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THE BUSINESS MODELS OF COMMERCIAL URBAN FARMING IN DEVELOPED COUNTRIES

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Sincerely,

David Ingemar Hedin

Vilnius, 2015-10-01

Summary

This thesis is an analysis of the business models used in commercial urban farming in the developed world. With its global sample and praxis to include all found firms not subject to delimitations, this thesis is an extension of the academic writing that already has gone beyond the case approach in studying urban farming and alternative food networks. Moreover, it further establishes the economic perspective on alternative food networks, and introduces this perspective for commercial urban farming.

Commercial urban farming can be partitioned into three main classes.

- Small production, their products ranges are either very focused or very diverse. Mode of output is typically a farmer's market and a few restaurants.
- Large production, their product ranges are typically focused around leafy greens or other perishables. Mode of output is typically retail and restaurants.
- Secondary purpose, their urban farming operation directly benefits another activity which provides additional revenue or lower costs for the business. The range of secondary activities includes marketing, distribution, self-harvest and recreation.

These classes were found by quantifying the business models of the firms in accordance with the conceptual framework of Boons and Lüdeke-Freund (2013) in terms of binary data. The binary data matrix was then converted into a proximity matrix (Warrrens, 2008) from which an agglomerative hierarchical clustering was able to discern some useful patterns (Jain & Dubes, 1988).

The classes was then analysed strategically following mainly Porter (1980). The analytical findings in this part of the thesis was mainly that the small production cluster is instable and that the firms in it are likely to either (1) expand outside the city after an initial marketing phase, (2) expand within the city and seek the business model of large production or (3) introduce or expand secondary value propositions in order to gain additional revenue or lowered costs.

The exploratory results of this research are generalizable and can be used to theoretically define a sample of commercial urban farms. It can thus be used as a framework within which to apply confirmatory research. The propositions of the strategic analysis need confirmatory research to be validated.

With the further analysis of commercial urban farming, this thesis contributes to a wider understanding of urban farming in general and deeper understanding of commercial urban farming in particular.

Sammanfattning

Den här uppsatsen är en analys av de affärsmodeller som används vid kommersiell stadsodling i industrialiserade länder. Med ett globalt urval av firmor och en öppen urvalsmetod (n = 32) är detta en uppsats som går bortom detaljerade beskrivningar av enstaka exempel på alternativa matnätverk. Istället har intentionen varit att generalisera de övergripande mönstren samt att introducera ett affärsmässigt perspektiv på kommersiell stadsodling.

Kommersiell stadsodling kan indelas i tre klasser.

- Liten produktion, klassens produktutbud är antingen mycket fokuserade eller mycket breda. De vanliga försäljningskanelerna är bondemarknader och restauranger.
- Stor produktion, klassens produktutbud är vanligen fokuserat runt gröna bladväxter och andra lättfördärvade grödor. Försäljningskanalerna är matbutiker och restauranger.
- Sekundärt syfte, klassens stadsodlingsverksamhet gynner direkt en annan aktivitet i företaget, vars syfte är att inbringa extra omsättning eller sänka kostnader. De sekundära syftena är marknadsföring, distribution, självodling och rekreation.

Dessa klasser hittades genom att affärsmodellerna för kommersiell stadsodling kvantifierades binärt i enlighet med det konceptuella ramverket som introducerades av Boons & Lüdeke-Freund (2013). Från matrisen med binär data skapades sedan en närhetsmatris (Warrens, 2008) från vilken en agglomerativ hierarkisk klassning (Jain & Dubes, 1988) lyckades finna användbara mönster.

Klasserna analyserades sedan stategiskt, framför allt med Porter (1980) som rättesnöre. De analytiska fynden i den här delen av uppsatsen var att klassen liten produktion är instabil och att firmorna som ingår i den sannolikt kommer att antingen (1) expandera utanför staden efter sin inledande markndsföringsfas, (2) expandera i staden och adoptera en affärsmodell från klassen stor produktion eller (3) skapa eller vidareutveckla sekundära verksamheter för att få tillgång till extra omsättning eller kostnadsbesparningar.

De undersökande resultaten i uppsatsen kan generaliseras och användas för att teoretiskt definiera ett urval av kommersiella stadsodlingsverksamheter. Det kan därmed användas som ett ramverk inom vilket bekräftande forskning kan urföras. Propositionerna som stammar från den strategiska analysen behöver bekräftade forskning för att kunna valideras.

Med sin affärsmässiga analys av kommersiell stadsodling bidrar denna uppsats till en bättre förståelse av stadsodling i allmänhet och en djupare förståelse för kommersiell stadsodling i synnerhet.

Abbreviations

AFN = Alternative food networks (Venn *et al.*, 2006)

AHC = Agglomerative hierarchical clustering (Jain & Dubes, 1988)

FAO = Food and agriculture organization of the United Nations (www, FAO, 2014)

PCA = Principal component analysis

SFSC = Short food supply chain (Wubben *et al.*, 2013)

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1 Introduction

As urban farming moves from private balconies and back yards to greenhouses on retail store roofs and other innovative places, the literature exhibits a gap in understanding why this common recreation is being commercialised.

1.1 A definition of urban farming

There are typically four kinds of urban farms (Cohen *et al.*, 2012). Institutional farms are farms that are run by a school, prison or similar, and that have a joint objective to provide recreation and to produce food. Community gardens are gardens that are taken care of by volunteering residents with a social, recreational or self-sufficiency objective. Community farms are farms that typically are run by some kind of non-profit-organization with a social objective. Finally, commercial farms are farms run for-profit though some of these organizations have a not-for-profit branch working in symbiosis with the profit driven operation.

In its essence, urban farming is plant cultivation and husbandry in and around cities (www, FAO, 2014). More specifically, it is "a complex system encompassing a spectrum of interests" (Bills *et al.*, 2002). Its traditional nexus is comprised by the activities associated with production, processing and marketing of food, as well as its distribution and consumption. Meanwhile, there are many other benefits and services which have been acknowledged and documented in conjunction with urban farming. These include intergenerational meetings, recreation and leisure, education, personal development, economic vitality, business entrepreneurship, individual health and well-being, community well-being, restoration of vacant land, storm water management and landscape beautification (Bills *et al.*, 2002); (Cohen *et al.*, 2012).

The literature has yet to explore the logic behind the commercial urban farms. Many commercial urban farmers believe that lower transport costs and increased revenues for fresher produce will make them competitive in relation to conventional supply chains, even though the land costs increase with population density. In stark contrast to community gardens, community farms and institutional gardens farmers, commercial urban farmers need to pay their employees competitive salaries and also generate acceptable returns on investment. Indeed, Midmore & Jansen (2003) wrote that it is unlikely that even currently economically viable peri-urban farms in the long run can compete for scarce labour and land resources "unless alternative production technologies become available and the positive externalities generated … become internalized".

1.2 Documented value creation of urban farming

Contrary to the prediction of Midmore & Jansen (2003), there are many current examples of commercial urban farming being established closely to consumers (Spiegel Online, 2011); (New York Times, 2012). Does this mean that the firms have found a ways to internalize positive externalities? What value does urban farming create?

As cities are built, concrete and asphalt changes the flow of water (Bills *et al.*, 2002). The issues resulting can be the flooding of aqueducts, erosion, or simply that the pollution is flushed from the streets into adjoining bodies of water, creating problems with sediment management and aquatic pollution. The land management practices of agriculture, which of course intend to keep a suitable amount of water in the soil over time, are proven to prevent the disruption of sensitive areas as a result from storm water runoff since water is held onto by plants' roots, slowing the flow. This is therefore a form of storm water management, which affects both the quality and quantity of storm water.

In urban agriculture, it is often seen as problematic that plants growing in contaminated soils can take up these contaminations, making the produce unsafe for human consumption (Midmore & Jansen, 2003). This uptake of heavy metals and decomposition of organic toxins by plants is also referred to as phytoremediation when used as a way of restoring brown fields, contaminated from previous use, thus hindering that the polluted land in the city is replaced with new land on the fringe of the urban environment (Bills *et al.*, 2002). Likewise, urban agriculture is a way of restoring vacant land into active and perhaps even beautiful land.

Plants have a filtering capacity to remove not only carbon dioxide, but also particles from i.e. soil, roads, exhausts, construction and combustion emissions (Leung *et al.*, 2011). In indoor environments, the transpiration from plants increase the air humidity to levels recommended for optimized human health (Bills *et al.*, 2002). This transpiration also affects the temperature of the surrounding air. On hot days, plant transpiration increases by taking energy from the surrounding air which cools the environment, thus decreasing the need for air-conditioning (Leung *et al.*, 2011). Conversely, an increased amount of plants also increase the amount of pollen in the air which can be problematic for allergic individuals.

Planted landscapes have been proven to reduce stress and anger as well as to raise people's mood (Leung *et al.*, 2011). Moreover, Ulrich (1984) showed that patients stayed shorter times in hospitals if placed in a room with views of trees as compared to views of brick walls. They also gave less negative feedback to their care takers and wanted decreased doses of their pain relieving medication following surgery. On a similar note, Bills *et al.* (2002) write that "nurturing plants can provide a sense of responsibility and belonging that often is lacking in institutional dementia care programs".

Beyond the positive externalities identified above, urban farming offers direct value in the form of fresh produce. An large amount of people from all income categories claim to be willing to pay a premium for local food (Rushing & Ruehle, 2013). 66 % of the consumers surveyed by Rushing & Ruehle (2013) wanted to support local economies, almost the same amount said they liked the wide assortments at farmers markets, 45 % expressed that they viewed local food as a healthier alternative, while 19 % wished to reduce the food's carbon footprint and encourage organic production.

A Canadian market analysis from 2011 claimed that markets that are saturated in terms of access to food, now see consumption trending toward multicultural, untraditional, everyday indulgence and natural (International Markets Bureau, 2011). Consumers' increased travelling

seems to create demand for exotic flavours and premium quality. Many consumers want stimulating food consumption and are willing to pay premium prices for this everyday indulgence. Natural products with a low degree of processing are trending under the perception that they are healthy foods that do not compromise on sensory attributes.

Premium quality in produce is directly related to the state of maturity or decomposition the produce at consumption. In moder horticultural supply chains, it is common practice to harvest produce before it is ripe because soft fruits tend to get damaged in transit to the consumers (Lamikanra, 2002, p. 16). These fruits are allowed to mature enough to satisfy a minimum level of sensory attractiveness on the point of consumption while still retaining damage resistance during distribution. With proximity to the consumer, a firm could possibly distribute fruits that ripe on the plant through small volume distribution systems without damaging produce, thereby providing the customer with more value. Proximity to the customer also reduces energy consumed by the cool-chain (Midmore & Jansen, 2003).

Sensory attributes mainly depends on the variety grown, the conditions under which it is grown and the combination with the produce's post-harvest handling (Mattson, 2003). Fruits and vegetables are partitioned as either climacteric or non-climacteric fruits. Non-climacteric fruits act mostly like any other part of the plant without any special phase of maturity or a rapid change in sugar content. All leafy greens belong to this group of fruits. After harvest, non-climacteric fruits keep breathing and burn carbohydrates for energy while losing water to the surrounding environment. As acids, lipids and carbohydrates gradually are converted to energy the fruit loses some of its characteristic aroma, taste, texture and colour. Similarly, the water loss changes the mouth feel and decreases the crispiness.

