Rotterdam” (Bauman, 07 Dec. 2019). The last project, OsterGro Rooftop Garden in Copenhagen, Denmark, founded in 2014, is a community supported agriculture (association) with 40 members who “pay in advance for the upcoming harvest season” (Urban Swart Haaland, 22 Jan. 2019). Hence, looking at the given data on the company’s legal structure and year of establishment of each project, it can be said that although one company has already been founded a much longer time ago than all of the other cases, the majority of urban farms are relatively young businesses. This is mainly due to the fairly new rise of the urban farming sector across Europe. Furthermore, the differences in legal structures of the businesses which are shown, can be related to reasons of government regulations of the respective city or the like.

## 2. Overview of the case study set

<b>Project name</b>	<b>Farming method</b>	<b>Location</b>	<b>Distribution channels</b>
Blün Farm	Commercial aquaponic greenhouse (fish farm)	Vienna, Austria	On-site selling, online shop, restaurants, cafeterias
DakAkker	Urban rooftop farm (soil-based)	Rotterdam, Netherlands	Restaurants, own bistro
OsterGro	Organic rooftop garden (soil-based)	Copenhagen, Denmark	Members of the association, own restaurant
Ponix Systems	Providers of indoor vertical farming solutions (hydroponics)	Vienna, Austria	Online shop, households, restaurants, schools

The Abattoir Farm	Greenhouse, outdoor garden, fish farm (aquaponics)	Brussels, Belgium	Retailers, brick and mortar and online shops, restaurants and caterers
Urban Crop Solutions	Provider of indoor vertical farming solutions (hydroponics)	Waregem, Belgium	Companies, organizations
Vydro-Farm	Provider of indoor vertical farming systems (hydroponics)	Coventry, United Kingdom	Restaurants, organizations colleges, companies

Table 7: Case study set (author's own)

The table above summarizes each project, its farming method, its location and distribution channels. First and foremost, it can be seen that the locations of the case study set are rather diverse, with two projects being situated in Vienna, Austria, another two companies in Belgium where one is based in the city of Waregem and the other in Brussels. Furthermore, one urban farm is located in Rotterdam, Netherlands, another in Copenhagen, Denmark and the last one in Coventry, United Kingdom. With this case study distribution and the knowledge of the literature research given prior, it can clearly be seen that the trend of urban farming is more spread in the Western countries of Europe since here infrastructure and economic developments are more advanced than in other parts of Europe. In order to further explain the table depicted above, each farming method and distribution channel used by the case study set is briefly be discussed as follows: Blün Farm, which is a commercial aquaponic greenhouse uses on the one hand, on-site channels for direct selling to customers, possesses also an online-shop and on the other hand, sells its produce to various local restaurants and cafeterias. The DakAkker rooftop farm which cultivates its plants and vegetables on a soil-basis, features an own bistro where the harvested produce is used for the menu. Moreover, they sell parts of their food to other restaurants nearby. OsterGro, which is an organic soilbased rooftop garden mainly serves their produce to its association members but also operates their own restaurant where they also organize events and special parties. Ponix Systems, a company which does not have their own farm but rather is a provider of indoor vertical farming solutions. Their distribution channels are

through an online shop, selling to households and individual customers, as well as offering their products to restaurants and schools locally. The Abattoir Farm, an aquaponic greenhouse with an outdoor garden and a fish farm is the biggest on-site farm of the total case study set. They sell their products to retailers, brick and mortar companies, restaurants, caterers as well as through an online shop. Urban Crop Solutions, the second company of the case study set which provides indoor vertical farming solutions, sells their technologies internationally to various organizations and institutions. Likewise, Vydro-Farm or V-Farm, is also a provider of indoor vertical farming systems and sells their solutions to restaurants, colleges and companies.

All existing farming methods that are known and spread across Europe have been previously described in Chapter 2.4 of this paper, starting with aquaculture which in this case study set is not represented. Hydroponics and vertical farming, on the contrary, are used by three of the investigated farms, namely Ponix Systems, Urban Crop Solutions and V-Farm. This implies that all of these three farms utilize the growing technique of vertical farming while at the same time harvesting their produce solely with water instead of soil. The method of aquaponics which is the combination of aquaculture and hydroponics, is installed by two of the total project sample, namely Blün Farm and The Abattoir Farm. Here, it has to be said that both companies are deploying a closed circular system where water from the fish farm is re-used for the greenhouse cultivation. Two of the remaining case studies are rooftop farms, harvesting their fresh produce with the traditional soil-based growing method, which are DakAkker and OsterGro.

### 3. Number of employees and volunteers

<b>Projects</b>	<b>Employees</b>	<b>Volunteers</b>
Blün Farm	3	0
DakAkker	1	16
OsterGro	12	15
Ponix Systems	5	0
The Abattoir Farm	8	6
Urban Crop Solutions	14	0
Vydro-Farm	105	0

Table 8: Number of employees and volunteers (author's own)

The table above presents the respective number of employees and volunteers each urban farm possesses. Here, one can state that the amounts differ depending on the

size of the farm as well as the business nature. For instance, V-Farm which has already been on the market for 23 years, employs more than 100 persons. On the contrary, Blün Farm which was only established in 2016, hence three years ago, has a much smaller amount of employees. To go into more detail, each farm will be discussed in the following paragraphs. Blün Farm in Vienna, Austria is led by a team of five persons (Berlin, 12 Feb 2019). Each has its own responsibilities in different areas (Berlin, 12 Feb 2019). “Currently, Blün Farm has one employee who works 40 hours per week and two part-time employees, one of them is working 10 hours per week and the other one is working 15 hours per week” (Berlin, 12 Feb. 2019). Until now, the farm has not hired interns or volunteers yet, but according to Michael Berlin (12 Feb. 2019), they will most likely consider employing additional workers to help them out during high-season. DakAkker Rooftop Farm in Rotterdam, Netherlands has one employee at the moment, who works 16 hours per week during the summer and eight hours during the winter season. Furthermore, they currently work with 16 volunteers which is the maximum number of volunteers that they are allowed to have (Bauman, 7 Dec. 2018). The Danish association OsterGro Rooftop Garden in Copenhagen, Denmark has one employee. However, the company “Bylanbrug”, created by OsterGro Rooftop Garden, usually employs eleven persons who work at the farm, but this varies depending on the season. During the high season, OsterGro gets help from approximately 15 volunteers - some of which are regular helpers and others are new faces (Urban Swart Haaland, 22 Jan. 2019). Ponix Systems is a company led by a team of five people where each person is skilled and experienced in different farming areas such as Fabian Schipfer – the interviewee, who is responsible for subsidies and other governmental support. (Schipfer, 2 Sep. 2019). “The Abattoir Farm was established by BIGH Holding where four people are part-time employed” (De Vos, 16 Dec. 2018). “BIGH Anderlecht is the team behind the operation of the Abattoir Farm - here four employees work together with approximately six full-time “free” workers including interns, volunteers and social workers” (De Vos, 16 Dec. 2018). Urban Crop Solutions “currently has 14 employees” (Stubbe, 28 Dec. 2018) working in Waregem, Belgium. (Stubbe, 28 Dec. 2018). The sales offices in Japan and United States are each managed by one employee on site. Additionally, they have one sales agent responsible for any commercial work (Stubbe, 28 Dec. 2018). HydroGarden Ltd. is running the VydroFarm with 105 staff members who are employed at the farm. According to Stephen Fry (28 Dec. 2018), they are growing and recruiting all the time (Fry, 28 Dec. 2018).



#### 4. Size of the farm

Here, it was interrogated what size in m<sup>2</sup> the respective initiative has. All farming sizes will be elaborated in the following paragraphs. However, for only one farm, namely V-Farm, it was not possible to detect the exact company size neither through desk research, nor interviewing the expert. Blün Farm owns a vegetable greenhouse with a surface of 400m<sup>2</sup> and an additional fish farm. According to Berlin (12 Feb. 2019), their volume of fish production has been 12 tons until recently. In the future, they will be able to produce up to 25 tons per year (Berlin, 12 Feb. 2019). Their overall vegetable output amounts to ten tons per year (Berlin, 12 Feb. 2019). DakAkker's open air rooftop farm has a size of 600m<sup>2</sup> and operates from March until December (Bauman, 7 Dec. 2018). They are not able to state exact production quantities as they mainly sell edible flowers. Therefore, it would not be reasonable to state kilogram quantities as these herbs are light-weighted. Nonetheless, selling flowers gives them the most benefit as demand is continuously rising (Bauman, 7 Dec. 2018). OsterGro's "total size is 600m<sup>2</sup> - 350m<sup>2</sup> of which is covered with soil" (Urban Swart Haaland, 22 Jan. 2019) and the remaining 250m<sup>2</sup> consist of a restaurant and a small greenhouse. Here, on this space of 250m<sup>2</sup>, they also host events and have set up an eating area for outside guests as well (Urban Swart Haaland, 22 Jan. 2019). Over the years, the volume of production has changed, since they started out with producing and selling all kinds of vegetables. To date, OsterGro has specialized in growing leafy greens (Urban Swart Haaland, 22 Jan. 2019). Harvesting season is from June to November where they usually achieve a yield of 2000 kg (Urban Swart Haaland, 22 Jan. 2019). Ponix Systems produces 'Herbert' which is an indoor vertical farming technology and is produced in a factory of 400m<sup>2</sup>. They have sold 800 pieces since the beginning of 2017 (Schipfer, 2 Sep. 2019). Additionally, they own a vertical container shipping farm for experiments which is set up in front of their factory (Schipfer, 2 Sep. 2019). The Abattoir Farm has "a rooftop of 4000m<sup>2</sup>, including an outside garden covering 2000m<sup>2</sup> and a greenhouse with a size of 2000m<sup>2</sup>" (De Vos, 16 Dec. 2018). Overall, they are producing 30 tons of fish per year, 16 tons of tomatoes per year and 2500 herb pots per week (De Vos, 16 Dec. 2018). "The size of Urban Crop Solutions' plant factory in Belgium is 240m<sup>2</sup>, which is solely for the purpose of research and development since they are a technology supplier" (Stubbe, 28 Dec. 2018). They do not grow crops for their own sales, hence they are not a classic commercial farm (Stubbe, 28 Dec. 2018). "At the same plant factory, they have ten individual research chambers, which means another 120-230m<sup>2</sup> of research facility in Belgium (Stubbe, 28 Dec. 2018).

All in all, three companies (Blün Farm, Ponix Systems and Urban Crop Solutions) out of the sample group work on a surface of below than 500m<sup>2</sup> while two other companies (DakAkker and OsterGro) are sized between 501m<sup>2</sup> and 1000m<sup>2</sup>. The Abattoir Farm represents an outlier as it is situated on top of a huge market hall and therefore, has a total size of more than 1000m<sup>2</sup>. One company, namely V-Farm cannot be included in this overview.

#### 5. Financial structure

Here, the seven interviewees were asked to provide details about their financial structure in terms of annual costs, starting capital, profit and turnover, with the aim to evaluate their current performance and financial viability. However, as the data given is very inconsistent due to internal regulations as to what kind of information can be communicated, the insights are not sufficient in order to draw valid conclusions for this study. However, the content analysis which will be discussed in the next section reveals that most companies are either currently at the beginning of gaining profits or are not making profits yet. Clearly, this holds for the six urban farming companies which have not been on the market for a long period of time.

#### 6. Subsidies

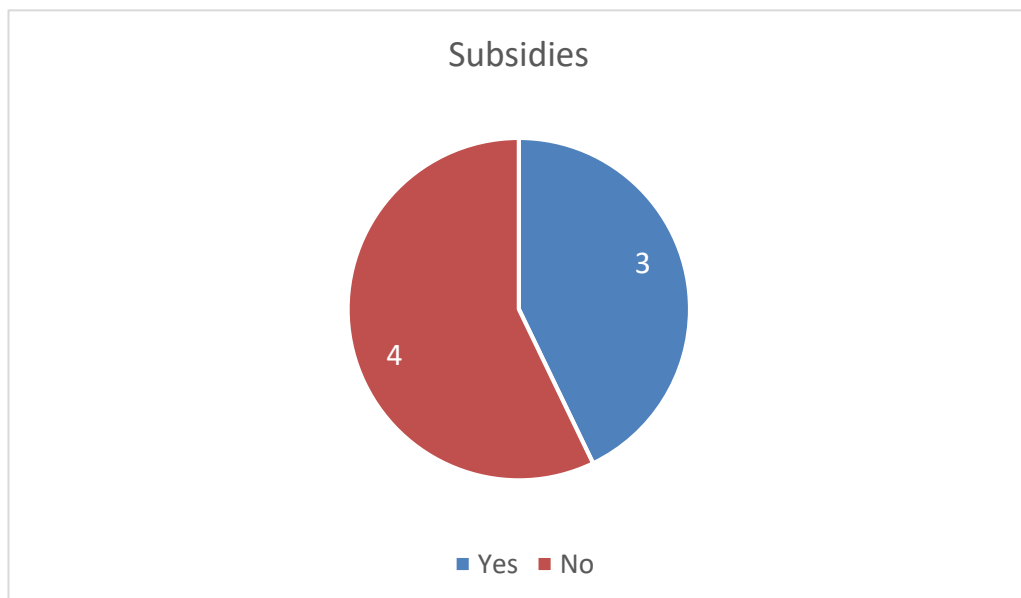


Figure 12: Subsidies (author's own)

The figure above depicts the financial support of either governmental or organizational subsidies which the seven urban farming initiatives have or have not received.

To begin with, Blün Farm has received some subsidy from the European Maritime and Fisheries Fund of which they have already spent the entire amount (Berlin, 12 Feb. 2019). DakAkker has received contest money from their neighbours who are architects. They used the contest money for paying off the rooftop. Due to this contest, the Dutch government did not grant any subsidy so far. All of their income is being reinvested into the company and used to cover their operational costs (Bauman, 7 Dec. 2018). At the very beginning of the launching of OsterGro, the company received half a million Danish crowns, this amounts to approximately 67,000 Euro at the current conversion rate (August 2019). At a later date, they acquired additional 250,000 Danish crowns, converting into approximately 33,000 Euro at the current conversion rate (August 2019) (Urban Swart Haaland, 22 Jan. 2019). Half of the total amount of 750,000 Danish crowns of subsidies came from the municipality of Copenhagen and the other half from a national grant called the Grant for Organic Farming (Urban Swart Haaland, 22 Jan. 2019). Ponix Systems has received a lot of research money, namely approximately 150,000 Euro, most of which came from the Austrian Business Service and the European Agency for Small Medium Enterprises - this is a European Grant from Horizon 2020. The remaining money was granted by the Research Promotion Agency and the Vienna Business Agency. Additionally, the Austrian Economic Chambers supported Ponix Systems by providing consultation services (Schipfer, 2 Sep. 2019). When it started in 2016, The Abattoir Farm neither collected any subsidy nor received any public support (De Vos, 16 Dec. 2018). This is due to the lack of subsidies for “regional farmers at this stage” (BIGH, 2018). The Belgian farm took a loan from the bank and used private investment to fund the launch of the initiative. According to Stubbe (28 Dec. 2018), Urban Crop Solutions did not benefit from any support by the public. They did, however, receive a funding in form of bank loans for start-ups accounting to 500,000 Euros (Stube, 28 Dec. 2018). Vydro-Farm developed by HydroGarden Ltd. did not receive any subsidies (Fry, 29 Jan. 2019). All in all, three of the sampled interview group state to have received some form of subsidy. More precisely, these are Blün Farm, OsterGro and Ponix Systems. On the contrary, the other four experts mention that they did not receive any subsidy. Out of those four companies, two have received funding in form of bank loans or private investments, one has collected a donation from their neighbors and one neither received any subsidy nor any funding.

#### 4.1.2 Content Analysis

Motivation and drivers:

One can see that when looking at the first central question of the interviews that there are four most frequently mentioned motivations for starting the respective urban farming project. These are the provision of fresh and local food to the community and customers, the desire to support sustainable urban food production as well as closed nutrient cycles and the reduction of resource utilization, and opting to make a business opportunity out of this trend. Here, it can be detected that the answers are almost fully homogeneous, regardless of the diverse company structures, locations of the farms and target markets. To name some concrete examples from the interviews, the majority of experts state that “closing the nutrient cycle” (Schipfer, 2 Sep. 2019), “decreasing the use of resources” (Berlin, 12 Feb. 2019), “making the city as green and sustainable as possible” (Bauman, 7 Dec. 2018), “addressing the problem of food availability in cities” (De Vos, 16 Dec. 2018) and “putting focus on local produce without using any chemicals” (Urban Swart Haaland, 22 Jan. 2019).

Difficulties and risks:

When starting their programs, six of the seven companies stated that there were definitely economic barriers and factors which had to carefully be considered when launching their business. More specifically, they explained that these economic difficulties involved making sure that the project is feasible and the conditions easily enable them to run the farm, as well as the struggle with finding and attracting the right customers and accordingly setting the appropriate marketing strategies. Also, the financial aspect has been a big risk at the beginning of their company establishment and for some remains to be a challenge. One expert namely Brecht Stubbe from Urban Crop Solutions named different difficulties and risks as his company is already very well advanced and established concerning customer bases and financial structures. More concretely, he explained that for Urban Crop Solutions the main difficulties in the first years of operation were how to “make use of existing technologies and combine industry solutions” hence “adopting robotic systems from the logistics market” (Stubbe, 28 Dec.2018).

### Business goals:

When asked *what business goals did you set for your business?*, answers differ to a certain extent, as formulating goals obviously highly depends on the nature of the business. Although the case study set is not entirely homogenous, the answers provided can be interpreted and contrasted as, on the whole, the majority of experts mention similar goals. More precisely, five out of seven experts put the focus on two major layers of where they are setting their goals at. One layer emphasizes on profitability and long-term viability in terms of reaching a specific level of sales and becoming a pioneer in their respective area of operation, hence reaching the full potential of their scope of business. Here, De Vos (16 Dec. 2018) for instance, mentions that for The Abattoir Farm, the first and most important goal is “to make the project economically viable”. Similarly, Schipfer (2 Sep. 2019) from Ponix Systems explains that their “main goal is to increase sales” as well as to ensure economic growth especially in the first years of operation. The other layer is referred to product optimization and development, as these experts state that the quality of their produce / solutions also counts as one of the biggest goals they are aiming to achieve. Here, Berlin (12 Feb. 2019) notes that their long-term goal is to always produce their harvest “with the highest quality possible”. Likewise, De Vos (16 Dec. 2018) highlights that The Abattoir Farm goals include “optimizing their circular farming systems as much as possible”, hence the focus is also laid on product optimization. The other two companies, namely DakAkker and OsterGro are narrowing down their business objectives and goals on areas such as education, community building and food security by stating that “they want to keep on sharing knowledge in urban farming” (Bauman, 7 Dec. 2018) as well as “creating awareness for the organic food production” and “teaching people” (Urban Swart Haaland, 22 Jan. 2019).

Next to stating the business goals and objectives, the seven experts were asked the following two subquestions: *To what extent could you fulfill them and turn them into success? How do you measure your success?* Both subquestions were posed with the intention of getting a deeper insight into how they evaluate their current business course as well as how they perceive the dimension of success, namely how important success is to them and what they are doing in order to be successful. Referring to the first subquestion, it can be detected that although most companies have either already fulfilled their main goals or are on the right track to achieve them, they are mentioning

that they are still in the process of getting enough profits (if any yet). Here, concrete examples can be detracted. Bauman (7 Dec. 2018) from DakAkker states that “they are currently starting to get profits” which, for the company is the most important factor on the long run. Similarly, OsterGro (22 Jan. 2019) and The Abattoir Farm (16 Dec. 2018) raise the point that they are about to “become economically viable” which for both is also one of their primary goals. Additionally, other achievements are mentioned such as “successfully establishing contacts with other farmers and companies” (Bauman, 7 Dec. 2018), “having a global brand and reputation” (Stubbe, 28 Dec. 2018) and “successfully receiving enough subsidies” to increase production and sell to different markets internationally (Fry, 29 Jan. 2019). Hence, based on these insights, it can be derived that the process of turning business goals into action and consequently reaching success requires time and dedication as the majority of these urban farms are still in their first five to seven years of operation (except for the company V-Farm), therefore only accomplishing a few of their total planned goals. Answers to the second subquestion of how these companies measure their success, are rather straightforward and clear as here, all experts uniformly declare that their basic and principal measurement tool of success is through monitoring their sales figures as well as “the success rate from converting enquiries into sales” (Fry, 29 Jan. 2019). Next to sales being the major indicator for success, the interviewees also emphasize that especially in their industry, it is very important for them to build “customer intimacy” (Stubbe, 28 Dec. 2018) and to “receive positive feedback from customers” (Berlin, 12 Feb. 2019). By these means, the companies examine their level of success as well.

Current barriers:

Subsequently, all interviewees were interrogated on current barriers that they are potentially facing, where most of them also elaborated on what they are trying to do to overcome them. It has to be said that here, all of the seven urban farms agree on viewing the financial status of the business as a challenge in terms of “successfully developing their business into positive figures” (Blün, 12 Feb. 2019) as well as the struggle “to pay off their salaries” (Schipfer, 2 Sep. 2019). Moreover, they mention that “lowering operational costs while at the same time improving quality” (Stubbe, 28 Dec. 2018) is another issue they are currently facing. Still, these barriers are more emphasized by farms which are limited liability companies as they are highly dependent on being profitable. The cases DakAkker and OsterGro rather see the seasonal factor and

variations in staff during the year as barriers since compared to the limited liability companies, these two urban farming projects cannot fully operate the whole year around due to their farming facility and business structure. Considering these points, it can be concluded that those barriers which the need to lower costs while working on exceeding the break even point of the business and starting to make profits can actively be addressed and overcome according to the interviewees' opinions.

Most important characteristics for success:

The next question of the interview is referred to the successful practice of farming in this industry and to the connected characteristics that are necessary to possess. More precisely, the question is formulated as follows: *What characteristics as an urban farm do you think are most important to be successful in this business?* Here, the intention was to comprehend the perspectives of the seven experts based on their personal experiences and opinions which are relevant for answering this question. Distinctively, every expert ranked the location and the team behind the project as the two most important characteristics for success. To be more specific, Stubbe (28 Dec. 2018) highlights that the farm needs to have a "location where there are the right customers" as well as the fact that hiring skilled and experienced staff "will have an impact on the efficiency of the operation". Similarly, Urban Swart Haaland (22 Jan. 2019) mentions that the team not only has to be skilled but also passionate and motivated in order to keep being successful as a business. Other mentioned factors which play a significant role are "the story behind the project" (Berlin, 12 Feb. 2019) implying that it is essential to have a clear and well-communicated mission in terms of "why" the business exists, stimulating the emotions of the target customers. Linked to the statement of Michael Berlin, another important characteristic is "trying to find a concrete USP for the company" according to Schipfer (2 Sep. 2019) since this also forms a prerequisite for the level of success the business will have. In addition, other experts also mention "having high quality produce" (De Vos, 16 Dec. 2018), "minimizing external influences and risks" (Schipfer, 2 Sep. 2019), "establishing the community" (Bauman, 7 Dec. 2018), as well as "investing in research and development" (Fry, 29 Jan. 2019) are part of the successful practice and management of the business. Unlike businesses in other industries, the level of competition and market share are not seen as real threats to the successful operability of an urban farm as the industry is rather young and the market is still a niche market at the moment. Therefore, it can be concluded that within this

specific field, there are several characteristics which ultimately influence the successful practice of an urban farm. These are: a suitable location, a skilled, well-experienced and passionate project team, a concrete USP and story, high quality products, as well as a strong community who supports the initiative. Also, the market environment and the city's municipality should ideally encourage and facilitate the implementation of the farm.

Internal and external influencing factors:

The following topic of investigation concerns potential internal and external influences on the practice of the respective farm. Here, the aim was to retrieve a deeper insight into additional information on possible parameters both within the company and externally that, on the whole add to the company's level of success. To be more specific, some experts go into more detail of the already stated answers to the question prior and other interviewees are not able to elaborate more on this topic. Nevertheless, some examples of external and internal factors can be highlighted. Also it can be detected that here the respective business nature, hence whether the company is structured as a limited liability company (Blün Farm, Ponix Systems, The Abattoir Farm, Urban Crop Solutions), partnership (V-Farm) or another form (OsterGro, DakAkker) obviously affects the answers given. The experts of the four limited liability companies state that internally "time and money" (Schipfer, 2 Sep. 2019) play a crucial role as well as the "diverse set of expertise of the team members" (Berlin, 12 Feb. 2019). Externally, these interviewees see both the customer demand and the "ratio of quantity / economic viability in regards to the fact of local production" (Berlin, 12 Feb. 2019) as influencing elements. Stephen Fry from the company V-Farm, a larger, more commercial business, adds that externally "market prices" and the general food trend towards "locally grown produce" (Fry, 29 Jan. 2019) influences the success of selling their products as well. Moreover, Livia Urban Swart Haaland (OsterGro) and Wouter Bauman (DakAkker) perceive the "seasonal factor" (Bauman, 7 Dec. 2018) as a very determining external parameter which shapes the practice of their farm as they mainly operate during spring, summer and fall months. Internally, both do not raise any specific input to this question. In summary, it can be said that externally, market prices of food items, customer demand and an efficient economic viable production output are the largest influencing factors of the practice of the farm, and internally, it is of great advantage



to have a diverse skilled team, as well as assuring to have a motivated team since money and time are fast exhausted assets.