Climacteric fruits experience a short period during which the fruit softens and the sugar content increases (Mattson, 2003). Unlike non-climacteric fruits, the sugar content of climacteric fruits can increase post-harvest and the maturing process be initiated by ethylene exposure. However, all mature-fruit vegetables (except for avocado) reach their best eating quality in terms of sensory attributes such as taste and texture when left on the tree to ripen (Lamikanra, 2002, p. 16). Therefore, fruits generally taste better as the time between harvest and consumption is shrunk.

The value of decreasing the time between harvest and consumption depends on the temporal sensitivity of the produce. Hardenburg *et al.* (1990) reviewed the properties of some commonly cultivated vegetables and mentioned their respective maximum storage time given optimal conditions, often with high humidity and near freezing temperature. Table 1 lists some of these time-sensitive crops.

Table 1. A few time sensitive vegetables, (adapted from Hardenburg et al., 1990)

Mushrooms, micro greens (sprouts) and fresh raspberries.	<1 week
Chervil, blackberry, salad greens, chard, strawberry, Sweet corn and southern peas.	1 week
Coriander, dill, basil, blueberry, fennel, yellow passion fruit, water melon and most leafy greens.	2 weeks

It would be expected that commercial urban farms grow crops from the table above. Meanwhile, Table 2 summarizes the beneficial externalities discussed in this chapter.

Table 2. Benefits of urban agriculture and premium inducing factors

Benefits of greening cities	**Source**
Storm water management	Bills *et al.* 2002
Reduced stress and anger, raised mood	Leung *et al.* 2011
Brownfield remediation	Bills *et al.* 2002
Restoration of vacant land	Bills *et al.* 2002
Improved air quality	Bills *et al.* 2002, Leung *et al.* 2011
Moderated temperature	Bills *et al.* 2002, Leung *et al.* 2011
Improved health	Ulrich 1984
Community well-being	Cohen *et al.* 2012
Education and personal development	Cohen *et al.* 2012
Premium inducing factors	**Source**
Supporting local economies	Rushing & Ruehle, 2013
Wide assortment	Rushing & Ruehle, 2013
Healthy food	Rushing & Ruehle, 2013
Reduced carbon footprint	Rushing & Ruehle, 2013
Organic production	Rushing & Ruehle, 2013
Exotic flavours and novelties	International Markets Bureau, 2011
Premium quality	International Markets Bureau, 2011

It should be noted that the benefits of greening cities mentioned in Table 2 can be accessed in a number of ways other than urban farming. Storm water management and temperature moderation can be achieved using green roofs (Mok *et al.*, 2014). Improved air quality, recreational areas that improve individual health, restoration of vacant land and brown field remediation can be attained by constructing parks. Meanwhile, the premium inducing factors of local food production are also accessed by farmer's markets for regional farms (Rushing & Ruehle, 2013).

1.3 Aim, delimitations and research question

The concept of commercial urban farming is an example of the wider concept of alternative food networks (AFN) (Venn *et al.*, 2006) or short food supply chains (SFSC) (Wubben *et al.*, 2013). The characteristics of the AFN is the differentiation from conventional food supply chains through means of establishing social ties between producers and consumers (Venn *et al.*, 2006) and a regional orientation (Wubben *et al.*, 2013).

Wubben *et al.* (2013) studied how the drivers behind the initiation of a new SFSC affects its business model and its profit margin. In doing so, the business model was the basis of the conceptual framework to study the supply chain. The business model is indeed a useful conceptual framework in research beyond case descriptions, as showed by (Venn *et al.*, 2006)

in their study of alternative food networks. The business model is the logic of the firm (Casadesus-Masanell & Ricart, 2010) and seeks to explain value creation and value capture (Zott *et al.*, 2011). It is a hypothesis of customers' wants, how a company best meets those needs and how it can get paid for doing so (Teece, 2010). Capturing or internalizing value refers to the ability to transform the value created for stakeholders into profit for the company.

Midmore & Jansen (2003) wrote that it is unlikely that even currently economically viable peri-urban farms in the long run can compete for scarce labour and land resources "unless alternative production technologies become available and the positive externalities generated … become internalized". The reality 2015 is that companies invest resources in a practice which in 2003 was seen as unable to compete for labour and land resources long term. There is thus a scientific need to reassess the viability and logic of urban farming.

A scientific assessment is based on the observed scope of factual activities and as Venn et al. (2006) argued, there is a lack of attention on how initiatives such as box schemes, farmers' markets and consumer supported agriculture is identified and examined. Such exploratory research is a necessary starting point for research and from it is possible to seek classes of business models. Analyzing such groups or classes of similar business models from a strategic point of view is one way to analyze of competitiveness as discussed by Midmore & Jansen (2003). Furthermore, because both Venn *et al*. (2006) and Wubben *et al.* (2013) studied food chains, there is yet no scientific documentation of the connection between business models and commercial urban farming, even though such a connection per definition exists. There is therefore a need to study the business activities of urban farming.

Business models already have had a central role in the study of SFSCs, yet searches for "urban farming business models" in various scientific literature search engines return no relevant search results. Although commercial urban farming is a subset, a part of or an example of a SFSC, it is also a distinct concept defined by its urban location of agricultural production. It has not yet been investigated what justifies the commercialisation of urban farming and how it takes its place in short or conventional food supply chains. This thesis aims to fill this gap, using the business model as unit of analysis in a large number of for-profit companies doing urban farming.

While several companies currently are starting new for profit farming operations in urban environment the literature exhibits a gap in understanding why. Because this area of urban farming is largely unexplored, this study must be explorative and firstly ask

RQ1: How do firms in commercial urban farming create and capture value?

Such an analysis needs a good framework which can describe how a company creates and captures value. In this thesis, the business model (Boons & Lüdeke-Freund, 2013) is that framework. The literature's documentation of benefits and premium inducing factors shapes the conceptual framework as these sources of value creation logically are reflected in business models of companies doing commercial urban farming. By using such a conceptual framework, it is possible to insert proxy variables that each represent characteristic of a

business model and so to create numerical representations of companies' business models in the conceptual framework.

However, in order to move beyond a case approach and enable some generalization it is not sufficient to represent the business models of a number of individual companies. It is also necessary to perform an analysis which connects these observations and groups them according to the characteristics of these companies' business models. Thus, a quantitative approach that groups quantified characteristics of companies' business models is needed. Such a grouping enhances the concept of commercial urban farming in scientific literature so that companies doing commercial urban farming can be further divided into groups with different approaches to the main concept. The groups will thus represent stylized business models.

With such an enhanced understanding of commercial urban farming, there exists a basis on which to analyse the business models' competitiveness in a general strategic sense. Such a strategic analysis is a contribution to the discussion on the competitiveness of urban farming which was mentioned by Midmore & Jansen (2003). A good business model provides superior value to the customer and captures this value for the innovator or implementer in monetary terms (Zott & Amit, 2008) while it is also hard to copy or imitate (Teece, 2010).

RQ2: Which of these ways to create and capture value are superior in creating and capturing value as well as defendable in competition from new entrants and substitutes?

With these three elements of analysis, this thesis will make a valuable contribution in the literature on urban farming, business models and the unexplored connection between commercial urban farming and business models which per definition exists.

This thesis will be concerned with the strategic analysis of classes of similar business models, discerned by quantitative approach, and move beyond the case approach. By studying companies rather than supply chains, the focus on governance structures and coordination mechanisms will be weaker than in the article by Wubben *et al.* (2013). However, as these aspects were covered in previous research; the gap concerns the logic of the producing companies.

The sample is limited to firms that do commercial urban farming in developed countries and that have an online presence in the form of an own website, Facebook page or sufficient volume of participation on third party pages, online media for example. See section 3.2 for how these delimitations were motivated.

2 Theory

The overall intent of the theory chapter has been to accentuate the merges already existent in combinations of strategic management literature and the business model literature, as to shape a solid framework in which to explore the creation and capture of value in commercial urban farms. Reference was taken to state-of-the-art literature on business models, the book competitive strategy by Porter (1980) and an analysis of "the Porter hypothesis" (Bradburd & Ross, 1989). This Porter hypothesis is that small firms can beat the profitability of competitors with larger market shares, given that the small companies find and exploit niches that do not require economies of scale.

An article from 2011 by Zott, *et al.* features a summary of the business model literature to date. Because of its generality and apparent comprehensiveness, this summary was used as a starting point for the literature review. Literature was thus not chosen arbitrarily as this could have enforced the researcher's bias in shaping the thesis. Instead, attention was paid to making a systematic and relevant literature review.

All notions of the business model's connection to a strategic perspective or to how business models can (or cannot) be a part in establishing competitive advantage were highlighted in the article by Zott *et al.* (2011). Each of the underlying articles that were referenced in conjunction with these highlights were then attained. In these articles, the same method was iterated until finally an associated article did not contain any further references that added to the literature review. Rather than following the researcher's bias, the literature review thus followed the scientific discussion from 2011 and backwards using predetermined rules.

All highlights were then physically cut out and puzzled together into stories about what business models are, what role they fill in academia and practice and what is important to consider when applying the concept. This picture of cut-outs from 10 different articles was translated into text and combined with the strategic management perspective of Porter (1980).

2.1 The business model

According to Boons and Lüdeke-Freund (2013), every idea and operation with an inherent potential value, needs a suitable business model which unleashes that potential so that the value reaches customers, making invention into innovation. The business model defines the architecture of how a company creates value and how it converts this value into monetary profit by terms of value capture (Teece, 2010). As consultants for IBM in 2006 surveyed the attitudes to innovation of large corporations' CEOs, the results showed that competitive forces has led to business model innovation being regarded an important part of firms' innovation (IBM global business services, 2006). At the same time, CEO's also accentuated the parallel importance of a focus on products, operations, services and markets.

Supporting the notion it makes sense to think of business model innovation and at same time maintaining a focus on products, services and markets, Zott and Amit (2008) claim that the firm with a special business model that creates value superior of the rivals' holds a potential advantage. Casadesus-Masanell and Ricart (2010) agree that the business model is an instrument through which firms can compete. Teece (2010) concludes that business model

innovation can be a path to competitive advantage, but only if it is differentiated enough from competitors' and hard to replicate for both current competitors and new entrants alike. Zott and Amit (2008) contend that the product market strategy and the choice of business model are complements which together create a competitive advantage. Meanwhile, they stress that a great business model alone does not in itself create that advantage.

Zott and Amit (2008) thus differentiate between the product market strategy and the choice of business model. They define that while product market strategy is the way in which firms choose to position themselves relative competitors in the market space, business models is a "structural construct" which describes the pattern of firms' economic interaction with external parties in the markets facilitating interaction with suppliers and customers. In this way, the business model is a plan for the firms' value creation, value capture, performance and conjunct competitive advantage (Zott *et al.*, 2011). Consequently, the business model offers a rationale for the value creation while remaining distinct from the firms' market strategies (Zott & Amit, 2008).