Values and benefits for the community:

The concrete question to this topic is formulated as follows: *What value and benefit do you deliver to the audiences and community you are targeting?* Since the message and story provided to customers counts as a major asset of today's businesses, the answers to this question also contribute to the final evaluation of what factors lead to the success of urban farms in Europe. More precisely, the experts mention "creating employment" (Bauman, 7 Dec. 2018), providing "transparency in terms of offering tours and giving insights into the procedures behind the farm" (Berlin, 12 Feb. 2019), offering "varieties of products that the consumer cannot find in supermarkets" (De Vos, 16 Dec. 2018) as well as having a "positive impact" on the city (De Vos, 16 Dec. 2018) and its "quality of life for consumers" (Stubbe, 28 Dec. 2018) when being asked about the values and benefits they deliver to their audiences. Furthermore, Fry (29 Jan. 2019) states that a highly valuable benefit is "the nutritional values of freshly cut produce" which is guaranteed, as opposed to products from traditional supermarkets. Hence, besides the already mentioned factors in prior paragraphs, it is also highly favorable to assure providing valuable benefits to the communities and target customers as these ultimately are part of the farm's success rate.

USP on a European level:

In connection to the question above, the seven interviewees were asked the following: *Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?* When looking at the answers given to this question, first of all, it can be highlighted that all experts emphasize on being a pioneer in the industry with their respective farming methods and solutions. For instance, Schipfer (2 Sep. 2019) claims that the main USP of Ponix Systems is the fact that they are "the first vertical indoor farm for home-use" hence serving technical solutions for individual customers and households. Also, Berlin (12 Feb. 2019) from Blün Farm states that they see themselves as a pioneer in operating as a commercial aquaponic business "with the sole focus of producing on their own" hence putting the entire emphasis on the product itself. Likewise, Fry (29 Jan. 2019) raises the point that the USP of V-Farm lies in looking at their business from the "plant's perspective", referring to ensuring their

full focus is put on the product itself, optimizing it and satisfying their customers' needs, which ultimately "distinguishes themselves from competitors" (Fry, 29 Jan. 2019). Second, the experts talk about other attributes which form their USP on a local and European level, namely being situated in a "A+ location" (Bauman, 7 Dec. 2018) as well as offering a diverse set of experiences for customers by having a bistro and / or restaurant as part of their farm. This is valid for the two rooftop farms - DakAkker and OsterGro, as their business models are set up based on diversification. The other five companies name "operating in high transparency" (De Vos, 16 Dec. 2018) and "being a one-stop-shop which "delivers all steps for customers from purchasing the technology, helping customers to grow plants and with after sale steps" (Stubbe, 28 Dec. 2018) as equally important USP traits. Summarizing these inputs, one can conclude that first and foremost, having a concrete USP is a major contributor to achieve success, but also explicitly knowing what distinguishes the respective urban farm from another in this area and on a wider level, is very crucial. Clearly, these distinctive attributes depend on the particular business model of the farm, since being positioned based on 'low-cost specialization', 'diversification' or 'differentiation' lead to different business strategies and USP characteristics.

Connection to tourism:

This question is not directly related to the main research aim of this thesis, however, especially in Europe where cities put more and more focus on offering smart and innovative attractions for tourists, it is of interest to see whether urban farms are connected to the tourism sector and actively target tourists as well or not. Here, answers nearly uniformly show that the seven companies do not engage in active targeting of tourists, mostly due to the fact that they are not really in need to do so, as for instance Bauman (7 Dec. 2018) states that they already have "a lot of media attention" internationally since they are featured on the municipality's platform hence the city marketing takes over this task. Similarly, Livia Urban Swart Haaland (22 Jan. 2019) mentions that OsterGro "is featured on various touristic platforms" and therefore, there is no additional need to include this customer base. Then again, Schipfer (2 Sep. 2019) from Ponix Systems argues that they "have considered to offer their systems in hotels and airbnbs" in Vienna but do not have concrete implementation plans for this yet. Stubbe (28 Dec. 2018) from Urban Crop Solutions claims that at the moment they do not have any tourism connection, however, it could be a future project in terms of

launching “a center of excellence where a vertical farmer is selling to the public and, at the same time, the site is used as a center for tourists and potentially as a business center as well”. He also states that for this, they would need a good partner who takes over the connected tasks of educating tourists (Stubbe, 28 Dec. 2018). On the whole, it can be said that nearly all companies do welcome tourists to a certain extent as they offer educational workshops, tours and seminars, but more importantly, there lies a huge potential in further developing strategies to attract and work with tourists as well.

## **4.2 Implications and Conclusions**

This thesis aims to firstly analyze the current urban farming industry in Europe by selecting a case study set of urban farming initiatives and comparing similarities and differences based on various parameters. Second, with the methodological tool of the conduction of expert interviews, the main purpose of this research namely the identification of success factors that are essential to achieve as well as barriers which are to overcome can be presented.

Considering the conducted desk research on urban farming and the results provided through the basic and content analyses, one can derive some relevant findings. Referring to the parameters which have been mentioned in the paragraph above, similarities and differences of the seven urban farming companies can be depicted when looking at two theoretical insights of this thesis. The theoretical framework as part of the literature review showed that both determining the respective type of business model as well as examining the business goals formulated by the urban farming companies is crucial when aiming to get a deeper insight into how and why success is being reached. First, as theory demonstrated, there are three types of business models adopted by companies in the urban farming industry. These are ‘low-cost specialization’, ‘diversification’ and ‘differentiation’. In order to better understand the implications which will be summarized subsequently, the description of these three models provided by Pölling et al. (2017) will briefly be reviewed. ‘Low-cost specialization’ implies that the company reduces its product variety to one or very few product types, thereby reducing unit costs. ‘Differentiation’ is defined as centralizing the company on a specific niche product or market. ‘Diversification’ as a business model can often be found where farms not only concentrate on food cultivation but also act in agri-tourism hence having a bistro or restaurant as well, or in social activities such as offering workshops,

educating students and the like. More importantly, as Rouse (2013) explains, a business model serves as structured guideline aiming to bring forth the company's viability by working towards fulfilling "its purpose, its goals and its ongoing plans" (Rouse, 2013). More precisely, the chosen business model should ultimately determine the necessary steps to undertake in order to "make an existing business work successfully" (Rouse, 2013). Hence, reaching a certain level of success highly depends on what business model has been selected and adopted. When combining these insights and the information given by the seven companies, one can categorize and evaluate the projects accordingly. Pölling et al. (2017) outline that urban farms in cities find it best working for them if they adopt the model of 'differentiation' and 'diversification'. The model of 'low-cost specialization' cannot be found as often as the former two. Therefore, looking at the information given by the companies and considering the theoretical input, one can make the following classification: DakAkker rooftop farm and OsterGro rooftop garden both apply the model of diversification as their business structure incorporates a diversified offer. Based on the case study analysis, it can be derived that both projects not only focus on harvesting food, but also offer educational programs, teaching students about urban farming, sharing knowledge with their community, as well as operating a restaurant or bistro as part of their sales concepts. Next, the second popular model amongst business in this industry is differentiation. Here, results from the case study show that Blün Farm, The Abattoir Farm, Urban Crop Solutions and V-Farm incorporate this type of model. All four of the projects centralize their core operation on a particular niche product or market. For Blün Farm and The Abattoir Farm it is concentrating on the method of aquaponics and putting their USPs on circular production systems. Moreover, Urban Crop Solutions and V-Farm are both solution providers hence having a niche product which is sold to a particular segment of customers. The content analysis depicted that all of these six companies are evaluating themselves as being on the right path for achieving success (if not already reached), hence incorporating a model which supports the business' viability. In contrast, Ponix Systems which exclusively orientates their business towards manufacturing one product type, namely 'Herbert' – an indoor farming system for households, adopts the model of low-cost specialization. The insights into the interview with Ponix Systems show that they not only failed to reach their desired level of success but also think that they are in need of changing their business concept if they ever want to be successful. Consequently, looking at this first parameter for comparing the cases of this study, it can be stated that one of the success factors that six of the total company sample have in

common, is choosing and adopting a business model that supports their continuous economic and financial viability.

The second theoretical insight which was given at an earlier stage of this thesis, is the formulation of business goals and objectives. This parameter is equally important when it comes to questioning the success of a company. To recapitulate, the term success is determined as “completing an objective or reaching a goal” (Web Finance Inc., 2019). Moreover, Pölling et al. (2017) highlight that success is defined “as the extent to which the business goals set by the business owners has been achieved” as well as that it is hardly ever reduced by financial aspects of a business. Also, goals should be aligned to the values which the respective urban farm wants to communicate as these are equally important to the success of the company. Hence, when looking at the content analysis and at the respective answers given, it can be said that all companies have clearly defined goals, both for the short and the long term. Although all of the seven urban farms state that they did not yet fulfill every goal they have set for themselves, they reveal that their goals and objectives are not solely concentrated on profitability and making their business economically viable, but rather also evaluate their level of success through customer intimacy as well as the positive feedback they receive from their customer base. Additionally, as the literature review also depicts, goals should be linked to the respective values and benefits the business communicates and provides to its customers. More precisely, providing valuable benefits to the communities and target customers ultimately forms part of the farm’s success rate. When looking at the values and benefits provided to customers, it can be summarized that all urban farms strongly strive for aligning their business goals with the values given to their audiences.

To finalize the implications that can be made from this case study analysis, the following main research question of this thesis will be answered in the next paragraph:

*What common factors / skills do European urban farmers see as necessary for overcoming barriers and achieving success in the industry?*

At the very beginning of this thesis, a preliminary assumption of potential success factors has been made. The hypothesis was formulated based on literature insights which have shown that in the urban farming industry, the number one factor influencing the success and sustainability of projects is the location hence farming site. Choosing a suitable location is expected to be a crucial contributor to the farm’s unique selling proposition and ultimately to its long-term success. Furthermore, it has been argued

that urban farmers will rate the linkage to their consumers, winning their trust as well as a great customer reach as essential factors in order to achieve success. With this being said, the methodological investigation of conducting desk research and expert interviews on a case study set of seven urban farming initiatives demonstrates the following: In order to achieve success in this specific industry, European urban farmers uniformly conclude that it is necessary to possess a skilled, well-experienced and passionate team behind the business; to choose an optimal location that facilitates the operability and supports the long-term viability of the company; to decide for a clear USP; to have and communicate a convincing story where the focus lies on the 'why' of the farm's existence; to establish a strong community and get support by relevant city representatives; to primarily lay the focus on the product itself; as well as to provide valuable benefits to the customer base. In order to overcome barriers, the urban farmers state that operational costs should be kept as low as possible; the farm or systems should be highly advanced and controllable to minimize any risks; constantly work on improving quality; as well as invest in research and development in the specific field of operations. Hence, considering these results given by the content analysis of this study, the hypothesis made at the beginning of this thesis can indeed be affirmed, however, as the conclusion shows, there is a larger set of common factors that can be identified to ultimately reach success and overcome barriers in the urban farming industry.

## 5 RECOMMENDATIONS AND FUTURE RESEARCH

Based on the insights provided by those interviewed for the case study set, one major recommendation for enhancing the urban farming industry in Europe in the future is combining it with the tourism sector. There lies a huge potential in further developing strategies to attract and work with tourists nationally as well as internationally. One concrete example of how urban farming can look like in the future and how tourists can be involved as part of the farm's business model is presented by the newest development in Europe – a 14,000m<sup>2</sup> rooftop farm in the middle of Paris, France which as of construction completion in 2020, will be the world's largest urban farm (Harrap, 2019). Besides cultivating a wide variety of produce, which will directly be sold to hotels, shops, cafeterias and locals in the city, the farm will also feature an on-site restaurant and bar. Additionally, this project will feature services such as conducting workshops, offering educational tours and more (Harrap, 2019).

There is also the possibility of leveraging Austrian expertise in urban farming technologies and selling it outside of Austria. In fact, even traditional farms can benefit from innovative urban farming methods and solutions such as aquaponics or hydroponic systems.

More concretely, the urban farming industry should not solely be minimized to the purpose of food production but also should put focus on technological solutions contributing to smart city developments especially in Europe.

With this being said, future research should emphasize on providing “up-to-date knowledge about growing methods, innovative business models” (Ngmubi, 2017) as well as best practices in terms of unique farming concepts which ideally lead to long-term sustainability. Also, Ngmubi (2017) mentions that the industry could be positively influenced and shaped if providing more financial incentives. Ultimately, the author concludes that “with the right supports, urban farming offers a promising approach to help feed the world's growing population” (Ngmubi, 2017).