The business model is often hard to protect from replication and therefore a successful business model often is not enough to assure competitive advantage (Teece, 2010). A good business model is hard to imitate, provides superior value to the customer and manages to capture this value for the innovator or implementer. In academia, the business model is a multidiscipline concept that has only been around in literature since the later part of the nineties as the e-business started making the importance of suitable business models apparent (Zott *et al.*, 2011). Economists generally assume perfect markets and therefore have no need for business models, the structural concepts which in reality exist to create incentives to create and capture value in a way that make markets work at all (Teece, 2010). Surprisingly enough, it likewise had no acceptable place in the organizational, strategic and marketing literature in 2010 (Teece, 2010). This was the reason for the summary of Zott *et al.* in 2011, which aimed to synthesize existing literature and define the term business model once and for all.

Doganova and Eyquem-Renault (2009) have assumed a less enthusiastic position in the discussion, claiming that the business model is scale model, artefact, performance or relational tool with empirically unproven instrumental efficiency. Their stance is that the business model primarily is an evidence of feasibility used in presentations of new ventures to investors, journalists, customers and other third parties. Certainly this is true to some extent, for companies do communicate their intentions to third parties (lecture, Berg, 2014). In this perspective, an efficient business model must pass the narrative test, whether the model story makes sense, and the numbers test, whether the implied math adds up (Doganova & Eyquem-Renault, 2009).

Doganova and Eyquem-Renault (2009) claim that quantitative empirical studies of the relation between the firm survival or its profitability and whether they performed business planning activities before initiating the venture have failed to provide consistent results. This is however not supported by their references. The results in the referenced articles are that, goal-setting is positively correlated with performance (Locke & Latham, 2002), business planning supports new venture survival (Delmar & Shane, 2003) and that formalizing a

business plan before approaching customers lowers the likelihood of termination with 46 % while the same action before initialization of marketing activities lowers the likelihood of termination 41 % (Shane & Delmar, 2004). On the contrary, there seems to be both philosophical and empirical support for the "instrumental efficiency of business models" and business planning.

2.1.1 Analytical perspectives on competitive business models

Zott and Amit (2008) offer a conception of business models with two design themes; novelty-centred business models include new ways to conduct economic exchanges while efficiency-centred business models intend to reduce transaction costs. However, referring to the example of Amazon, they conclude that the two themes are not orthogonal; Amazon's business model was both novel and efficiency-centred.

According to Boons and Lüdeke-Freund (2013), different business models are characterized by differences and similarities in four generic areas; value proposition (the value offered to the customer), supply chain organization (structure and management of upstream relations), customer interface (structure and management of downstream relations) and financial model (benefits and costs from the three previous elements and their distribution among business model stakeholders). While these are interesting and helpful frameworks, they do not relate the business model literature to the strategy literature.

Casadeus-Masanell and Ricart (2010) make the following division between business model, strategy and tactic.

- *"Business model refers to the logic of the firm, the way it operates and how it creates value for its stakeholders and*
- *Strategy refers to the choice of business model through which the firm will compete in the marketplace while*
- *Tactics refer to the residual choices open to a firm by virtue of the business model it chooses to employ."*

Note that they make no difference between product market strategy and business model as means to compete in the marketplace. Zott *et al.* (2011) later clarified the matter by insisting that the business model "provides a rationale for value creation" distinct from the product market strategy. Strategy however, can still refer to the choice of both business model and of product market strategy. Moreover, a firm's strategy can include several courses of action – several business models to be applied in different scenarios of technology development, conjuncture and status of the competitive landscape (Casadesus-Masanell & Ricart, 2010)

Because business models usually are costly and difficult to effectively change, firms tend to try acting within their current business model (Casadesus-Masanell & Ricart, 2010). If tactical measures within the business model frame finally are considered insufficient to confront competition, companies can make a strategic change and redesign the business model. In such a strategic process, the management makes choices about how the organization is to operate which in turn will have consequences for how the firm performs and how well it performs.

Casadesus-Masanell and Ricart (2010) define three types of choices that shape the business model; policy choices, asset choices and governance choices. “Policy choices” refer to decisions that apply to all parts of operations such as opposing unionization of workers or encouraging attention to sustainability concerns in operational decisions, possibly by the use of monetary incentives such as profit sharing or high management bonuses. “Asset choices” refer to decisions about manufacturing facilities, flexible or cost efficient production equipment and other tangible assets. “Governance choices” refer to the contractual structure that distributes decision making power over assets and policies throughout the organization.

(Chesborough, 2007) has tried to explain why established companies sometimes have a hard time adapting their business model in different scenarios of technology development, conjuncture and status of the competitive landscape. They suggested that (1) managers that have been brought up in the existing organization know the current business model very well and therefore are reluctant to switch even when this might be necessary. Meanwhile, other firms change management on a regular basis to overcome this but the time with the same management might be too short. The new business model design is often not optimal straight away, but rather a good business model is the result of a long process of trial and error (Teece, 2010).

To summarize, business models matter for a company’s competitive ability and are the results of strategic planning (Zott *et al.*, 2011); (Casadesus-Masanell & Ricart, 2010); (Teece, 2010), yet a decision distinct from the choice of how the company is to position itself in a product market (Zott & Amit, 2008). All companies have a business model, but it is not always consciously chosen. Empirical analysis has shown that undertaking business planning before starting to market the product decreases the likelihood of business failure in new ventures (Delmar & Shane, 2003). Good business models are either efficiency-centred, novelty-centred or both (Zott & Amit, 2008) and answer the questions “who is the customer and what does the customer value?” and “what is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?” (Casadesus-Masanell & Ricart, 2010). Moreover, the good business model is distinct and hard to imitate (Teece, 2010). Finally, not least in order to be able to effectively communicate the business plan, the business model “story” must be coherent and its underlying mathematics must add up (Doganova and Eyquem-Renault, 2009). Arguably, business models are finding an acceptable place in the literature, not least thanks to the works of Zott *et al.* (2011).

2.2 Competitive strategy

In terms of business models, strategy refers to the choice of business model, the vehicle through which the firm competes in the product market (Casadesus-Masanell & Ricart, 2010). The model which likely is the most used in strategic analysis is the five force model by Porter (Figure 1). The idea is that if any one of the powers relative to the company in question becomes too strong, profitability decreases. The company must therefore manage its position in response to the development of the five competitive forces or affect the forces in a way that benefits it in terms of profitability. Only one of the forces is the rivalry among organizations; being competitive is thus a much more general quality than one might intuitively imagine.

Figure 1. Forces driving industry competition (Porter, 1980, p. 4).

Parallel to this model, Porter (1980, p. XVIII) describes a model of the context in which a company's strategy is to be formulated and accentuates the importance of that a strategy is adapted to its environment. In the language of Casadesus-Masanell and Ricart (2010) the strategy should choose a business model which is adapted to its environment and context. In this context of strategy formulation, Porter (1980) suggest looking to the company's strengths and weaknesses, the industry opportunities and threats, the personal values of key implementers to ensure commitment and the broader societal expectations on the firm.

2.2.1 The threat of new entrants

The threat of new entrants in general depends on the attractiveness of an industry in terms of possible profits relative to the cost of overcoming barriers; a relationship which can be described as the entry deterring price.

There are seven barriers to entry. Those of most interest here are capital requirements, product differentiation and access to distribution channels. It is important to realize that entry barriers are dynamic, that firms do have the power to influence these barriers and that height of any entry barrier is relative; some firms outside the industry may possess skills or resources that help them overcome existing barriers easily.

Product differentiation is a barrier to entry if it means that customers are loyal to brands. Overcoming loyalties can be difficult and involves risky investment on advertisement that only is worth what the advertisement might bring in future revenues. That is, a company which fails to break the consumers' loyalty toward a competitor has only incurred sunk costs.

Capital requirements limit the amount of possible entrants and also means exit barriers are large if the greenhouse must be regarded a sunk cost in the case of liquidation.

Access to distribution channels is another barrier to entry, as new entrants need to convince retailers to provide shelf space, possibly through offering promotion campaigns, lower prices and other costly initiatives.

2.2.2 The intensity of rivalry among existing firms

The intensity of rivalry among existing firms depends on the number of competitors and their relative balance, industry growth rate, fixed costs (related to exit barriers), commoditization, diversity of competitors and the prioritized goals of each firm.

If stakes are high and the price of failure substantial like that of not being able to run production at full capacity, the competition cannot afford to overlook aggressive strategy implementation and will not be forgiving to establishment of extra capacity. Especially so if growth has declined and the industry has matured so that extra capacity may not be met by an increase in demand at a profitable price level.

Commoditization implies low switching costs (another entry barrier) for customers and low brand loyalty due to non-existent product diversification. This usually leads to tough competition on the basis of cost minimization and price.

2.2.3 The threat of substitute products

Determining *the threat of substitute products* is a matter of finding products that provide the same function as the own product. It is necessary to look far away from the own sphere of competitors in order to find these. Special attention should be paid to products that improve the price-performance trade-off and substitutes from industries earning high profits. High profits usually imply strong financial vitality and these firms may be able to rapidly bring their product into play if profits in the own industry decline. The threat of substitute products is also influenced by consumers' propensity to substitute the existing scheme. Sometimes customers are only loyal because they lack alternatives.

2.2.4 The bargaining power of buyers and suppliers

The bargaining power of buyers depends on buyer vs. supplier concentration, the price of the product relative buyers' funds, commoditization, the presence of switching costs, profitability of buyers, the importance of the product quality for the final quality of the buyer's offer or pleasure (consumer), information balance and whether buyers can pose a credible threat of backward integration.

If the buying entities are more concentrated than their suppliers (the industry under analysis) then the suppliers can rarely afford to decline an offer of purchase from one of the buyers. Conversely, if suppliers are more concentrated than their buyers, the buyers have few alternatives to choose to buy from. There is a matter of low or high exchangeability in the negotiation situation that shifts the bargaining power balance of the parties and that increases with the extent to which the product resembles a commodity, the absence of switching costs for the buyer and the unimportance of the industry product's quality for the final quality of the buyer's offer.

Commoditization has been on the agenda in the food industry for years now and retailers have begun posing a credible threat of backward integration by creating private labels (lecture, Eckerdal, 2014). The production of these labels is most often outsourced to another manufacturer that perhaps already is supplying the retailer with its own A-brand. Although a deal for producing a private label may be initially profitable, it is a way for the buyer to increase the exchangeability of producers. Consumers choosing the retailer brand buy a product and a brand and may not notice a change in origin. Thereby the content of the pack has been commoditized and the bargaining power of the retailer increases.

The bargaining power also depends on how hard the party tries. Specifically, a buyer that is pressured by low profitability and who needs to buy a product representing a significant part of the cost mass then that buyer is prone to wield as much leverage as possible to keep down the price, even to the disadvantage of suppliers.

The bargaining power of suppliers depends on roughly the same factors as for the buyers' bargaining power, only reverse. Suppliers can threaten to forward integrate, create switching costs for the industry or diversify in order to improve their position in the negotiation situation. Their bargaining power also depends on the importance of the industry as a market and their concentration relative to the industry. In particular, one should note labour as one supplier to any industry and obviously the bargaining power of that entity increases with the degree of organization.

2.2.5 Challenging the Porter hypothesis

Can small firms be competitive in relation to producers with big market shares? In the 1980's it was often argued that market share is positively related to profitability (Bradburd & Ross, 1989). However, before Porter's publication of Competitive Strategy in 1980, he hypothesised that small firms could be able to reverse this relation by means of strategic choice by *focusing on niches that don't require economies of scale*.

Bradburd & Ross (1989) attempted to statistically test this hypothesis for a number of firms in the United States. Before doing so, they carefully noted that if small firms found profitable niches that were easy for larger firms to follow into they would soon face increased competition and loose the benefit of their diversification. Thus they realized that it is a hypothesis that has to do with heterogeneity and compared the value of sales in certain product categories with the total amount of sales in the same industry made by small and large firms respectively. This became a measurement of heterogeneity which was set in relation to the firms' profit to sales ratio.

The small firms employing niches could not beat the profitability of their industry leaders, but they could beat the average of the top four. They then concluded that both the relation between market share and profitability and the Porter hypothesis has empirical support. Consequently, the strategic literature teaches us that market share does affect profitability because size gives greater negotiation power but that smaller firms via diversification still can manage to reduce or even reverse the profitability advantage of the larger competitors.

3 Method

Based on literature review, a framework of business models in commercial urban farming was made. The basis was the "generic business model concept" by Boons & Lüdeke-Freund (2013) which consists of a

- value proposition (the value offered to the customer)
- supply chain organization (structure and management of upstream relations)
- customer interface (structure and management of downstream relations)
- financial model (benefits and costs from the three previous elements and their distribution among business model stakeholders)

This conceptual model of the business model provided a framework in which empirical data from commercial urban farming could be prepared for analysis and was thus necessary to fulfil the aim of this thesis. This thesis aims to fill the literary gap concerning business models in urban farming by using the business model as unit of analysis in a large number of for-profit companies doing urban farming. It will not take a case approach but extend the study to strategic qualities of groups of similar business models.

The information about the companies' activities from websites and email conversations (see appendix 1) was quantified in accordance with the business model concept by Boons & Lüdeke-Freund (2013) (see data in appendix 2). Thereafter, Agglomerative Hierarchical Clustering (AHC) was used to classify the firms according to the proxy variables used (see 3.2). Additionally, four in person interviews were made for triangulation and calibration of the data. To answer the second research question, the classes of business models were analyzed strategically according to the literature review in chapter 2.

3.1 Choice of method

The first research question was answered using two components: (1) a conceptual framework for numerically representing the firms' business models and (2) a way to classify the observations of characteristics in companies' business models into classes. The conceptual framework shaped by Boons & Lüdeke-Freund (2013) was chosen because it was based on a comprehensive literary review on the state of the art of business models and thus well positioned in the scientific literature consensus on business models.

In order to connect this business model concept to urban farming the framework was "dressed" in proxy variables describing the characteristics of each firm's business model. These proxy variables were chosen based on the documentation of benefits of urban farming and in the form of yes and no questions, because this was a rational way to translate qualitative observations to numbers without subjective estimations. Yes was given the value 1 and no was given the value 0. See more about this in chapter 3.3.

With the binary data at hand, a continuous approach such as component analysis would have been inappropriate (Lee *et al.*, 2010). Instead a binary approach was used, agglomerative hierarchical clustering, as described by Jain & Dubes (1988, p. 58) and endorsed by Warrens (2008, p. 8) for usage with binary data. Its establishment in the scientific statistical literature,

the detailed mathematical documentation available, the apparent suitability to the required analysis (clustering data without a dependent variable) and to the data type (binary data) were four strong reasons supporting the choice for this method of classification analysis. It therefore became the quantitative analysis tool for meaningfully answering the first research question, as mentioned in 1.3.

Finally, with a theory chapter based on 10 different articles and a book by Porter (1980) there existed a good documentation of the connection between business models and strategic competitiveness in its general sense. From this basis, it was therefore possible to develop the results of the agglomerative hierarchical clustering into strategic analysis that conversed with and contributed to the literature on the competitiveness of commercial urban farming.

3.2 Data collection

Because the economics of urban farming were of interest, only commercial firms were included in the sample. This means that every firm in the sample is operated for-profit. No restrictions in terms of size were made, but based on the chosen definition of urban farming (Bills *et al.*, 2002), only food producing urban farming were studied.

Urban farming for personal consumption as well as for income supplement exists in developing and developed countries alike (Hamilton *et al.*, 2014); (Mok *et al.*, 2014) yet in developed countries this is generally not referred to as commercial urban farming (Cohen *et al.*, 2012). Because of the existence of a defined difference between commercial and not-for profit urban faming in developed countries, the population was constrained to firms operating commercial urban farming in developed countries.

Still, because the research questions warranted no geographical delimitation, a limited geographical perspective had to be avoided. Therefore, the internet was an important source of information. Firms in developed countries appeared more likely to have a website with information which further justified the choice to delimit the data collection to developed countries. However, it is also acknowledged that there exist urban farms without online presence. Thus, the sample studied was the firms within commercial urban farming in developed countries with online presence (own website, Facebook page or mentioned in online media).

To avoid a bias toward English speaking developed countries, friends were asked to contribute search terms in their native languages via social media. The search terms on Google included *agricultura urbana* (Spanish), *stadsodling* (Sweden), *agbe igbalude* (Yoruba) and *urbana poljopriveda* (Serbian/Bosnian/Croatian). However, most firms were found not because of the brilliant precision in these search terms, but more often because somebody had made a mention of the company name in media and on blogs.

Finally a specific search for urban mushroom was made, due to the fact that mushrooms were identified in section 1.2 one as highly perishable, yet no firm growing mushrooms in the city for commercial reasons had been found using the search terms above.

Using mainly Google and Facebook, for-profit firms were sought whose primary value added was urban produce. A total of 32 such firms were found that fit within the delimitations. They stemmed from the Americas, Europe and Asia.

The goal was to find a large enough sample to allow for meaningful statistical analysis and this was achieved. However, a sample of 32 is dwarfed by the fact that the Swedish company Plantagon that develops greenhouses for urban farming has been mentioned in 50 000 articles in the last 2 years (pers. com., Pettersson, 2014). Although it is known that most urban farming in developed countries is non-commercial (Cohen *et al.*, 2012) and accentuates other values than food production, the disproportionality of the media attention that the phenomenon has received came as a surprise.

With the rather small sample of 32 cases, it was realized that a survey or email enquiry with a less than perfect response rate would render the analysis unviable or irrelevant. Therefore a survey method was not used, as to avoid burdening the respondents with questions whose answers already were to be found on their websites and in earlier interviews. The data was instead taken from webpages, online presentations, new articles and press information sheets. However, in most cases, there were some pieces of information missing and it was then that email contact was used to ask precisely the question(s) that would give the missing information. No questions that had already had their answer in media and displayed on the website of that firm were asked. Personal contact was mostly taken with the CEO, COO or similar position at the company in question.

In addition, four interviews were made in person as to understand the research area and to triangulate the data. One was with the urban farmer Mr. Borowsky in New York City, another with Mr. Hoffman, marketing manager of GrowNYC, a company that manages over 60 farmer's markets in New York City. These two interviews were on the topic of their business models while the other two were open conversations. One open interview was held with the CEO of Efficient City Farming, a Berlin based company developing solutions for large scale urban aquaponics and the other was held with the COO of Plantagon, a Swedish company developing solutions for large scale urban covered horticulture.

3.3 Proxy variable selection

Using the framework of the business model concept as a basis, proxy variables where chosen for each category to dress this frame in proxies that would make it suitable for data collection and analysis of commercial urban farming. For example, the value proposition contained proxy variables describing what actually was being produced and some known premium inducing factors. The factors accentuation of environmental sustainability, organic production and social sustainability were given their own proxies. The proxy variable *2-purpose* was meant to show that apart from a traditional nexus of activities associated with production, processing and marketing of food, as well as its distribution and consumption, the firm was using the urban farming operation for gaining marketing benefits or selling services designed to capture indirectly created values.

The proxies of value proposition each got the value 1 if the answer to the corresponding question was yes and 0 if the answer was no. This binary approach was simply a practical choice, the only possible choice, as questions with yes and no answers are best quantified as 1 and 0. Some proxies may appear to sort firms according to what products they offer. This is reasonable in terms of classifying commercial urban farms according to their business models as different product strategies may call for different business models.

- Leaves: Does the farm grow leafy greens?
- Fruits: Does the farm grow any kind of climacteric or non-climacteric fruits?
- Fish: Does the farm raise any kind of seafood?
- Animal: Does the farm keep animals either for derivative products or slaughter?
- Environ: Is the farm communicating environmental sustainability as part of the value proposition?
- Organic: Is the produce grown with organic methods?
- Social: Is the farm communicating social sustainability, community welfare or social interaction as part of the value proposition apart from creating jobs?
- Quality: Is the produce marketed as superior quality?
- Price: Can it be safely assumed that the produce sells at a premium?
- 2-purpose: Does the company sell a secondary value proposition that directly benefits from the production of plant cultivation and husbandry in and around cities? Any company with a secondary value proposition has this briefly explained in text in appendix 1, which contains all the information gathered on the examined firms.

The second part of the business model framework is supply chain organization. Since by definition, all firms included in the data were producing a product, their inputs were similar. These inputs of fertilizer, seeds, growing substrates, labour, financing, equipment etc. were rarely discussed in the information on the firms' websites and their sourcing did not seem all that unique. Instead, four proxies were chosen with focus on the technology application mentioned by Midmore and Jansen (2003). One of these proxies was ordinal, taking the values 1-3.

- Centrality: What is the degree of urban centrality of production? High (centrality = 3) means production is taking place in a particularly dense area, for example among high rise buildings. Medium (centrality = 2) means in or in direct conjunction to an area densely built with lower houses such as malls or villas. Low (centrality = 1) means that the production is just on the fringe of the densely populated areas and therefore on the edge of urban farming's definition. Food production more rural than "low" has no part in the dataset.
- Lease: Does the company lease production space/equipment?
- Vertical: Is the production system physically vertical? Vertical production can be on the ground or on a roof top and is therefore considered independent from "Roof top".
- Roof top: Is the production area on a rooftop? A rooftop location can house either vertical or one story production and is therefore considered independent from "vertical".

The implicit perspective taken to view the supply chain was therefore just after production. Unfortunately, this meant that the dataset of binary numbers could not describe the level of vertical integration in the supply chain. This also meant that customer interface, the organization of downstream relations, was seen as the description of where the produce then was sent, and by whom. In customer interface, two proxy variables dealt with presence of a contractual relationship between the producer and the customer. CSA, *Community Supported Agriculture*, referring to a sort of annual, seasonal or open subscription (Venn *et al.*, 2006), and PPA, *Produce Purchase Agreement*, (Thumann & Woodroof, 2008) referring to a long term contract reserving the bulk of a production site to support one dominant customer.

- Market: Is the produce being sold at a farmer's market or an onsite market?
- Retail: Is the produce being delivered to grocery stores or other commercial retail?
- Rest.: Is the produce being delivered directly to restaurants?
- Home: Does the company offer consumers home delivery?
- Own distr.: Does the firm have internal capacity for transporting the produce to customers?
- CSA: Are annual production shares or subscriptions offered that resemble *Community Supported Agriculture*?
- PPA: Are the sales contracted in terms of volume and price to a dominant buyer?

Finally, the financial model was simply interpreted as a representation of the sources of finance needed to undertake the investments.

- Equity: Is the company a limited liability company or other form of equity taking entity?
- Credit: Does the company rely on loans from banks for financing?
- Grant: Has the company received special grants to finance operation or investment?
- Crowd: Has the company ever used crowd funding?