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## 7 APPENDICES

### 7.1 Appendix 1: Survey Template

*Questionnaire with the aim of identifying and analyzing common factors that European urban farmers see as necessary for overcoming barriers and achieving success in this industry.*

*Thank you for your support to complete my Master thesis at Modul University Vienna!*

*Victoria Felser, BBA*

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#### Part I: Basic Questions

1. Please provide your contact information below:
  - a. Name:
  - b. Company:
  - c. Position:
  - d. Phone:
  - e. E-mail:
2. What is your company's legal structure?
3. How many employees and volunteers do you currently have?
4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?
5. To who do you sell / give away the produce?
6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?
7. What is your financial structure regarding start capital, annual costs, income/turnover?
8. If so, what kind of funding did you receive? (public support)

Part II: Central questions

9. What was your original motivation for starting your urban farming project?
10. What kind of difficulties and risks were involved when starting your business?
11. What business goals did you set for your business?
12. To what extent could you fulfill them and turn them into success?
13. Please provide some details of how you have reached your goals.
14. How do you measure your success?
15. What Barriers are you facing at the moment?
16. What characteristics as an urban farm do you think are most important to be successful in this business?
17. What internal and external factors influence the practice of your urban farm?
18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?
19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?
20. To what extent is your initiative connected to tourism?
21. Do you target tourists?
22. Could you imagine targeting other people than your current customer base (locals / tourists)?

## 7.2 Appendix 2: Collection of Expert Interviews

### a. Expert interview with Blün Farm in Vienna, Austria

Interview via phone on Tuesday, February 12<sup>th</sup>, 2019 with Mag. Michael Berlin,  
one of the founders

michael@bluen.at / m.berlin@zehetbauer.at

Schafflerhofstraße 156, 1220 Wien

+43 (0) 1 774 13 33

info@bluen.at

#### Part I: Basic Questions

#### 1. Please provide your contact information below:

- a. Name: Michael Berlin
- b. Company: Blün Vienna
- c. Position: Member of founder team
- d. Phone: +43 (0) 1 774 13 33
- e. E-mail: michael@bluen.at / m.berlin@zehetbauer.at

#### 2. What is your company's legal structure? (Ownership)

Blün GmbH (Limited Liability Company)

Team of five leading the company

Each of the five is responsible for another area: Stefan Bauer is a tomato gardener in Essling, Michael Berlin farmer and turf producer, Bernhard Zehetbauer vegetable and also a turf producer. Manfred Mautner Markhof is in charge of food and marketing, Gregor Hoffmann is the agricultural consultant.

#### 3. How many employees and volunteers do you currently have?

They currently have one person employed 40 hours per week (Philipp Filzwieser) and two part-time employees, one working 10 hours per week and another 15 hours per week.

At the moment no volunteers or interns, but probably this summer, they will consider employing some interns to help them.

#### 4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?

400m<sup>2</sup> vegetable greenhouse with additional fish farm.

Until a few days ago, their production figures for fish were 12 tons, now they have expanded the fish production and will produce 25 tons per year.

Vegetable production amounts 10 tons per year.

**5. To who do you sell / give away the produce?**

Their produce is sold directly from the farm where most of the selling is done right now. Additionally, they sell through their online shop (transporting via mailing in cooling boxes within Vienna and sometimes also throughout Austria), as well as through the gastronomy sector such as restaurants, delicatessen, cafeterias and so on.

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

They don't own the place, they are renting it from one of the owners and co-partners, Stefan Bauer. He owns the greenhouse for nearly 20 years now, so they rented a part of the greenhouse and the main hall.

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

Start capital was 75,000€, their annual costs are approximately 150,000€.

Currently they don't make profit yet, because they are still in their second fiscal year. However, they planned to rise up from break-even this year, having positive figures for the first time as they are currently in the middle of shifting their products. Until now, their business operations were rather small, now they are ready to extend and shift their activities, such as focusing on catfish instead of both catfish and perch since perch didn't sell well. With this, they are aiming to have more income in the future.

**8. If so, what kind of funding did you receive? (public support)**

Yes, they received some funding from the EMFF (Europäischer Meeres- und Fischereifonds). However, the amount of subsidy is fully used by now.

Part II: Central questions

**9. What was your original motivation for starting your urban farming project?**

The idea for Blün is based on the fact that him and Bernhard Zehetbauer were heavily engaged in farming, they actually had an agricultural holding and did a lot of brainstorming about where they see themselves by the year of 2040. The main drive was to be independent from mineral oil, also, since plants need a lot of fertilizers, they aimed at reducing the use of fossil fuels. By this, they came across the phenomenon of circular systems, thinking of harvesting on their own, increasing composting, producing electricity themselves and so forth. Having this in mind, they stepped upon aquaponics which was just introduced in 2016, they started looking at different units in Berlin and Basel and shortly after launched their urban farm with aquaponics. Hence, the thought of decreasing the use of resources by operating the farm via circular water and waste systems ultimately will bring better and more valuable produce. So, they decided to try this in Vienna and started Blün in 2016.

#### **10. What kind of difficulties and risks were involved when starting your business?**

Internal-wise, there were no difficulties at all. Looking at the business operations, definitely one of the major barriers was the marketing, specifically speaking of how to communicate their story and concept, making them aware of the fact that production takes place directly in Vienna and so on. Hence, attracting the right customers has definitely been a challenge.

Additionally, knowing which products will have the best reach and demand has been a challenge, however, since starting their operations, they have learnt a lot and for example now they totally shifted the fish production to only having one fish type, namely catfish as with this, they make more sales.

Concerning their vegetable range, one difficulty is that they have to adapt to the standard market prices since otherwise customers won't buy their produce in spite of the fact that the cultivation and harvest are fully done on spot in Vienna.

#### **11. What business goals did you set for your business?**

Their aims from the beginning were to produce vegetables and fish with the highest quality possible while at the same time keeping the utilization of resources at the minimum. Furthermore, as their location is in Vienna, one of the goals was to solely focus on the market in the city, producing for Vienna rather than for whole Austria. By that, they also follow their goals and shorten transportation which also benefits the environment. Additionally, they choose to stay away from supermarkets and their price policies, meaning that they focus on selling directly to customers or restaurants and thereby establishing a loyal customer base.

#### **12. To what extent could you fulfill them and turn them into success?**

One of the main achievements was that they could quickly convince the high-end gastronomy classes of their products, as well as inspire top restaurant chefs about their concept and the quality behind it.

**13. Please provide some details of how you have reached your goals.**

x

**14. How do you measure your success?**

One of the founders is a controller, hence they have an exact monitoring of their sales which forms the the basic measurement of their success. However, it is not only about the overall sales figures, they also have smaller factors which are considered as success for them such as winning new gastronomes or receiving positive feedback of customers and so forth.

**15. What Barriers are you facing at the moment?**

Challenge right now can be seen that the business is developing into positive figures for the first time.

**16. What characteristics as an urban farm do you think are most important to be successful in this business?**

First of all, the most important characteristic is the sales and marketing, implying that it should be possible to sell the produce for a higher price since the production itself is simply more expensive due to the location, techniques used and so on. Hence, going international should not really be the aim as it wouldn't be reasonable with price / cost policies.

Second, the story behind the project is an essential characteristic which should be communicated very well to customers, especially the added value and benefits they get from their high quality products and the like.

Third, they had the advantage of launching their company in an already existing infrastructure area and building, hence choosing the optimal site for the urban farm is another crucial criteria.

**17. What internal and external factors influence the practice of your urban farm?**

External: ratio of quantity / economic viability considering the fact of local production

Internal: Variety of experienced staff (their team is rather diverse in the different areas of expertise → advantage)



**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

They convey three main values, namely local (producing in the city for the city), transparent (offering tours every week, giving customers insights into production procedures, staff behind the farm, regulations and so on), and ecologically efficient (stick to the cycle system as much as possible by using the minimum of resources possible; example: they don't have any agricultural sewage water - they completely recycle it).

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

Michael Berlin argues that Europe-wide, they are pretty much the first urban farm which operates as a commercial aquaponic business with the sole focus of producing on their own and putting the emphasis on the product itself. Since most aquaponic farms have showcases which focus on selling the technology itself and merchandising these systems.

Variety of skills within their team is quite unique and definitely an advantage for the operation of their urban farm.

**20. To what extent is your initiative connected to tourism?**

They don't have any cooperation with the tourism industry in Vienna, however, they often have tourist groups from Germany which come to visit their farm, as well as students from universities (from BOKU for example), or people who come from the agricultural sector from areas around Vienna / Germany and have interest in seeing the farm. Additionally, people from companies which do business excursions and so forth.

**21. Do you target tourists?**

Not actively at the moment, as their capacity for doing tours and giving insights into the farm has currently reached the maximum, they have a lot of inquiries so they don't want to push anything now, because they are not in need for any cooperations with Wien Tourismus etc.

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

In terms of customers, they are pretty much happy with their current customer base. Their plans for the future are amongst others to extend their production facilities, con-

centrate on the local fish production and also adding crabs to their product range. Furthermore, they aim to manufacture and sell more processed products such as a sugo or passata.

**b. Expert interview with DakAkker Rooftop Farm in Rotterdam, Netherlands**

Interview via Phone on Friday, December 7<sup>th</sup>, 2018 at 11:30am

with Wouter Bauman, Advisor Nature & Public Space and Rooftopfarmer

Rotterdams Milieucentrum (Rotterdam Environmental Centre), Schieblock- Schiekade

189 - unit 302; 3013 BR ROTTERDAM, Netherlands

0031 - 10 - 465 64 96

Part I: Basic Questions

**1. Please provide your contact information below:**

- a. Name: Wouter Bauman
- b. Company: Rotterdams Milieucentrum (Rotterdam Environmental Centre)
- c. Position: Advisor Nature & Public Space, Rooftopfarmer
- d. Phone: +31 10 465 64 96
- e. E-mail: wouter.bauman@rotterdamsmilieucentrum.nl

**2. What is your company's legal structure? (Ownership)**

NGO, officially farm belongs to the owner of the building, this is the city government

**3. How many employees and volunteers do you currently have? (+org. structure)**

1 employee, that is him, he works:

in summer work 16 hours per week on farm, in winter 8 hours a day

They currently have 16 volunteers (that's the maximum they can have)

They even have waiting list of volunteers

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

Size: 600m<sup>2</sup> open air rooftop farm

Producing in kg is hard to say because what they mainly sell is edible flowers, in kg

quite little, but selling flowers gives them the most benefit, every year they grow

more and more flowers, there are lot of restaurants interested in that

operation is from March until December (open for visits)

**5. To who do you sell / give away the produce?**

4 Restaurants, 1 bistro on top of roof they harvest product on roof = 5 restaurants

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

They don't pay any rent because at the start: rooftop was paid by a contest, contest won by couple of architects (which are neighbours) that's why the city government didn't pay for the rooftop farm, so it was paid by price of contest when they started to maintain the roof, they said they want to pay the maintenance costs but not the rent - because farm is a benefit for them at moment no rights at all because they don't have any contract but they are trying to get a contract

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

Start capital: roof was made by price money of a contest, was won by architecture company (neighbours), and when the roof was made, he said that he has experience in gardening and they want to give it a try

Annual costs: mainly maintenance costs;

Since last year they are now making profits, took them a couple of years to get to this point but now they are becoming quite popular with having 30.000-40.000 people a year on the roof (really busy)

Income / turnover: profits through bistro, tours, educational program, which gives a good income and profit

**8. If so, what kind of funding did you receive? (public support)**

they never got any subsidy, only got the contest money

all the income they receive done by own work and goes into operation

Part II: Central questions**9. What was your original motivation for starting your urban farming project?**

Since he works at the environmental center, their mission and aim is of course to make the city as green and sustainable as possible, especially with climate change nowadays, green roofs are really efficient, but just having the green roof doesn't exploit the full potential, so they thought that they can do more with a green roof and grow food up there

So now their roof is multi-functional: it has a water collection, growing food recreation, solar panels and so forth; also, they added extra space to this building because it used to have 6 floors and a roof, but now it has 7 floors, hence they created extra space in a busy city since rooftops are unused areas

**10. What kind of difficulties and risks were involved when starting your business?**

In the beginning, they had to get the permit from city government which was one difficulty, because for buildings if you want to build something, you need to get permits, follow certain rules (has to look good etc.) when building extra roof/floor

Risk: fire department, because if there is a fire in the building, visitors have to get down in a certain time

Another challenge / difficulty: because this project was the first one as such in Europe in 2012, it took more time than usual projects

Also: when they had the farm, they thought "ok we have the food, what now?", so they started approaching restaurants, but they didn't know what the restaurants would like to buy, but every year it gets better and better now (having more knowledge), so will be more profitable with time

**11. What business goals did you set for your business?**

First goal: Of course is to be profitable, meaning they want to have their own income and not be dependent on any subsidy or money from other people,

Second goal: they are trying to get more efficient now, for example next year they want to do rooftop dinners because they think they can earn more money with this

Third goal: since they have gained some experience in rooftop farming now, they are aiming at and want to do more experiments to extent their horizon

Fourth: since have good contacts to other rooftop farmers (informal network), they want to keep on sharing knowledge in urban farming etc.

**12. To what extent could you fulfill them and turn them into success?**

getting profits now, that's the most important

but also having the contacts to other rooftop farmers now,

in general, they can always be better so it's a work in progress

they have good knowledge about restaurants' wants and needs which is also important to be successful

**13. Please provide some details of how you have reached your goals.**

x

**14. How do you measure your success?**

according to the attention of visitors, meaning the number of groups they get and where they come from, but also number of other visitors (e.g. visitors of bistro on top of the roof)

also by means of establishing cooperations with other companies or people, e.g. they know have a pretty good cooperation with the water board of Rotterdam because the board thinks what they are doing is really innovative

another point: they now have engineering groups from other countries who come to them and ask for workshops to get more familiar with their concept etc.

**15. What Barriers are you facing at the moment?**

Not really any, but it would of course be nice to have a bigger rooftop, however, going to another building would be a bit difficult, because now there is no room to grow at this building (could be also barrier for the future)

**16. What characteristics as an urban farm do you think are most important to be successful in this business?**

Of course this is depending on what your goal is, for example there is a farm in brussels who completely focuses on growing products but for Dakakker it's also important to share knowledge, receive the people, spread the know-how via educational workshops etc.

they are situated in a very good location, in the middle of city center so it's very easy for people to get there, so that is one of the reasons why they are successful (and of course important characteristic)

having a person who is constantly taking care and looking after the farm, in combination with a small team who is always there for a longer time

**17. What internal and external factors influence the practice of your urban farm?**

Internal: thinking of their educational programs with little kids from primary school, they can only do this when it's not cold (so April until November)

External: they don't have greenhouse so they only grow in the open air, hence selling products from May until November (influencing of course their operational capacity) so seasonal factor

**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

During the high season, they of course create employment, e.g. volunteers helping them with giving tours; next year someone will deliver flowers to the restaurants also: next year, they will offer rooftop dinners (attracting more people thereby) another benefit for the community: tours on the roof and twice a year (two week-ends) people can come to the roof and the team explains what they do, their daily work on the farm, etc. (free of charge)

(tour costs: different rates, starting from 100€ incl. taxes for schools, and up to 175€ incl. taxes for companies (duration: 45 minutes up to an hour depending on how enthusiastic the group is, and on the day, if it's on the weekend or during the weekdays and on the language, Dutch or English) -> there's a variety in that

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

They are the only one in the Netherlands (first one nearby is in Copenhagen and another one in Brussels)

USP here is that you can visit them and have a restaurant / bistro and they are in an A+ location in the city center

**20. To what extent is your initiative connected to tourism?**

They do tours of course

They were in the Lonely planet tourist guide a couple of years ago (they worried that there would be huge bus loads of Japanese groups coming but this didn't happen so that was fine)

Asian tourists visiting of course with their cameras

Last week, he was approached by a cruise ship company, Rotterdam is an harbour city, they want to offer the guest tours in the city and of course with sustainability and green cities becoming more popular, they want also want to offer them a tour at their rooftop farm

In general, if you want to visit Rotterdam, their rooftop farm is mentioned on the websites, so they don't target tourists themselves actively but the city marketing of Rotterdam does active targeting at tourists

also there is a lot of media attention for the rooftop farm, they are some Dutch TV programs for gardening and travel programs from Germany, but also the tourist information center in Belgium has their rooftop farm in their promotion activities (free attention)

**21. Do you target tourists?**

x

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

x



**c. Expert interview with OsterGro Rooftop Garden in Copenhagen, Denmark**

Interview via phone on Tuesday, January 22<sup>nd</sup>, 2019 with Livia Urban Swart Haaland, one of the founders  
farmengro@gmail.com  
Æbeløgade 4, 2100 København, Denmark  
+45 20 88 38 98

Part I: Basic Questions

**1. Please provide your contact information below:**

- a. Name: Livia Urban Swart Haaland
- b. Company: OsterGRO
- c. Position: Member of founder team
- d. Phone: +45 51 55 9303
- e. E-mail: farmengro@gmail.com

**2. What is your company's legal structure? (Ownership)**

OsterGro is an association which was established in 2014, the year after (in 2015) they created the company "Bylanbrug". Both the company and the association do activities on the roof, so the rooftop farm is owned by the association and the company rents the space from the association to do other activities.

The association has 40 members and it is a CSA = community supported agriculture; those members pay in advance for the harvest season and then get a share of the harvest every week in the harvest season from June to November

The company does activities such as tours on the roof, workshops and so on, so everything that is not directly linked to growing and the distribution of the vegetables. And they also have a restaurant up on the roof which is called "Gro Spiseri" (=Gro Eatery) which is a part of the company as well restaurant (part of company)

**3. How many employees and volunteers do you currently have? (+org. structure)**

Company: depends on the season (right now a little bit lower), but normally they have five chefs and one friend of house and a dishwasher, and two persons in charge of administration, and then Livia (herself) and Christian (one of the founders team) are responsible for handling and overlooking the whole company. This makes eleven employees in total in company.

Association: one employee

Furthermore, they also have volunteers who participate on Wednesdays only - Wednesday is their weekly open day (for everyone who just wants to visit the rooftop farm, but also for whoever who wants to participate whether they are a member or not can come from 10am to 6pm, from April to December). From December to April, they don't do any activities on Wednesdays.

During high season it's around at least 15 people (both regular people who come every year, but also new faces from Denmark and around the world such as foreign students, regular tourists, people who just came to Copenhagen to start a life there etc.

The visitors can learn more about how to grow organically, eat a big lunch together in the middle of the day.

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

The produce amounts has changed over the year because in the first year, they produced all kinds of vegetables, also potatoes and so on, but in the following years until now, they have focused on leafy greens etc. because the "heavier" produce now takes over another farm which they have a cooperation with.

Total size is 600m<sup>2</sup> - 350m<sup>2</sup> of this is covered with soil, the remaining 250m<sup>2</sup> are not covered with soil, here one part is the restaurant, and then the greenhouse amounts 30m<sup>2</sup> (which is also the space for hostings etc. and the eating area), kitchen and restroom together are also around 30m<sup>2</sup>, the chicken coop is 30m<sup>2</sup> too.

Produce: amount of kg they harvest for their members from June to November: its 2000kg = 2 tons

Besides, they also harvest for their restaurant and also a little bit from December to June

**5. To who do you sell / give away the produce?**

The vegetables from the roof are sold to the members of the association - that is 40 families who live around, so local families from Ostergro, they pay in advance for 24 harvest days which equals 150 Danish crowns per week, 36000 Danish crowns a year for the 24 harvest days - they themselves are able to grow for 25 families but since they started to collaborate with nearby farms, they can produce for up to 40 families.

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

They don't pay any rent but they do have costs for electricity and water, and the use of the elevator, for at least another 2 years they have this deal with the owner of the area.

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

When they started, they got grants (around half a million Danish crowns)

In the following years, they received additional funds, here all together, they got around 750 000 Danish crowns)

After that: the farm has been running around during first years with only a few employees, then in 2017, they started their restaurant, with this they were able to hire more staff. The restaurant now is their main income source.

Concerning costs: the company pays the association rent to be there, the rent is approximately 6,5% (every month) of the company's income, implying that the more income the company has, the more rent it pays to the association. So, the more activities the company has, the more rent it pays to the association. The association more or less goes into zero every year. Also, whatever profit is made in the association, this money is used to improve the place (to keep developing the place).

The company's income per year is around 5 million Danish crowns, and the profit is around 300,000 Danish crowns per year (these are the newest numbers from last year).

**8. If so, what kind of funding did you receive? (public support)**

The funds they received (the 750 000 crowns) were half from the municipality from Copenhagen and the other half from a national grant called the Grant for Organic Farming.

## Part II: Central questions

### **9. What was your original motivation for starting your urban farming project?**

They were three young people who started the rooftop farm in 2014, the inspiration came from the Brooklyn Grange in NYC which is the world's biggest rooftop farm. From there, they got to know the concept of CSA, which before hasn't been known in Denmark.

Therefore, their motivation to start OsterGro was to make an organic field of vegetables in Copenhagen, so that citizens can learn and be aware of how to produce food, as well as taste how fresh vegetables and greens actually taste, hence their aim was to put focus on local produce without using any chemicals (pesticides and artificial fertilizers).

Furthermore, they really wanted to introduce the model of CSA to Copenhagen, they wanted farmers and consumers to know about it, because they think that this is a very good way of producers and consumers working together, securing that we can grow food in a way that respects nature.

However, their goal was never to be self-sufficient but they really just wanted to give people a connection to natural cycles and vegetable production, hence to understand what sustainability means, because it all comes down to using our resources in a better way and reusing our resources - this is a very concrete and crucial issue. Also, food is a good tool to engage people into a more natural thinking.

So, with all their activities on the roof, they try to get as many different people up on the roof, such as people who are already into urban farming and are trend followers but also some who just happen to be invited to a wedding that is taken place in the restaurant because they also host weddings there.

In total, they have around 20,000 visitors per year (members, visitors, volunteers, restaurant guests etc.)

### **10. What kind of difficulties and risks were involved when starting your business?**

First, you have to be really aware of the roof / building that you are on, for example asking "can it take the waste that you are going to throw up there?"

So, there are definitely some risks involved, you have to make sure you start the whole project in a proper way, like being careful when choosing the roof and seeing if it has leaks or if it's feasible / possible to run the farm.

Second of all, you then have to ask permission to actually build it, they have been lucky that they have a private owner who gave allowance to use the roof, because in general, in Denmark it is quite difficult to get permits for a building, you have to apply at the municipality of Copenhagen, because they in the beginning, they received

only a temporary permit, and when they then applied for a permanent one, all of a sudden the municipality said that there were parking lots on the building and this got an issue although there were never parking areas before. Hence, getting permits for rooftop farms or urban farms can be a difficulty because it is still such a new field, also urban farming is still not in the minds when new buildings are built, at least not in Denmark yet.

Hence, until developers understand the real value of rooftop farms and gardens and money will be invested in this, the current situation won't change.

#### **11. What business goals did you set for your business?**

In the beginning when they started Ostergro, the vision was to create awareness for the organic food production, as well as to distribute the vegetables for the members. Additionally, idea was to do lot of tours and workshops with the focus on teaching people, such as school kids, architects, or any interested audience. Hence, they really wanted to be a place of a learning room.

Later on, the opening of the restaurant made it possible to run the rooftop farm in an appropriate way as a business (financially).

So, the primary goals were fulfilled, afterwards they set themselves new goals which are also very much fulfilled by now.

In general, it is hard to run a business only growing vegetables in the city, but that was never their dream from the beginning, rather they do much more, because they aim at selling experiences (not just crops). Also the crops that they have on their fields have a value their whole life and not only when they are being harvested. Hence, they have many functions, whether it is just for the beauty of the green roof or they are actively used through the tours and workshops.

#### **12. To what extent could you fulfill them and turn them into success?**

The primary goals mentioned above could all be fulfilled and were successful, since they reach the audiences they targeted, they give tours and workshops, they very much created awareness for urban food production and are well-known in Copenhagen.

Next, the aims of selling experiences, also through the restaurant they operate on the roof (hosting weddings, special events etc.) were fulfilled.

Additionally, the value and benefit they give to the visitors / audiences through the messages they are portraying, as well as the educational factor has been crucial and very important to fulfill.

#### **13. Please provide some details of how you have reached your goals.**

x

#### **14. How do you measure your success?**

One small part of the whole picture is through measuring their harvest (seeds etc.). Also, of course they always set themselves goals and a budget at the beginning of the year, it mostly turns out bigger than expected but this is also a good tool of measuring their success.

And then, the major and easiest way of seeing their success is through their restaurant guests and visitors.

#### **15. What Barriers are you facing at the moment?**

Biggest barrier at the moment is the conflict with the municipality of Copenhagen concerning the parking lots (MORE INFO LOOK UP ON FB)

The winter season is also always a bit of a challenge: You have to be creative during winter, because clearly, people tend to find the place more interesting in the summer (because summer is also the time where they really can reach the full potential of the rooftop). Nevertheless, they still try to do a lot of activities in the winter, also having the restaurant opened. However, there is no full production during the winter, but still they want to eat local food, that is why they usually buy most produce from farmers nearby, they also get good fish during the winter time which is very much in season in the colder months. Only a very small part of their harvest (from greenhouse) during winter is used for the restaurant.

Also a challenge is that not all of their employees can be hired all around the year, staff varies from approximately eight to eleven during the year, but they can cope with this very well.

#### **16. What characteristics as an urban farm do you think are most important to be successful in this business?**

Definitely the most important characteristic for them is the team behind it, having passionate people is an important element.

Additionally, since especially in their business everyone is very communicative, for them the focus is put on involving people, teaching and telling all the stories about urban farming.