3.4 Data analysis

When addressing firms' business models, Casadesus-Masanell and Ricart (2010) note that the complete business model description often is too complex and vast to work with, so an analyst needs to simplify its representation. The two ways in which the analyst can take the full business model and reduce it to a workable representation are decomposition and aggregation. Aggregation is to zoom out and to categorize detail level choices and their consequences into larger shares. Decomposition refers to finding groups of choices and consequences that do not correlate and interact with each other and therefore can be viewed in isolation.

Two aggregations were made during the analysis. One aggregation was to replace the proxies describing the firm's product (*Leaf, Fruit, Fish, Animal*) with the number of products offered by the firm. The number of products ranged from 1 to over 500. Because such high numbers seemed disproportionate in relation to the binary numbers, the measured values were replaced with an ordinal variable ranging from "focused" (1) to "very diverse" (5) product offering.

This proxy was labelled *Diversity* and was used in order to see the relation between the level of variety in the product offering and the other proxies.

The second aggregation move was to replace the factors representing intangible values (*Environ, Social, Organic*) by simply adding them into the ordinal proxy *Intangible* taking values 0-3 as it is the sum of *Environ, Social* and *Organic*. It was used to see the relation between the level of *Intangible* value focus and the other proxies. Numerical analysis was made both on the original data (without the eliminated proxies) and also on the data set with aggregated proxies instead of the proxies that the aggregation replaced.

It should be emphasized that an extremely important part of the data analysis was attributed to the domain knowledge, the qualitative interpretation of implied numerical relationships. This method is noted in Jain and Dubes (1988, p. 189) as one part in the cluster validation process and is referred to as an external validity index where results are compared to a priori information.

3.4.1 Tools of analysis

To answer the question of how firms in commercial urban farming create and capture value, the data collected had to be analysed in such a way that patterns could be found which could describe different distinct ways to compete. Although a few patterns appeared obvious even during data collection, a correlation table was needed in order not to miss any correlations.

The statistical tool applied for clustering the firms was agglomerative hierarchical clustering (AHC) [1]. The software used for analysis was XLSTAT (version 2014.06.04), a statistical add-in for Microsoft Excel.

Agglomerative hierarchical clustering looks at the similarities between two binary vectors that each represents an object (Warrens, 2008, p. 3). An object can either be a (proxy) variable or a firm. Thus, this method can not only help discern the patterns between variables, but between firms as well, without any need for a dependent variable. Its basis is a proximity matrix which in this thesis was calculated using Pearson's phi, a similarity measure especially made for binary data which is closer described in section 3.3.3. Using a proximity measure for binary proxies, it was not possible include the ordinal proxy centrality in the AHC, nor the ordinal aggregated proxies of the secondary analysis.

In order to compensate for Pearson's phi's incapability of quantifying the similarities and correlations between ordinal values, the Pearson Correlation Coefficient complemented the analysis. This meant that the binary proxies were treated as continuous in order to find

[1] Other attempted methods for cluster analysis were multivariate correspondence analysis (MCA) and principal component analysis (PCA). In MCA, a number of ordinal or nominal variables are checked for correspondence so that the number of dimensions describing a certain output or result can be reduced and the interpretation simplified. However, this thesis is exploratory and not confirmatory (Robson, 2011, p. 419) and therefore no dependent variable such as profitability or market share exists for the data set. Consequently, the factors did not seem to, as intended, each describe a distinct business model and multivariate correspondence analysis was dropped from the analysis.

PCA is a kind of factor analysis intended to make sense of a large dataset with correlations between many variables (Robson, 2011, p. 442). It is a technique typically used in exploratory research and can be applied on datasets stemming from questionnaires. Although often useful, Lee *et al.* (2010) mentioned that the common PCA is generally inappropriate for anything but continuous data. For the (ordinal and nominal) data of this thesis, it produced messy that were difficult to interpret.

correlations between the ordinal proxies and the binary ones. When applied to binary data, the Person correlation coefficient returns the same results as Pearson's phi and thus all the cells that described a relationship between two binary proxies remained the same as when Pearson's phi was used. Therefore, the matrix displayed in section 4.1 (Table 3) is actually calculated with the Pearson correlation coefficient and special caution should be exercised when interpreting the relations between binary and ordinal proxies.

3.4.2 Agglomerative Hierarchical Clustering

Agglomerative Hierarchical Clustering uses the values of a proximity matrix to gradually merge the n objects into classes (Jain & Dubes, 1988, p. 58). The first step is to merge the two objects with the most similarity (highest phi or r-value). After two objects have been merged, the rows and columns representing the two merged objects are replaced by a row describing the class' proximity to the other objects, according to the applied algorithm's rule (Jain & Dubes, 1988, p. 72). The number of matrix dimensions then decreases through an approach referred to as updating matrices.

The proximity of the formed two-object-class to a third object is then given by whichever of the objects in that class has a higher similarity to the third object (single-link algorithm) or whichever has a lower similarity (complete-link algorithm) depending on the algorithm applied (Jain & Dubes, 1988, p. 61). For the data under analysis, a complete linkage algorithm separated the classes better than the single linkage algorithm and thus the dendrogram was easier to interpret. Therefore complete linkage algorithm was used in the AHC of this thesis.

After the matrix has been updated, the highest r (or phi) is again sought out and targeted with the next merger. This process is continuously visualized in a dendrogram (Jain & Dubes, 1988, p. 58). On the bottom are all the individual objects. As the algorithm works its way from the strongest significances to the weakest, clustering is made on different levels of significance, which can be read on the left side significance scale. The clustering is made by cutting the dendrogram horizontally at some level of similarity.

When using the AHC and interpreting its result, one should be aware of that since the algorithm stops only when the firms all have been clustered together, i.e. it takes no consideration to the statistical significance of the values in the proximity matrix, not always are the similarities between objects in a cluster statistically significant. The cautious researcher thus interprets the dendrogram in light of the proximity matrix and takes the shape of the dendrogram into consideration (see section 4.1 where this is discussed in connection to the presentation of the dendrograms).

3.4.3 Pearson's phi as proximity measure

The basis for AHC is a proximity measure which must be chosen in respect to the data. A discussion which has rendered a multitude of similar yet distinct proximity measures is whether it is an indication of similarity between objects that a sample has one 0 in each of the cells of the two objects under analysis (Jain & Dubes, 1988, p. 5). It was decided that this binary combination indeed could be an indication of similarity in the dataset of this thesis, and therefore the obvious choice of proximity measure was Pearson's phi.

It is important for the continued method chapter that an understanding of Pearson's phi is established. Pearson's phi measures the degree of similarity between two binary variables and thus ranges from -1 to +1 where -1 implies a negative correlation and +1 implies a positive correlation (Jain & Dubes, 1988, p. 5). The measure is composed by four quantities, a, b, c and d, each representing the number of occurrences of (1,1), (1,0), (0,1), (0,0), respectively.

The columns representing the objects (firm or proxy variable) are placed next to each other and the number of rows having the value 1 for each of the variables equals the quantity a, the number of rows having the value 1 for the first variable and 0 for the second equals the quantity b, the number of rows having the value 0 for the first variable and 1 for the second equals the quantity c while the number of rows having the value 0 for each of the variables equals the quantity d. This is illustrated by the contingency matrix below.

		Variable two	
Variable one	Value 1	Value 0	Total
Value 1	a	b	p_1
Value 0	c	d	q_1
Total	p_2	q_2	1

Figure 2. Pearson's phi contingency matrix (Warrens, 2008, p. 4).

These four quantities are then used to calculate Pearson's phi so that

$$S_{phi} = \frac{(ad-bc)}{\sqrt{p_1 q_1 p_2 q_2}} \quad (1)$$

where S_{phi} denotes Pearson's phi. The proximity measures are then entered into a proximity matrix of size m x m where m is the number of objects.

There is then the matter of validating the statistical significance of these measures. After considering the different validation methods available, a simple Student's t-test was chosen.

The t-test applied in significance evaluation of the proximities in this thesis was successfully applied by Wang and Tian (2013) on continuous data. They chose as significant variables those that had a moderate or strong effect on the responding variable and which also were significant at the p = 0.05 level. Moderate and strong are to evaluative terms which were defined by Evans (1996) and which refer to similarities represented by proximity measures with quantities in the ranges 0.4-0.59 and 0.6-0.79 respectively. A proximity measure quantity below 0.4 is referred to as weak and that above 0.8 as very strong. Moreover, Lowry (2000) explains that the statistic used by Wang and Tian is approximately equal to the normal t-statistic when n>5. That means that

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} \quad (2)$$

where r is Person's correlation coefficient and n is the number of data samples.

The initial problem of using common significances such as t-tests on binary data still remains and stems to the fact that the mean of a set of binary values is undefined in terms of a binary dataset (with the extreme exceptions of only 1s or only 0s). The mean of the binary numbers instead returns the percentage share of the samples with the value 1.

In disregard of this complication, applying the measurement on the proximity matrix describing the similarity between proxies yielded useful results that highlighted the statistical significance of some similarities. Thus, applying the t-test to this set of binary data, although not mathematically correct, was useful in this particular case. Just as Wang and Tian did, a confidence level of 95 % was chosen, which means that t-values in excess of 2,042 were highlighted.

Solving (2) for r yields

$$r = \sqrt{\frac{t^2}{(n-2)+t^2}} \qquad (3)$$

which means that correlation coefficients or phis in excess of 0,349329 were highlighted for proxies (degrees of freedom = 30) and 0,466388 for firms (degrees of freedom = 15).

The numerical relationships were compared to a priori domain knowledge and also evaluated with other proximity measures that gave matching results. Those similarities were deemed statistically significant that would have been significant if the data truly had been continuous.

3.5 Ethical considerations

As a means of doing everything possible to secure the requested information, every firm that contributed with information in person or via email or telephone was offered anonymity. Although no one requested this, it was an ethical consideration that also made sure my research did not create disadvantages for some participants in any way.

While the data revealed that most of the firms in commercial urban farming accentuate environmental sustainability as a part of the value proposition, attempts were made to avoid assumptions about the inherent sustainability (or unsustainability) of urban horticulture. Rather, this research has been about the economic aspects of the phenomenon. Still, because many firms in the sample claimed their operation environmentally sustainable, a part of the discussion was dedicated to problematizing some common arguments posed for that urban horticulture would be inherently sustainable, or have a superior potential for sustainability.

3.6 Contribution to literature

The exploratory research of urban farming is approaching completion. This thesis follows the overview of urban farming in developed countries from a historical and contemporary perspective by Mok *et al.* (2014) and the more detailed description of New York's urban farmers by Cohen *et al.* (2012) where urban farms were divided into four classes. With the further analysis of the commercial class, which contained the smallest number of firms, this thesis contributed to a wider understanding of urban farming in general and deeper understanding of commercial urban farming in particular.

Parallel to this line of academic work, Wubben *et al.* (2013) applied a business model approach which influenced the method choice of this thesis. Unlike much of the previous academic writing on alternative food networks, their analysis abandoned the case approach. However, their data was only collected in the Netherlands and although this simplified data collection, it affected the generalizability of their results negatively.

With a global sample and a praxis to include every identified firm not subject to delimitation, this thesis is an extension of the academic writing that already has gone beyond the case approach in studying urban farming and alternative food networks. Moreover, it further establishes the economic perspective on alternative food networks, and introduces this perspective for commercial urban farming.

On the aggregated level where classes were produced, its exploratory results are generalizable. This framework can be used to theoretically define a sample of commercial urban farms and can thus be used as a framework within which to apply confirmatory research. For example, the finance measures (profit margin, return on capital employed) of urban producers, peri-urban producers and conventional producers can be compared in order to see whether urban farms make more money and in what contexts.

The propositions of the strategic analysis have a weaker empirical basis than the classification of firms and would require dedicated confirmatory research in order to be properly validated.

4 Results

This chapter is an overview of the results of proximity matrices and AHC analysis which was made using XL-stat as a plugin for Microsoft Excel parallel to data interpretation by means of domain knowledge (learned lessons, gut feeling etc.). The data that the analysis is based on can be found in Appendix 2.

4.1 Primary analysis of proxy similarities

As can be easily understood, the mean calculated over a set of binary values returns the portion of those values equal to 1. Figure 3 below thus shows the proportion of the companies that have the value 1 for the proxies[2] defined in section 3.3 Proxy variable selection.

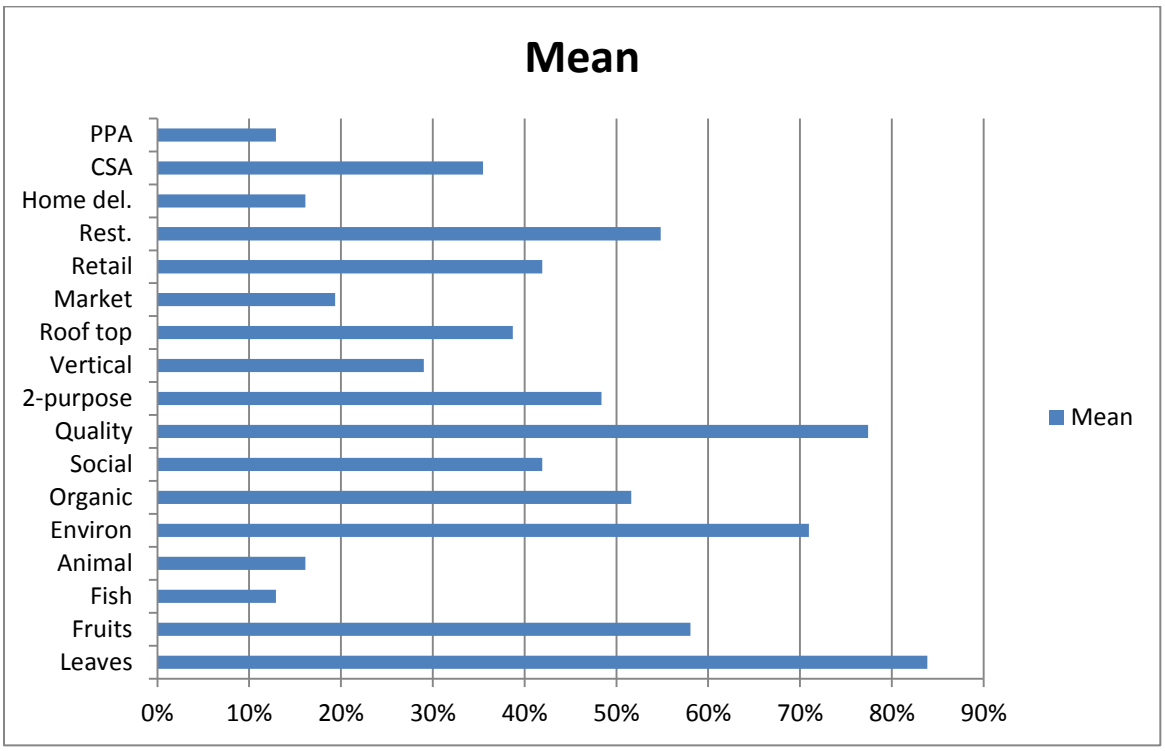

Figure 3. Mean of binary proxies.

In order to only show proxies that are in the same range in one figure, *centrality* with the mean value of 2,129 was omitted from Figure 3. The strongest trends in the value proposition was that 84 % of the companies grew some sort of leafy green, that 78 % accentuated the quality of their product, and that the sustainability of the operations was an important selling point in 71 % of the cases. In the customer interface, restaurants were the most common mode of output, applied by 55 % of the surveyed firms, before retail at 42 %.

Table 3 is a proximity matrix calculated with the Pearson Correlation Coefficient where the relationships between the binary proxies are as if computed with Pearson's phi and the correlations with the ordinal proxy variable *Centrality* stem from treating the binary proxies as continuous and thus should be interpreted with caution.

[2] The proxies *Lease*, *Equity*, *Grant*, *Crowd*, *Price* and *Own distribution* were removed from the analysis because they did not add analytical value. See 6.3 for details.

Table 3. Pearson correlation coefficients

	Leaves	Fruits	Fish	Animal	Environ	Organic	Social	Quality	2-purpose	Centrality	Vertical	Roof top	Market	Retail	Rest.	Home del.	CSA	PPA
Leaves	**1**																	
Fruits	0,141	**1**																
Fish	-0,052	-0,314	**1**															
Animal	-0,289	0,033	-0,185	**1**														
Environ	-0,104	-0,051	-0,081	0,104	**1**													
Organic	0,086	0,252	-0,086	0,086	**0,539**	**1**												
Social	**0,356**	**0,473**	-0,181	0,170	-0,129	-0,064	**1**											
Quality	-0,020	-0,314	0,228	-0,189	0,133	-0,076	-0,332	**1**										
2-purpose	0,059	**0,576**	-0,404	**0,458**	0,093	0,313	0,243	-0,563	**1**									
Centrality	0,201	**0,430**	0,046	0,046	-0,170	0,000	0,309	-0,339	0,191	**1**								
Vertical	-0,081	-0,357	0,267	-0,290	-0,127	-0,135	-0,420	**0,357**	-0,498	-0,315	**1**							
Roof top	0,156	**0,553**	-0,156	**0,378**	-0,174	0,000	0,279	-0,371	**0,566**	**0,603**	-0,383	**1**						
Market	-0,234	0,262	-0,207	0,014	0,151	0,320	-0,071	0,254	-0,130	0,144	0,022	-0,207	**1**					
Retail	0,206	-0,492	0,141	0,141	0,051	-0,126	-0,088	0,314	-0,323	-0,430	**0,357**	-0,163	-0,262	**1**				
Rest.	-0,033	-0,016	0,033	-0,141	-0,051	-0,126	-0,297	**0,600**	-0,434	0,068	0,187	-0,098	**0,424**	0,016	**1**			
Home del.	-0,052	0,033	-0,185	0,289	0,290	0,258	-0,005	0,228	0,286	-0,201	-0,290	0,022	0,014	-0,033	-0,141	**1**		
CSA	-0,051	**0,506**	-0,311	0,232	0,062	0,197	0,339	-0,413	**0,639**	0,059	-0,346	0,119	0,158	-0,373	-0,423	0,232	**1**	
PPA	0,163	0,333	-0,163	0,098	0,051	0,189	0,072	-0,029	0,213	0,068	-0,255	**0,488**	-0,182	0,238	0,143	0,098	-0,274	**1**

In Table 3, the significant positive correlations/similarities as determined by formula 3 have been indicated with bold font and green colour, while the significant negative correlations/similarities have been underscored and market with red. The corresponding table for the firms' similarities with each other was deemed too large to be usefully presented here. Instead, the visualization of the firm-clusters are shown later in this chapter.

From the proximity matrix in table 3, the AHC produced 4 classes. 4 classes were chosen in order to get reasonable likeness to the proximity matrix from which the AHC derives as can be seen in table 4. These classes need to be interpreted with caution and with respect to the proximity matrix above.

Table 4. AHC results, classes

Class	1	2	3	4
Objects	5	3	6	3
Sum of weights	5	3	6	3
Within-class variance	6,500	5,333	6,067	6,333
Minimum distance to centroid	1,897	1,667	1,986	1,453
Average distance to centroid	2,248	1,879	2,235	2,011
Maximum distance to centroid	2,864	2,028	2,759	2,472
	Leaves Fruits Social Roof top PPA	Fish Vertical Retail	Animal Environ Organic 2-purpose Home del. CSA	Quality Market Rest.

Table 4 is visualized in Figure 4 below. In a "good" classification, the horizontal top bars of each class should be low, as this means that there is a great similarity between the objects in the class and the next level upward of horizontal lines should be high, as this means the classes are distinct from each other. This is represented by the similarity scale on the left. In this analysis, some of the top horizontal lines of each class are quite high, meaning that not all the objects in the classes are closely related to each other.

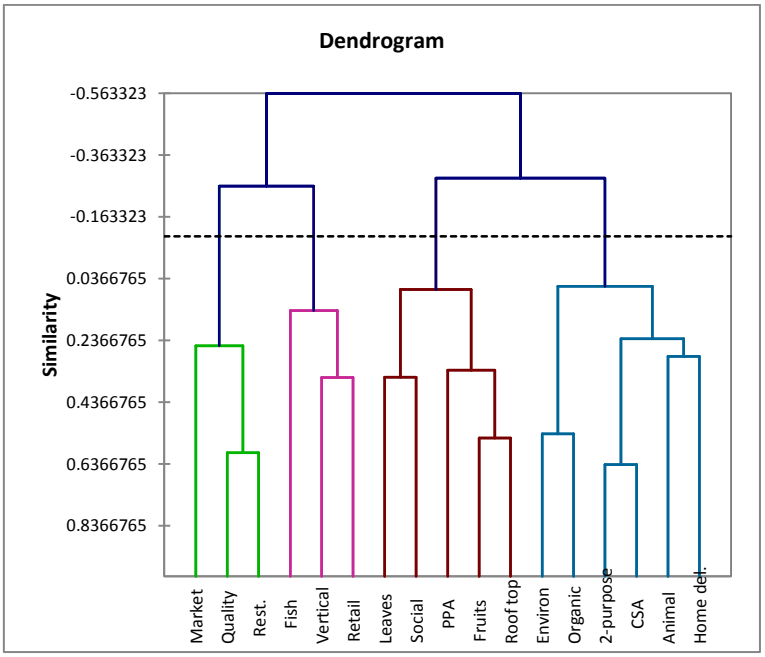

Figure 4. Dendrogram describing the classification of business model proxies.

The AHC algorithm made clusters of proxies whose similarities were weak as well as not statistically significant. This was preliminarily seen in the shape of the dendrogram and could be confirmed by looking at the proximity matrix. Thus, the AHC of variables did not add meaningful contributions to this part of the analysis.

The proxies *2-purpose* and *Fruits* are the ones that each have most statistically significant similarities tied to them and they are also moderately positively correlated with each other (2-purpose/Fruits = 0,576). This means that *2-purpose* is of central importance in the analysis. The tendency that a commercial urban farming company either is production focused or focused on a secondary activity directly befitting from the urban farming activity was an early realization in the data collection stage. Based on the data sample, it seems that production focused companies (2-purpose = 0) are accentuating the premium quality of their products (2-purpose/quality = -0,563) and sell their products to restaurants (2-purpose/restaurants = -0,434). Likewise there is a moderate indication that retail is another popular mode of output for production oriented firms (2-purpose/retail = -0,323) though this relationship is not statistically significant at the 95 % confidence level.