Also, these people behind the project have to be skilled in what they are doing, especially in teaching so preferably having some experiences in educational science and

well-developed social skills. For instance, speaking of their team behind it, the founders all either studied landscape architecture or architecture, so how they shaped the rooftop was thoroughly planned. Thus, it is not just a hobby for them, they've put know-how and skills from experiences into the project.

Concerning their location, for them this hasn't been that important because it doesn't have to be a super central place in the city to attract people, since they are situated more on the outskirts of East Copenhagen.

Looking at the competition, there is also no real fear of competitors taking over some of their market power since the demand for the local food produce is so big. Hence, they do not see the competition as real competition, especially because all the green actors in Copenhagen (all together) have a good collaboration.

On the contrary, important and crucial factors are to find the right roof (space) and size of the farm, so the conditions for running the farm have to be preferable and feasible to work with.

Another point is, that the farm should be well-maintained, so representable to the audience, meaning that it should be a beautiful contribution to the city.

Comparing their farm to little backyard harvests, they really want OsterGro to be a more consistent and remarkable element of the city.

#### **17. What internal and external factors influence the practice of your urban farm?**

EXTRACT INFO FROM ABOVE

#### **18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

One of the biggest values for them is community and organic thinking, hence the community spirit they are portraying to the people and all the organic food production knowledge they are delivering.

Also, they cannot operate with just "one man", implying that working and being together is an essential part, making a life that is more social and especially being present with each other, this means less technology and more nature experiences are important values and messages for them.

Concerning organic thinking, they want to deliver the benefits of producing in an organic way, so actively thinking more of recycling and the efficient use of the resources.

#### **19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

First significant characteristic is that they are very open to the city and always welcome people.

Second, their diverse offer, speaking of whether it is visitors who just want to go out in the evening and dine, or people who actively want to learn about growing and getting their first vegetables of the season. They can serve everyone's needs.

Third, they have a very unique location, since there are significant differences of whether you are on a roof or not, especially in a city. So, being on a roof in the city means that they are right in the middle of where everything is happening, but still, on the roof, above the city, hence they do not have to be concerned about traffic, noise, the hectic life and other stimulations that cause stress. Rather, the visitors have their piece and can relax their minds in a way that makes social engagement much easier. Simply, the atmosphere makes it a place to stay.

#### **20. To what extent is your initiative connected to tourism?**

This became very important, attracting tourists, because the farm inspires not only locals but also people from all over the world.

So it is very important for them to be featured and mentioned on various touristic platforms like Visit Copenhagen, Wonderful Copenhagen and Visit Denmark.

Thus, they are actively seeking tourist mostly by saying yes to whomever contacts them, so they definitely already have a great customer bases of tourists visiting.

For instance, if an Indian journalists asks them to come by and report on the farm or specific events, they always approve and say yes because for them, it is essential to be open-minded to all groups of customers, hence their focus is not solely put on Denmark and Danish people.

#### **21. Do you target tourists?**

x

#### **22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

x



#### **d. Expert interview with Ponix Systems in Vienna, Austria**

Interview via phone on Monday, September 2<sup>nd</sup>, 2019 with Fabian Schipfer,  
Singerstraße 30/48  
1010 Vienna  
+43 680 328 365 4  
+43 (0) 664 / 914 29 74  
office@ponix-systems.at

##### Part I: Basic Questions

#### **1. Please provide your contact information below:**

- a. Name: Fabian Schipfer
- b. Company: Ponix Systems
- c. Position: Member of Founder Team (Fund-raiser and Researcher)
- d. Phone: +43 680 328 365 4
- e. E-mail: office@ponix-systems.at

#### **2. What is your company's legal structure? (Ownership)**

Ponix Systems, GmbH (launched in 2014)

Team of 5 persons:

CEO: Mag. Alexander Penzias,

CTO: Ing. Alvaro Lobato-Jimenez (Technical Director),

Prototype builder: Sebastian Babos,

Technical Development: Patrick Diem,

Funding / Responsible for execution of funded projects (since 2015): Fabian Schipfer

In 2017 the company took part in a Kickstarter campaign on [www.kickstarter.com](http://www.kickstarter.com) which is an innovation platform where people pitch company ideas and consumers can support the cause by donating money or order the pitched product. However, as a customer of this platform, you conclude in the purchase agreement that if the company fails to produce, that it is ok if the money is lost. This is called crowdfunding. During this period after pitching their product Herbert, Ponix Systems has sold most of its Herberts until now.

#### **3. How many employees and volunteers do you currently have?**

There are no additional employees or volunteers working in the company.

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

Ponix Systems sold 800 pieces of Herbert since the beginning of 2017. These sales were a direct result from the Kickstarter campaign.

They have also set up larger facilities in Viennese schools.

Additionally, they own a vertical container shipping farm for tests / experiments etc. (can be found at the parking lot in front of the factory building)

**5. To who do you sell / give away the produce?**

They sell their products to private customers worldwide.

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

The shipping container in front of the production facility belongs to them, however they are tenants of the factory where they produce the Herberts (Vertical Farming solution)

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

They have not yet reached a commercial size: 800 proof of concept created so far, in order to accomplish this they spent half a million euros just to reach the proof of concept, proof of concept is a typical phrase in the startup business, when is a start up a commercial business, when did you achieve proof of concept and when you are still in the suburban phase, you are at the very beginning

Now they are just reaching the point where they can say they have created a real proof of concept

During the founding process it was a lot of learning by doing, building themselves and having someone else build a lot of prototypes, having to return a lot of material parts and having to re-produce the final product, changing the concept again etc., for all that they have spent half a million,

They still have losses.

**8. If so, what kind of funding did you receive? (public support)**

They have received a lot of research money (circa 150,000 €), most of that money came from the "Austrian Business Service" (Austrian Wirtschaftsservice) AWS & "European Agency for Small Medium Enterprises EASME (This is a European Grant from Horizon 2020)

and by the Research Promotion Agency (Forschungs Förderungs Gesellschaft FFG) and Vienna Business Agency (Wirtschaftsagentur Wien)

WKO also supported them by providing consultation

There are various subsidies: also advisory subsidies, subsidies where you get money, and there are subsidies where you get money, but where you have to carry the largest share yourself - they have received very different subsidies

## Part II: Central questions

### **9. What was your original motivation for starting your urban farming project?**

The motivation in the beginning was quite clear: to close the nutrient cycle, their basic motivation was that they could not imagine that there could not be any business opportunity in this area

They got there where they are now by having tried many ideas, pitching and have given the topic a lot of thought

At some point as a young entrepreneur one comes to the point where you think / ask yourself, where do you get the market entry the fastest? What is the quickest way to make money with the basic idea? The answer is private households, end consumers, etc.

At first they were also considering fish and aquariums but now they are only focusing on plants, as the people were not interested in their early concept

And so, finally, a product has emerged that no longer has anything to do with the nutrient cycle, but it is the right step in the right direction, however still far from being sustainable

### **10. What kind of difficulties and risks were involved when starting your business?**

Many factors: financial aspect, no idea of anything, founding a company, there are certain rules of running a company that you do not know in the beginning, assemble products, finding trustworthy producers/retailers for the items/components to supply and manufacture for the final product, finding enough customers, building trust with consumers and suppliers, at the same time the team has to remain motivated

**11. What business goals did you set for your business?**

Goals were: to enter the market and sell 500 pieces of Herbert during the kickstarter campaign, they were able to sell 800 through the kickstarter campaign from the time that they delivered these 800 pieces, they wanted to sell 1000-1500 pieces each year (but they have only sold about 10 pieces so far) - not significantly many

So they did not reach their goals after the Kickstarter campaign

At the moment they are still trying to find a way to make the idea successful with minimal changes, but have not yet decided how to tackle the problem

target market was global during the kickstarter campaign, but outside of a crowd-funding campaign you have to focus on a few countries. We have thought (roof region, native, easiest for farm structure) of Austria and Germany, these would be good, but the interest/demand here is rather low / disappearing for innovative vertical indoor farms, people think the idea is cool, and understand that it is nice to harvest their own salad from the wall at home, but the pain point is not very strong in Austria and Germany, eg If you say you are in a desert and you do not have a garden, or it is too cold outside, you have very little fresh water and you have to use water wisely, then such a system is a good solution or you have too little space like in a big city like Singapore. In Austria and Germany, households would not spend 500 euros, so they will have to go down with the price or turn to other markets

USP: they are the 1st vertical farm for household consumers

therefore in Austria or Germany they cannot score well with their USP

**12. To what extent could you fulfill them and turn them into success?**

x

**13. Please provide some details of how you have reached your goals.**

x

**14. How do you measure your success?**

Success would be a mixture, so 1000 pieces per year sold and 800 of these customers are so satisfied that they regularly reorder our products (sponges, seeds), that would be optimal.

Those who have bought the products so far - current community is quite happy with the products and order accessories

**15. What Barriers are you facing at the moment?**

Money and time are very important factors that will eventually come to an end, everyone has worked for free until now, motivation is the most important factor to stay tuned and this is coupled with money and time, unfortunately the company cannot pay off salaries yet

And as a startup, hardware start ups are still very difficult, which means software is much easier, but only money does not help. - Despite the good funding in Austria, it is still very difficult to build a hardware start up

**16. What characteristics as an urban farm do you think are most important to be successful in this business?**

Keep operational costs / expenditures as low as possible, because the products you produce are not worth so much, eg increase product value (which is considered organic or local) and sell to the market with mark-up, that you can not compete with a traditionally bred salad

It is also important that such a farm is high-tech, because ecosystems are complex systems, and in vertical farms one often wants to control every parameter, so one tries to keep it as simple as possible, the plants are less resilient eg more endangered of pesticides (external influences), etc., and when an ecosystem gets out of control, this quickly results in big financial losses, in the worst case there is no harvest left, resulting in no income etc., eg. it has to be high-tech, you need biologists, real scientists , high-tech systems, with good lock systems, expertise, UV radiation, etc., must consider investing in further innovations

**17. What internal and external factors influence the practice of your urban farm?**

x

**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

USP: first vertical indoor farm for home-use, hanging on the wall

it is very productive, faster harvest cycle, within a month up to 15 ready-made salads, herbs (mint, lemon balm), violets (flowers), (they do not offer tomatoes yet, but it would also work (however tomatoes are complex plants, as they are dominant and do not let any light through for others)

Productive, clean, no earth necessary, simple, eg the system tells you when to water, and when on vacation, plants do not die because of vacation mode where they get

less light and grow slower, most people hang it in dark areas of the apartment, which then are lightened by a Herbert  
hang in the hallway eg, LED light burns out 10 hours a day, at night its turned off, effectively  
Space saving, does not take up much space

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

There is no second vertical wall farm for your home!  
There are a number of similar products on the market (plentui etc) but where you have to place somewhere, which you cant put up on the wall

**20. To what extent is your initiative connected to tourism?**

They have considered to offer systems for hotels and airbnbs but not yet planned (difficult, because who is servicing the systems in the rooms, how do they guarantee that the customers handle it properly)

**21. Do you target tourists?**

x

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

Decision lies with the CEO on how to proceed with future plans, but Florian as Head of Research says company should allow a lot of research and support, the question is whether he manages to enforce this

**e. Expert interview with The Abattoir Farm in Brussels, Belgium**

Interview via Phone on December 16th, 2018 at 2 pm with Mathias De Vos, Site Manager 'Ferme Abattoir'

Technical project manager BIGH Holding

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mdv@bigh.tech

BIGH Anderlecht SPRL

Part I: Basic Questions

**1. Please provide your contact information below:**

- a. Name: Mathias De Vos
- b. Company: BIGH Anderlecht SPRL
- c. Position: Farm Manager
- d. Phone: +32 (0) 478 753 679
- e. E-mail: mdv@bigh.tech

**2. What is your company's legal structure? (Ownership)**

Société Privée à Responsabilité Limitée (SPRL) = Limited Liability Company (LLC)

**3. How many employees and volunteers do you currently have? (+org. structure)**

BIGH Holding develops the farms: 4 people all part-time

BIGH Anderlecht is the team that rules the first project: 4 employees and between 4 and 8 full-time "free" workers: interns, volunteers, social workers

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

Rooftop of 4000 m<sup>2</sup> with outside garden 2000 m<sup>2</sup> and greenhouse 2000 m<sup>2</sup> --> 30T fish/year, 16t tomatoes/year, 2500 herb pots/week

Microgreens: 120,000 units/year; Tomatoes: 15 tonnes/year; Potted herbs: 2700 pots/week; Fish: 35 tonnes/year

**5. To who do you sell / give away the produce?**

Sold mainly to carrefour and smaller shops, restaurants etc.