Moreover, there is a moderate negative relationship between *Fish* and *2-purpose* (2-purpose/fish = -0,404) stemming from the fact that many of the production oriented companies grow seafood for consumption (the Salty Prawn) or have an aquaponic production (Urban Organics, Farmedhere, Comcrop, Greens and Gills). With the opposite perspective, all the companies in the sample that grow fish are production oriented, thus explaining the dissimilarity between *2-purpose* and *Fish*.

The firms characterized by focus on a secondary purpose which directly benefits from the urban farming (2-purpose = 1) include fruits such as tomatoes and peppers (2-purpose/fruits = 0,576) in their value offering. The tendency was to grow on roof tops (2-purpose/roof top = 0,566), possibly because it is a spectacular view for the customers that visit the farm. The most popular mode of output was a subscription method such as community supported agriculture and the similarity was strongly positive (2-purpose/CSA = 0,639). Meanwhile, companies that sold their produce through a subscription tended to avoid retail and restaurants as modes of output (CSA/retail = -0,323) (CSA/restaurant = -0,434).

2-purpose also showed a significant moderately positive similarity with the proxy *Animals* because all the companies analysed that had animals on their farms (Bee Urban, Ballard Bee Company, City Farm, Brooklyn Grange and Green City Growers Boston) were 2-purpose firms (2-purpose/animals = 0,458). Either their business was bee keeping or they had a direct interaction with customers who enjoyed the presence of chickens and hens, see Appendix 1 for detailed information about each of the companies.

4.2 Secondary analysis of proxy similarity

During the data collection stage, a mismatch between the expected cultivars and the actual cultivars was found. It was not, as briefly hypothesised in the introductory chapter, the most perishable varieties of produce that were cultivated in commercial urban farms. It seems that those that grew fruits (which are less perishable than leafy greens and mushrooms) do so in order to offer a wider range of food products to the customers. If this is true, then the number of products in the value offering should be related to the other proxies in the same way as *Fruits*. In general, this was indeed found to be the case as shown in Table 5. The proxy

Diversity was introduced to replace *Leaves, Fruits, Fish and Animal*. See section 3.3 for a detailed description of the approach.

The second conflation was to create a proxy called *Intangible* which was the sum of *Environ*, *Organic* and *Social* for each firm. In the previous analysis many companies accentuating the environmental sustainability of their value offering also grew their produce with organic methods (Environ/Organic = 0,539) while the same relationship could not be found between environmental concerns and accentuating the social sustainability as a part of the value offering. Still, it was deemed interesting to see how the intangible part of the value offering correlated with the rest of the variables. *Social* conflated social concern with social activities in the value offering and five of the firms in the sample had the social interaction among customers and member participation in growing the produce as dominant parts of the value offering (City Farm, Omotesando Farm, Natürlich Wild, selbsterntegarten.at, Sorado Farm). Thus, although there was no statistically significant similarity between *Social* and *2-purpose*, the subset of firms in the parenthesis above (n=5) would have showed a perfect similarity in this proxy combination.

Table 5 shows the correlations of proxies to *Diversity* and *Intangible*. Note that the Pearson correlation coefficient applied treats binary proxies as continuous data in order to create these similarities. Thus the results should be interpreted carefully. The right side of the proximity matrix has been cut, as it shows exactly the same values as in table 3. The careful reader can confirm this by comparing any column right of *Intangible* with the corresponding in table 3.

Table 5. Correlations between ordinal variables diversity and intangible

	Diversity	Intangible	Quality	2-purpose	Centrality
Diversity	**1**				
Intangible	**0,451**	**1**			
Quality	0,016	-0,150	**1**		
2-purpose	**0,414**	0,343	-0,563	**1**	
Centrality	0,191	0,078	-0,339	0,191	**1**
Vertical	-0,316	-0,358	**0,357**	-0,498	-0,315
Roof top	**0,385**	0,061	-0,371	**0,566**	**0,603**
Market	-0,034	0,210	0,254	-0,130	0,144
Retail	-0,188	-0,089	0,314	-0,323	-0,430
Rest.	-0,081	-0,250	**0,600**	-0,434	0,068
Home del.	0,165	0,280	0,228	0,286	-0,201
CSA	0,267	0,316	-0,413	**0,639**	0,059
PPA	0,161	0,165	-0,029	0,213	0,068

Diverse value offerings are moderately positively correlated with intangible aspects in the value offering (diversity/intangible = 0,451) and a secondary purpose directly benefiting from the urban farming (diversity/2-purpose = 0,414). It was also weakly positively correlated with growing on rooftops (diversity/roof top = 0,385) just as *intangible* was weakly negatively correlated with growing vertically (intangible/vertical = -0,358).

Worth noting is that there is no statistically significant correlation at the 95 % confidence level between having a secondary purpose and a focus on intangible values in the value proposition (2-purpose/intangible = 0,343). This means that also commercial urban farms focused on production do not avoid communicating the environmental and social sustainability as a part of their value proposition.

4.3 Firm business model similarity analysis

This chapter contains description of some of the business models applied in some firm classes in the sample. In order to access all the firm descriptions that were the basis of the similarity analysis in the thesis, please refer to attachment 1.

When clustering the firms, it was expected that production oriented firms would form a class with each other and that secondary purpose firms would form another class. This was confirmed by the AHC in Figure 7 where four classes were identified.

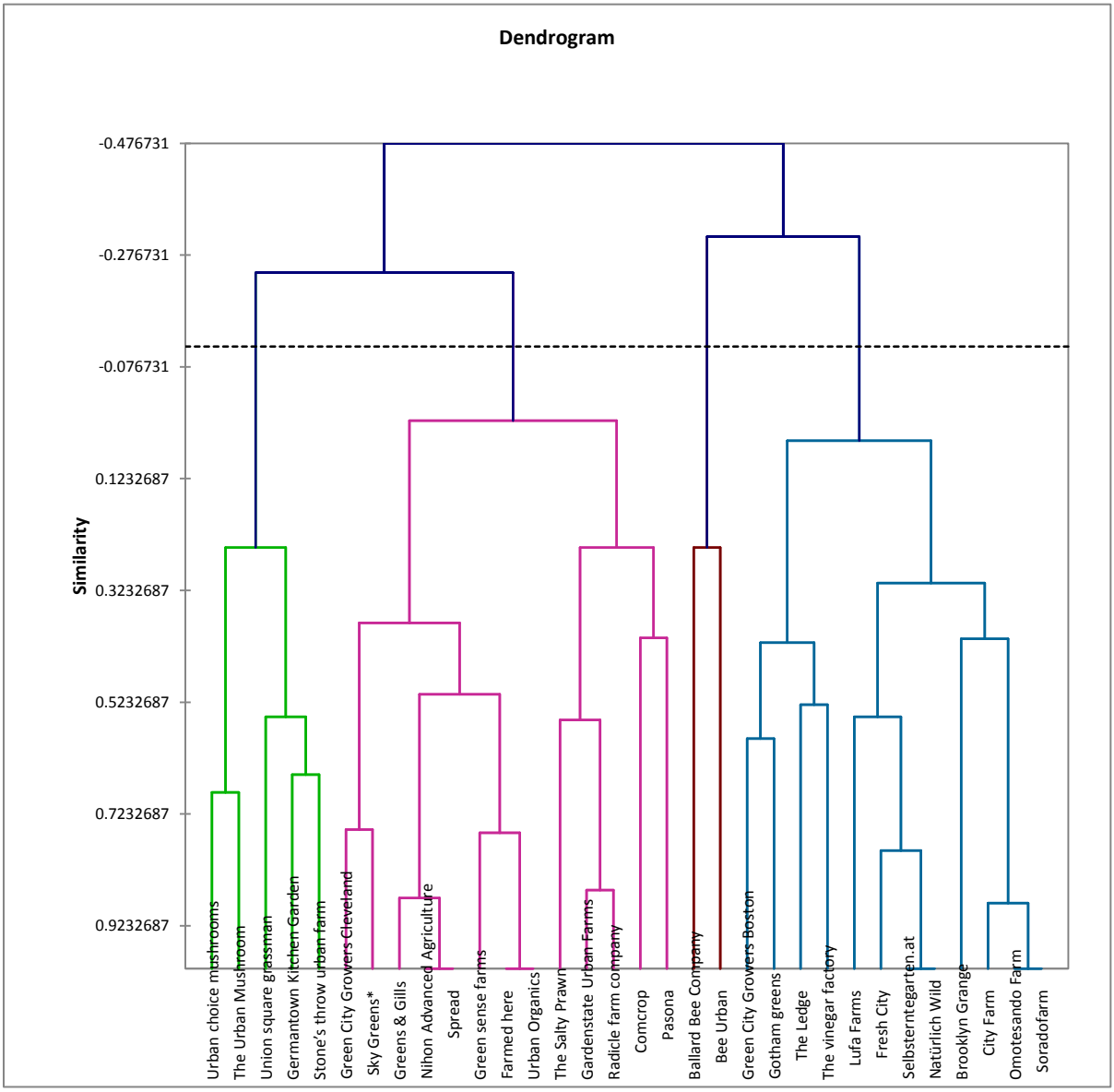

Figure 5. Dendrogram from AHC of firms based on similarity of attributes.

In the first class were small scale, production oriented companies. Urban choice mushrooms and the urban mushroom both produce delicacy mushrooms that they sell to restaurants and on farmer's markets. Germantown kitchen garden, a 2000 m^2 soil garden in Philadelphia, and Stone's throw farm, consisting of a patchwork of idle plots that are farmed free of charge in exchange for the landscape beautification (2-purpose = 1), use the same modes of output. This is true for Brooklyn based Union Square Grassman as well and thus the mode of output is a common factor in this class. Their small size is another common factor, although this is not a defining part of a business model.

The second class contains a few larger producers such as Green City Growers Cleveland and Sky Greens that share a strong positive similarity (S_{phi} = 0,751). The common factor in this class seems to be that retail is one output even though this is not a feature shared by all companies in the class. The Salty Prawn, Gardenstate urban farms and Comcrop only sell to restaurants and thereby break the pattern. Between them they do share similarities, but only one similarity is statistically significant at the 95 % confidence level.

Reflecting on the meaning of these classes, one realizes that the algorithms are not only making classes from statistically significant similarities. Thus even this AHC, though not consistent, contributes analytically by showing general patterns in the data so that the attention of the researcher is guided.

The third cluster contains only two companies, Bee urban and the Ballard bee company. These companies are extremes in the sample and apparently the algorithm thinks so too. Their idea, to charge customers for the privilege to have bees on their property, has no comparison in the sample. Perhaps it could even be argued that they are the pollination services of urban farming and in first hand not farmers themselves. The next closest farm is probably Stone's throw urban farm that leases land for free in exchange for the upkeep of the land.