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

We rent it to the site owner, 10€/m<sup>2</sup>\*year, contract of 36 years

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

Start capital 3,5 million € (investment + development), sales turnover when full production 1 million €/year

**8. If so, what kind of funding did you receive? (public support)**

Private + bank credit, no public support

Part II: Central questions

**9. What was your original motivation for starting your urban farming project?**

The project has been founded and created by Steven Beckers (architect and founder of BIGH), his background is in circular economy in the construction sector, at a certain moment the city of brussel asked him to make a study about potential of rooftops in Brussels: results were that there was a huge potential, there were a lot of rooftops empty and big enough to use as a rooftop farm, therefore, he created the idea of launching his own project

His thought: to find a solution for what the study had shown and in combination with this to address the problem of food availability in cities

In addition, responding to population growth in cities which leads to more consumption of food, however food comes from farer and farer away which makes a bigger ecological output, so avoiding transport from the outside to the inside of the city

Also, consumers are more and more disconnected from the production of food they eat, where does the food come from?, additionally: less connection to producer, not knowing how this tomato consumer is buying is produced, by who and so on

Hence, since Steven Beckers also knew that there is a lot of energy available in the city, he wanted to start urban food production while using this energy and the heat of city, decreasing CO<sub>2</sub> etc. and also building jobs because a lot of people are looking for work etc., so incorporating all these factors, Mr. Beckers founded BIGH (Building Integrated Greenhouses) where the aim always was to build greenhouses which are integrated to the building, the site, the neighborhoods

**10. What kind of difficulties and risks were involved when starting your business?**



Main difficulty was that there was a larger investment to make, but also to build the technology for a greenhouse, to have an economically viable project, also to find the funds which only happened through private investors

Additionally, the challenge of finding the right space, a rooftop which is large enough and strong enough to carry such a greenhouse with a fish production as well

**11. What business goals did you set for your business?**

First idea / aim was to have a project which is economically viable and to have the funds from their investors, and to show and present it to the people

Also, another goal was to get other projects / contract from building owners who have rooftops, suitable spaces where large amounts of heat, CO2 etc can be found, so to also target other potential projects

Hence, from the beginning they knew that BIGH would only be viable with having a network of projects and farms which they have successfully achieved by now

Their main goal of having their farm economically viable is set to be reached by the term of seven years

So the timeline of what they achieved is as follows: Outdoor garden has been launched in 2016; the construction of the greenhouse (including tomatoes, herbs and fish) has been completed in April 2018; so since end of May this year, they are able to sell the tomatoes and herbs, and since end of October 2018 they also sell their fish

**12. To what extent could you fulfill them and turn them into success?**

x

**13. Please provide some details of how you have reached your goals.**

x

**14. How do you measure your success?**

main measurement of success is by their sales, so they only make money by selling their products which is the major indicator for their success

but also there is the “success” in terms of visibility, how many people come to visit etc., because urban farming is such a huge trend at the moment but this interest doesn’t directly bring you money so sales!

**15. What barriers are you facing at the moment?**

There is not enough marketing, not enough commercial knowhow, not enough commercial work that has been done, they still have to make a larger marketing and commercial work to, for example sell their whole production of fish because this is a big barrier where they didn't reach the optimum by now

Also, the fish production itself is quite challenging, it is a high quality fish but sometimes they have a big mortality

**16. What characteristics as an urban farm do you think are most important to be successful in this business?**

To be successful, you have to sell (!) otherwise the farmers would get bankrupt, so first of all you have to know that you will make money by selling the food

Also, you won't sell your fish better when you reach the fact that the production is more sustainable. Of course, there are people who tell them why don't you make the production system even more circular etc. but since they aren't sure what the result would be by improving this (no proven know-how in this)

Hence, the first important characteristic for a successful urban farm nowadays is to have high quality produce, so focus on production first and next on the selling

And of course, the sustainability can always be improved but this should be the second aspect

**17. What internal and external factors influence the practice of your urban farm?**

Most important external factor would be the sight where you are producing, because in urban farming you are always located in a city

Another factor is that there is big impact from your neighbours or owners of the site (if you are not the owner), hence there is a big work of collaboration to do big impact of neighbours and people you are in contact with

Internal factor which is crucial is that you have to choose a team who is convinced this alternative way of farming, but also a team who has the experience of selling and the expertise of farming

**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

First thing/solution that they are targeting and trying to address: we want to bring back the farming and food production to the people, that is to offer local products that you can buy locally, and to go beyond the standard / common products that markets sell, for example a local fish production is something extraordinary, but also

for their tomatoes, they chose to cultivate varieties that the consumer cannot find in supermarkets

Also, they don't target the whole mass, their audience / customers already have to more or less on the "local food flow", meaning that they themselves value the local, healthy aspect and as well to be ready to put more money into local produce, so they need to be willing to pay more

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

Steve wants to create farming where he can integrate heat, Co2, circular economy, they were the first to revolutionize this, hence being unique even comparing on a global level (also regarding the combination with aquaponics)

Additionally, they try to operate in high transparency, meaning that everybody can come and see how they produce, everything about the processes involved etc. and taste it afterwards

**20. To what extent is your initiative connected to tourism?**

They already offer tours on the farm, and a lot of people pay for visits and come (locals as well as foreigners), but this isn't really a big part of their business plan, because they don't actively target tourists for the visits, they just put on website that it's possible, sometimes groups or individual contact them, no special targets in tourists

Actually, they didn't think about an active collaboration with e.g. the tourist board in brussels to promote this kind of activity for tourists yet but definitely for the future is a good idea

**21. Do you target tourists?**

x

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

x

**f. Expert interview with Urban Crop Solutions in Waregem, Belgium**

Interview via phone on Friday, December 28<sup>th</sup>, 2018 at 2pm with Brecht Stubbe,

Global Sales Director

brst@urbancropsolutions.com

Grote Heerweg 67

B-8791 Beveren-Leie (Waregem) Belgium

+32 472 55 94 39

Part I: Basic Questions

**1. Please provide your contact information below:**

- a. Name: Brecht Stubbe
- b. Company: Urban Crop Solutions
- c. Position: Global Sales Director
- d. Phone: +32 472 55 94 39
- e. E-mail: brst@urbancropsolutions.com

**2. What is your company's legal structure? (Ownership)**

Closed company with shareholders so a limited liability company (LLC)

**3. How many employees and volunteers do you currently have? (+org. structure)**

They currently have 14 employees

The offices which they have in Japan and in the U.S. are only sales offices, each having 1 employee and for the commercial work, they have a sales agent

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

Technology employment

The size of their plant factory in Belgium is 240<sup>2</sup>m, which is solely for the purpose of research and development since they are a technology supplier, so they don't grow crops for their own sales so not commercial farm

At the same site (plant factory), they have ten individual research chambers, which means another 120-230m<sup>2</sup> of research facility in Belgium

**5. To who do you sell / give away the produce?**

The produce that grows from these crops is given away for sampling or to local homeless people (the needy)  
Approximately 200 crops of salad per day

**6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

See first question

**7. What is your financial structure regarding start capital, annual costs, income/turnover?**

The company is still owned by two founders, owned and managed by them, they also are the 2 persons who put in the capital until today  
Right now they are trying to restructure their backbone of the company so that they are capable of becoming larger  
By the end of 2018: valued at 5 million (so 5 million in the company)

**8. If so, what kind of funding did you receive? (public support)**

No real public support, however, they did receive some funding in terms of bank loans, so took start-up loans of 500k € between the two of them

Part II: Central questions

**9. What was your original motivation for starting your urban farming project?**

The idea of Urban Crop Solutions is based on the United Nations report of 2012 where issues with agriculture land, population and so on are raised  
So, going into 2014 (with even more scary numbers), the concept was initiated by Marteen (one of the founders), who was studying back then had within his entrepreneurship course, he took the idea and wanted to tackle this problem  
The initial idea was to have a greenhouse on the rooftop but after thorough consideration, he found that there are enough greenhouses already, and therefore went from the idea of a 2D bubble to a 3D indoor model

**10. What kind of difficulties and risks were involved when starting your business?**

One major difficulty / challenge was that they needed to be scalable, as well as the issue with global scope meaning that the technology that they apply has to be able to

be installed anywhere in the world which they successfully solved by providing an industrial scale solution

Hence, from the start, they could not rely on themselves to invent something, so they focused as much as possible to get input through existing technology (e.g. adopting robotic systems from the logistics market) or any other technology they could adopt e.g. from the greenhouse systems: irrigation method - they used  
So major hurdle was to make use of existing technologies and combine industry solutions

#### **11. What business goals did you set for your business?**

The vision of their business is to become the global reference, hence one of their business goals is to have customers and being able to serve customers globally, that is why in 2016 they opened the sales office in the U.S. (Miami), as well as end of 2017 / beginning of 2018 opened up another sales office in Japan

Also, aim right now is looking into other markets too, such as China, Russia and even Australia to become even more active in being a global reference

Their business model is constructed not only as providing the technology for their customers but they also differentiate themselves as to being an one-stop-shop for customers - this comprises the supply of the technology, offering the know-how and training of how to operate (in terms of consumables) etc. so their customers can rely on having them tested in their research facility and on providing the right technical solutions

Hence, long-term business goal / importance for them is to remain a one-stop-shop in this industry

#### **12. To what extent could you fulfill them and turn them into success?**

Of course they want to be able to sell their solutions, so they have internal goals which he cannot mention in terms of the financial aspects and so on

But as of now, for them it is important to have their installation and reference in those geographical territories, so until now they have been able to sell in the U.S., China, Europe (Scandinavia, Belgium etc.), and of course target the remaining territories such as Russia, Canada and Australia

#### **13. Please provide some details of how you have reached your goals.**

x

#### **14. How do you measure your success?**

Of course through sales target / figures

But also through customer intimacy: they really are working with them, it is about setting up a long lasting relationship

Hence, if their customers are happy and stay happy, that's also a way for them to measure their success since by this means, at the end it transfers again into sales (come back -> repeated sales, e.g. 25% of their sales happens through repeated customers)

#### **15. What barriers are you facing at the moment?**

He thinks that this specific industry is still evolving, it's not a niche market but it's a niche product in an existing market since the agriculture industry is one of the oldest sectors

From the economic point of view, offering indoor vertical technology solutions might be a challenge since they are of course struggling to prove their economic and financial viability

Another barrier that they have to keep working on is on the one hand e.g. searching LED lights that consume lower electrical consumption and have better quality which in the end would make the economic business model more viable

Also, there are some companies in this industry which don't deliver high quality equipment, which of course has an effect on the trust that the customers have in the products in general (but this just takes time)

#### **16. What characteristics as an urban farm do you think are most important to be successful in this business?**

It all comes down to few things to consider: (of course the technology has to be there), so to start with you need a location where there are the right customers (where you can reach your customers, has to be an area with potential customers), and a location that makes most sense in the current local economy, as well as knowing which types of crops you want to grow and finding the right site to grow the specific produce (herbs, pharmaceuticals, ..) so to find the right product balance as well  
Next, you need to hire staff who either has some background in this sector (experience / studies) or enough knowledge in plant-based growing, as well as knowing how plants work -> all that will have an impact on the efficiency of the operation!

another characteristic: in terms of business model, you need good funding, and it is important to build your own organisation and chain of supply

example of the U.S., a lot of urban farms there are funded through venture capital but these are farms which build their own crops and the technology but Urban Crop

Solutions doesn't believe in this, because in his opinion either you are a solution supplier or a grower ( so that is something which is crucial as well and needs to be decided)

**17. What internal and external factors influence the practice of your urban farm?**

See above

**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

On the one hand they believe that their solution or many urban farming solutions have capacity to grow crops using 90 - 95% less water, hence with this the benefit to the consumer is directly applied, it is very efficient etc.

Also, they are battling some challenges that farmers face, namely climate change, carbon footprint, etc., so through Urban Crop Solutions' technology and research, they enable farmers to become more efficient

And in terms of values for the industry, the provision of technological advancements is of course good and important for the industry, also providing more jobs -> huge benefits for economy

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

Being a one-stop-shop (nearly no other business is doing this on a global scale, they never saw another business which delivers all), implying delivering all from purchase of the technology to the end, helping the customers to grow plants etc., after sale steps etc.)

Their ability to grow larger crops (a lot of the vertical farms focus on micro herb growing due to technological boundaries) however, Urban Crop Solutions focus also on medical plants, flower and seedling production as well as plants), additionally they are doing research on wheat (for bread)

Also, a lot of companies are working with other suppliers when it comes to lighting, but this, they are doing in house, they have their own brand name of lights which allows them to increase efficiency and be up-to-date with newest technology

Vertical farming industry: they are the only business which is acting global

**20. To what extent is your initiative connected to tourism?**



At the moment there is no active connection to tourism, however, this could be a future project: they could potentially attract tourists via their customers, for example a center of excellence where a vertical farmer is selling to public and at the same time the site is used as a center for tourists / as a business center as well (so technology & action)

For this they would need a good partner who is willing to do that, educate the consumer (tourist) about growing and so on

**21. Do you target tourists?**

x

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

x

**g. Expert interview with Vydro-Farm in Coventry, United Kingdom**

Interview via Skype on Tuesday, January 29<sup>th</sup>, 2019 with Stephen Fry, Commercial Sales Manager at HydroGarden / V-Farm

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Part I: Basic Questions

**1. Please provide your contact information below:**

- a. Name: Stephen Fry
- b. Company: HydroGarden Ltd
- c. Position: Commercial Sales Manager
- d. Phone: +44 (0)79 8093 2424
- e. E-mail: stephen.f@hydrogarden.co.uk

**2. What is your company's legal structure? (Ownership)**

It is a privately owned company

It was set up 23 years ago in Coventry by Mr. Ean Reynolds

3 Shareholders (NAMES): Mr Ean Reynolds, Mr. Baragini, Mr. Steward Green

Last year the company turned over just over 28 million pounds (Turnover last year as a company Hydro Garden)

The farm is one of the brands that sits under the Hydro Garden Umbrella, along with nutrients, lumi lightings, spectro leds, etc - They have a number of brands which stand alone but sit under the umbrella

**3. How many employees and volunteers do you currently have? (+org. structure)**

Currently they have 105 employees (they are growing and recruiting all the time)

**4. What size (m<sup>2</sup>) is your urban farming initiative and how much produce (kg) do you harvest per year?**

55m<sup>2</sup> (Urban Grow)

They actually have two rooms:

One of which is what they call the restaurant room (which houses 3 of the smaller 5207 racks, which really is for trials if they wanted to do a quick trial, new variety or a different nutrient - then they tend to use the smaller room

The large room which was recently completed in September last year, houses one large 5206 flow and drain rack, one 5219 and three 5223s, again these are for variety trials, but any other trial they want to look absolute, this could be a different wave length, a different duration, different temperatures, different CO2 etc, they can change all the variables for each trial

The original room, which is residing at a College near us, houses 3 of the 5205 racks (6 m long, about 0.8 m wide, 4 layers high) and that box would produce 2,000 lettuce heads every 28 days, looking at a about 170 grams. So they would produce in between 340-350 kg every month (about 4 tons in a year) (this is measured by 8m by 4m by 2,75m)

#### **5. To who do you sell / give away the produce?**

They give away produce to charity:

And are nextdoor to the Coventry food bank, which is part of the Trussel trust

They also donate to our staff, they are kept well supplied with lettuce, pak choi, herbs, basil, and any other crop they currently trial in

They have donated substantially to the Twycross Zoo (pictured on the web) (elephants, reptiles etc)

#### **6. Do you own the place (who owns it) - do you rent it (rental costs, contract length)?**

No rent

They own the facility

#### **7. What is your financial structure regarding start capital, annual costs, income/turnover?**

Product Prices: depends, they do various, distance from the small 5207 and 5222 (look at brochure, sent on skype) - typical small system for micro green production (images on skype) - those are currently 6000 Euros ex Coventry

The other unit (image skype) NFT system - for lettuce and herbs- whole head production (entry units 6000 euros ex coventry for a rack

A lot of universities in the UK, places like Oslo have these systems for doing their own trials, but also small scale producers, a number of restaurants and food producers

and restaurants who have low level production requirements for sandwiches, for microgreens, to display food before serving in the restaurant

its very mobile, very versatile

→ that was sort of starting point

The restaurant room (image skype) - works for the 60,000 Euro mark (and that contains 3 of the small systems) so you can have a choice, you can have two of the 07 and one of the 22 or vice versa, just depends on what the restaurant wants to produce - the original box has the 3 of 5205 (image skype) - something like that youre talking about 120,000-130,000 Euro - then they can go up to whatever size people want

The latest one that they have commissioned is this one here (picture on skype) still doing final calculation on the price of that but probably 200,000 Euro for the operational turnkey solution - gives flavor of what it is they do

(brochure in skype)

#### **8. If so, what kind of funding did you receive? (public support)**

The first 3 years they really just used horrondy funds from within the company because primarily the first systems they developed were for their farms in Australia, and then for their farms in Singapore, they had an internal need to develop vertical growing systems, cause effectively in Australia on their original nursery they ran out of space, the need to go up was there

(2011,2012 did some experiments with some guy from zoo): He's done some poultry work with Kevin Freddy Army from Paignton Zoo Environmental Park, when they had the first system down there(back in 2011, 2012)

that was originally were the idea came from and then he designed some systems to go to the farm, they went out in 2012 to Australia, really from there they got involved with Kevin and Nottingham University professor Dr Chungui Lui who ran the first vertical farming conference at Nottingham University: and he wanted them to sponsor it and they then developed and took two small 6m rack up to Nottingham in the back of a van

On the day of the conference they actually sold 3 racks to different universities

And discovered there was a demand for vertical racks

So they started building them back in 2012 now they have got 70+ racks from Australia to America,Greenland, Finnland, Norway, France,etc - they are all over the place

#### Part II: Central questions

#### **9. What was your original motivation for starting your urban farming project?**

In the first instance it was their nursery in Australia, a company under the HydroGarden umbrella which is called pocket herbs, they are one of the largest producers of microgreens and easyleaf - the demand for their products was going up and they couldn't meet the demand since they were only growing on one level. Their chairman Ean Reynolds came up with something where they could stack layer on layer: first prototype went out in May 2012, to increase production by 20% - it satisfied orders and gave them time to build the second nursery. That was their entry into it - the need to satisfy the demand for microgreens in New South Wales.

#### **10. What kind of difficulties and risks were involved when starting your business?**

There were several challenges, he has got 30 years experience in horticulture – He has been a manager and a commercial grower. The biggest issue you have as soon as you go above a single layer, then to get a continual unequal flow on the second layer compared to the lower layer is very difficult, because as you increase the head height on a rack then the flow rate decreases. So on our four layer system they are probably getting no more than 1 liter per minute but the bottom layer was receiving 3 liters per minute and to get a continual growth crop, so they are all equal, they needed to make sure each layer received the same amount of liter (water) and nutrient - so that was the first challenge to overcome. And again the lighting, prior to LEDs it was totally impractical to use CFL lighting because you were having basically layers of water above electrical lighting which is not conducive to health and safety. So they then developed our own LEDs and their own IP67 rated aquarium caps so if there was a spillage of water then you were not in danger in the operatives. There were several challenges, obviously tactical and investment is always a challenge. The ROI depends on the crop you're growing and the markets you are selling into, so there's economic barriers and factors but once you have overcome those, and you developed a market and a brand, they've got a brand in Singapore, a food brand in Australia, you can get brand loyalty - they overcame the challenges because effectively V farm got a very very good team of staff that can look at problems and issues and resolve them.

#### **11. What business goals did you set for your business?**

Primarily for our their needs, they developed the NFT system. Because they want to be on the Singapore market.

They did apply back in 2014 for an Innovate Agritech Grand, which they were successful, they got just under a million pound from the European fund for innovate, which enabled them to build the third room that he showed me, it also enabled them to develop a flood and drain version for Easyleaf and Microgreen Production - so total investment they are probably in the region of 2 and 2 and half million invested, development they are currently doing, although they are currently looking for further grants/funding, without it means they will still do it, using their own funds but its obviously slower progress, so they know at the moment, they developed a protocol for growing whole-head lettuce over the last four years' trials, they are now looking at other crops such as strawberries, basil, any crops they can grow in there, what they do is they give out the algorithm that gives the perfect growing condition for each crop, so when they sell a system, people then have the algorithm to build it in the computer, so its actually very simple for them to build the perfect crop

**12. To what extent could you fulfill them and turn them into success?**

x

**13. Please provide some details of how you have reached your goals.**

x

**14. How do you measure your success?**

Primarily through sales, but also the number of enquiries, the success rate from converting enquiries into sales, social media, they've got quite strong social media following on Twitter, Instagram, Facebook, so again that is one of the metrics they can use to see what effect our marketing is having, but he thinks also to be able to exactly predict how a crop will grow day by day, their aim is to have controller where for example you have all the technical data which can be a little bit confusing if your ability to read and write is challenged, then they can have images of crops so you can have a picture of a lettuce, strawberry, pak choi, whatever crops you want to grow, you literally put the plant into the system, push the picture of the strawberry it is automatically downloaded, knows exactly the day length, Co2 concentration, temperature at day and night, humidity, etc - so it basically will facilitate that their systems can be put in cold remotes or small mansion, they can actually see and control, and assist their customers, but also they don't need highly qualified or culturalists to grow the crop, they literally put the lettuce plant in, push the picture of a lettuce, 28 days later the box goes ping, they go back and harvest it - thats oversimplification but that's ultimately where they want to be

**15. What barriers are you facing at the moment?**

Brexit

At long last, today and only today the politicians in the house of westminster have realised that we import 90% of our lettuce, 85% of our tomatoes and a very high percentage of salad crops across the board - Today they have realised it, come at 1st of April with difficulties passing through the exit point main land europe, a lot of perishable salad will be sat on lorries on the French side and slowly - rotting away before they can ever come into Dover and go to Central distribution - food security is a major issue

V-Farm has had a very positive response this year from their European friends who want to buy systems before brexit, he's got 17 systems that he needs to build and delivery off, and certainly have them invoiced and paid before the 29th of march - it's challenging, interesting times

They just hope to get trial data on a greater number of species, so the protocols will be available for their customer base worldwide

**16. What characteristics as an urban farm do you think are most important to be successful in this business?**

The actual system itself needs to be scalable

They have one common pathway and the racks are movable

Racks are adjustable for height (each layer can be lowered or raised to accommodate different sizes of produce)

Lights are movable

Number of USPs: compared to other systems, they've got 17 systems out there, customers repeat orders as they grow their business, its easy with V-Farm systems to just increase the number of racks so flexibility, it's easy to expand and adjust the production

**17. What internal and external factors influence the practice of your urban farm?**

Primarily its market price

Eg if you look at berries or whole head lettuce (from October through to March the UK relies heavily on imports - difficult to grow strawberries crop from October to March, the same with lettuce, its a low value crop lettuce, currently you're looking at about 34 pounds wholesale for a lettuce - so you know market prices affect the ROI quite dramatically

Again food trend (locally grown produce) they are seeing certainly in the UK a significant increase in vegetarian and veganism - so the demand for very fresh, highly nutritious and locally grown produce is increasing which is great for their business, post brexit, well they don't know how that demand is going to be met, certainly V Farm can be a major player, if the UK wants to become less reliant on imports, and more self-sufficient in salad crops, then the UK does need to rapidly start producing their own, it's very difficult with greenhouse production, not because of the significant costs but again the land that it takes up and the heating and venting and everything, with V-Farm systems they can move into a redundant warehouse insulate it, put racks in and be growing in a couple of weeks, its very very quick and when the lease is up, because its movable, they can literally roll it out, shut the doors and put it on flat back trucks and take it to the next venue.

**18. What values (economic and other) and benefits do you deliver to the audiences and community you are targeting?**

Again Vertical farming really does lend itself to urban and peri-urban locations (lends itself to urban locations)

In cities if you can grow in redundant warehouse spaces, basements, rooftops, if you can grow locally within the community, supermarkets will be rapidly reduced, but the benefits, shelf life are increased because it's literally being cut and put straight into the ultimate consumer

The nutritional value of freshly cut produce is much better and higher, than crops that had been cut in Spain and then driven 14,000 miles and put in a refrigerated lorry into refrigerated warehouse, by the time it hits the shelf it's probably 5 or 6 days old - local production does represent a higher nutritional status of what people are going to eat, shelf life is longer of crops

**19. Where do you see your concrete USP when compared to other urban farming projects in your area and Europe-wide?**

Can get up to a third more racks within a given area because you have one common path, key features

Secondly, V-Farm has always approached production of the system from the plant perspective (if the plant doesn't benefit, then it does go into a V-Farm, as simple as that)

Competitors don't look at it from the plants perspective, but rather from the manufacturing perspective, they don't look at why they use that particular material or that design even though plant is actually compromised - They look at it from the business perspective, which is great but ultimately the product you are selling is the lettuce or



the strawberry or the herb, that's what consumers are going to pay for, so it's very important to look at what the plants' needs are and not what the companies' needs are

**20. To what extent is your initiative connected to tourism?**

Primarily, they do have the farm up in Coventry, if anyone approaches him, potential customers, local school, local colleges – he genuinely accepts them all to have a look around at the system, because he thinks it's very important to educate effectively everybody, 85% of salads are grown hydroponically, not many people are aware of this, they don't understand growing plants in water, so there is the educational element, and they have a specific training area

So again last year there was a community project in the middle of Bristol, called the Barricade, V-Farm had a system down there for 4 months, where the general public could walk around (in the city centre) (and it was linked to a coffee shop and sandwich shop, so people walking through the barricade could see LED lights would go over, what's this and what does it do), and look at the system and crops growing. So educating people as to where the food comes from and the benefits of vertical growing is important and therefore I actively encourage it

**21. Do you target tourists?**

x

**22. Could you imagine targeting other people than your current customer base (locals / tourists)?**

x