The fourth class only contains secondary purpose firms (with the exception of Gotham greens who definitely is production oriented) and is thus the most diverse cluster. Someone might even argue that this group of companies should be further partitioned according to their different secondary purposes in order to be properly described. There is merit to such an argument, but for the sake of generalizability in the answer to how commercial urban farming firms create and capture value let us keep the classes as they are for now, without further partitioning. Then, the proposed clustering of commercial urban farming based on the analysis above is

1) Small production, either very specialized or very diverse, but never extensive in the production of any one product. Selling these exclusive items to restaurants or consumers via farmer's markets.
2) Large production, fewer products, often specialized on one or two ranges of products such as microgreens or seafood or leafy greens. Mostly selling these through retail, sometimes to restaurants.
3) Secondary purpose farms, usually a very wide product range, the company benefits financially from an activity other than farming by using the attention that their urban

farming brings or the properties of the urban farming operation. Examples of secondary purposes include marketing (the Ledge, the Vinegar factory, Pasona), recreation services (Green city growers Boston, Brooklyn Greens, Pasona), self-farming (Natürlich wild, selbsterntegarten.at, Omotesando Farm, Soradofarm, City farm) and distribution (Lufa Farms, Fresh City).

4.4 Value creation and value capture

The large production class contains firms of various sizes that mostly are united by selling through retail and with many also selling to restaurants. These firms are all rather similar, many of them share moderate, strong and very strong similarities in the firm proximity matrix. This is therefore seen as a mature class which seems to take advantage of consumers willing to pay a premium for quality, sustainability and local food. By selling through retail or restaurants, the consumers are met by a wide assortment at the point of interaction.

In section 4.3, one of the classes of the AHC was called small production. However, perhaps this is a misleading concept, which should be revised for a true representation of commercial urban farming. Mr. Borowsky, the man behind Union Square Grassman, probably the first modern commercial urban farm in New York (founded in 1996), said in interview that the size of his business is "adapted to my (his) own personal strengths and weaknesses" (pers. com., Borowsky, 2014). Thus it is not for business reasons he has little interest in expansion. Meanwhile, the idea of growing high quality mushrooms occurred not only in the two companies included in the sample. In fact, two other companies (www, Dragon Gourmet Mushrooms, 2015); (www, Back to the Roots, 2015) had to be eliminated from the sample because they had moved their production from the city to rural areas or small villages when scaling up their production and going into retail. These farms have thus had secondary purpose as a part of the logic for producing in the city, even though the conceptual framework has not been able to reflect this.

The temporary presence in the urban environment served to connect closely with customers and to get media attention around the new venture. Therefore, it is possible that also the producers in the small class will move to the rural areas given time, if they cannot find a way to successfully scale up within the city, or add secondary purposes to their value propositions.

Size was not measured, because no reliable measure of size could be identified and accessed. However, there seemed to exist a tendency that retail was became the output mode of choice when firms scaled up. It is possible that sales through the farmer's market and administration of an own CSA are profitable options up to a certain size, where retail suddenly becomes the preferred choice.

There was a similar indication that the larger producers were less central. This makes sense because with less construction in place it is possible to purchase or rent larger patches of land to operate farming on, in greenhouse or in another way. Assuming that is possible and preferable to use roof top space, abandoned industrial buildings or other vacant land at a low price, the main challenge for an efficient commercial urban farming is not the high cost, but how to efficiently operate a multitude of small farms in the urban area.

Developers of (commercial) urban farming solutions should then avoid copying experienced developers of large industrial greenhouses and instead focus on how their products can be applied in a way that makes coordination of small farms possible, with minimum work input.

The secondary purposes are

- Marketing: This is a business model applied by the two relocated mushroom companies mentioned earlier, but also of two other companies in the sample, the Ledge and the Vinegar Factory. The Vinegar Factory is a gourmet market place and thus has access to a natural mode of output for the production on its roof. Meanwhile, food waste from the marketplace below is composted and used as input in the farming. Thus, this part of the business is an example of a circular economy which is used to attract customers. The Ledge is a restaurant who has a soil garden on its roof, producing vegetables for the restaurant below at least for a part of the year. The garden was created by Green city growers Boston and is tended to by its creators and the personnel of the restaurant, when they have the time. With a similar idea as The Vinegar Factory, albeit without a greenhouse, The Ledge assumes a vibe of quality, fresh and natural that might be good for (restaurant) business.
- Self-farming: In the review by Venn *et al.* (2006) self-farming was referred to as "producers as consumers". Such gardens are most often community farms (Cohen *et al.*, 2012) but the idea has been transformed into a business model where the costumers pay to get for help with their farming. Natürlich Wild and Selbsterntegarten.at work the soil and plant the seeds in spring before leaving the responsibility of the divided land to the respective paying customers. Both these companies have made sure that the farms are accessible via local trains. According to (Vogl *et al.*, 2004), the value of the harvest customers can hope to get is of greater value than the fee paid for the plot, even without great effort. In this analysis, the effort invested had no cost.
  In Japan, Omotesando Farm lets customers rent a plot on a central roof top which is taken care of even when the customer is not present. Sorado farm has the same offer, but locates all of its farms along the subway lines of Tokyo for easy access. The flagship farm is on the roof of a subway station. City Farm expands the value offering of its two peers and makes the customer/farmers members in a club through which they are allowed unlimited access to a barbeque area on the same roof top as their plot.
- Distribution: Lufa Farms and Fresh City each offer hundreds of products from a multitude of producers. In this sense they resemble any high end grocery store. Themselves, they only grow a part of this product range and use the attention it gives to also distribute other's products, in order to provide a grand variety to the consumers. Meanwhile, growing some goods themselves also means they can offer leafy greens of high quality and fully mature tomatoes to the customers. The companies each have a number of pickup points at offices, gyms and cafés around the city where customers collect the products. The actual purchase takes place before harvest as the customers do their grocery shopping on the company's website.

- Recreation: Brooklyn greens is a unique farm in many ways, because of its annual fashion show, its yoga session and that it can be rented for wedding celebrations. Moreover, Brooklyn greens managed to secure a grant for the construction of the farm from the Storm water management fund of New York City. Thus being the only firm in the sample known to internalize this benefit, by locating the farm in the right place. Pasona, the company behind the green office, thought the idea would make them more attractive as employers and benefit their consulting service for agriculture. Their radical greening of the office improved air quality, but also meant a decrease in effective office area.

4.5 Strategic quality of business models

Section 4.3 ended with a description of the classes seen in the data and three dominant orientations of a commercial urban farming could be identified; small production, large production and secondary purpose. Now follows a brief strategic analysis of these classes.

Based on what was found during data collection and analysis, it seems to be possible to scale up by mixing urban and regional production without losing the premium inducing local image. Given the validity of this argument, peri-urban farmers may be able to design sustainable business models if they learn from urban farmers how to market their products and connect with customers. However, for this very reason, small urban farmers will struggle in the face of competition from regional farmers unless they cannot access other sources of revenue or cost savings.

Small commercial urban farmers with diverse product ranges therefore do not create superior value for their clients if they do not abandon diverse product ranges and concentrate on producing highly perishable products. Small producers with only highly perishable products harvest the time-related quality advantage, but it seems that retail is not accessible at a reasonable cost. In order to offer variety when the product range is small, the farmer's market is the only available mode of output besides restaurant sales, though it is a time consuming activity. The sample contains two examples of diversified small urban farms.

Germantown kitchen garden, although offering a diverse set of vegetables to its customers, does not earn enough money for its workers, who need additional work on the side to make their private economies work. Meanwhile, Stone's throw urban farm has been more successful in securing grants for development, finding different ways to sell the produce and finding free land for cultivation. While breaking even before labour cost in 2013, they did not manage to create "living wages" for its workers (www, Stone's throw urban farm, 2014). Still, Stone's throw urban farm is good example of how a small urban farm can make money in innovative ways by harvesting many different created values.

Larger, focused commercial urban farmers are dependent on their customer's willingness to pay for quality. The marketing manager of GrowNYC, a non-profit organization running 65 farmer's markets in New York for regional farmers, said in interview that there is a lot of people in New York that can and want to pay premiums for local food of high quality (pers. com., Hoffman, 2014). This was also supported by the CEO of Efficient City Farming, a

company developing urban greenhouse farms; Mr. Leschke said that there still is plenty of space for expansion (for urban greenhouse developers) in the young market (pers. com, Leschke, 2014).

A good business model must be able to provide the customer with superior value and to capture this value for the innovator or implementer (Zott & Amit, 2008), as well as be hard to copy or imitate (Teece, 2010). Large production requires access to a mode of output that can offer the consumer variation in order to create superior value. Selling to retail is vulnerable to competition as this can result in commoditization of the premium inducing values with consequent lower premiums for the producer. Therefore, investors should study the entry deterring price at the intended location before starting their business. This price goes up as more competition establishes in a certain area, because the amount of grant money and premiums available per firm are likely to decrease.

There exists a risk that the hype that often surrounds new urban greenhouses make the first movers' operations viable on basis of sheer novelty excitement as novelty is associated with profitability. Urban farming investors should make careful judgements about the size of the segment that might be able and willing to pay the sort of premium that seems to be necessary for the businesses to be profitable and able to compete for resources of land and labour. The entrepreneur must know who currently fills the need of the intended segment and analyse whether there is an urban farming business model that can provide the customer with superior value.

Now looking at secondary purposes, the restaurants and stores that want to use urban farming as a marketing measure will lose the advantage of such a move if it is applied by more companies in the same area. Companies offering self-farming are also vulnerable to competition, not least from community gardens, from which they must always differentiate themselves. Moreover, it is hard to find entry barriers with such a business model. Possibly access to locations close to public transport lines is one such applicable barrier to entry.

Recreation companies like Brooklyn Grange compete with other companies that offer space for events or exercise classes. However, such a business is diversified and thus benefits from a wide range of applicable tactical choices. The danger is that focus is lost and that this deters the quality of the value proposition.

Lufa Farms include regional farmers (and even farmers far away) in their offering of "local food" and a few urban farms move into rural areas when they scale up. Thus, it seems it is possible to produce with less centrality while still remaining local in the perception of the consumer. Recently mimicked by Fresh City (in a different city than Lufa's), this business model combines the quality benefits of producing highly perishable products close to the consumer with the cost efficiency of producing other products rurally. Moreover, it accesses the premium inducing factor variety without any third party involvement.

By contracting outlets such as gyms, offices and restaurants as pickup locations, this business model can contractually dominate the ability to deliver custom orders by use of a cost efficient and highly effective mesh of pickup points in any one city. This is a powerful

advantage with which competition in urban farming aimed at sales to customers can be faced and deterred.

Finally, the Japanese companies Spread and Nihon Agriculture are two vegetable productions that focus more on health and safety than taste and thus are unique in the sample. Greenhouse technology developers also follow this popular (Japanese) trend. One example of a that is the Granpadome, a round greenhouse which produces safe food even on contaminated soils and which are made to be cheap and quick to deploy after, say, a nuclear accident (Sawaji, 2012). Plantations are made in the middle and the produce is harvested at the edge which means that plants just the space they need for all stages of growth. These companies are all good examples of adaption of value proposition to suit the competitive environment and the social expectations on food producing companies.

5 Discussion

In the discussion, the answers to the research questions are put in relation to the literature of chapter 2. Then, the quality of the data and the generalizability of the results is problematized. The discussion also contains comments on two common themes that are recurrent in the academic and non-academic writing of the field of alternative food networks; the desirability of vertical farming and the inherently good in the local. Finally, the alternative (commercial urban farming) is contrasted to the conventional (large scale covered horticulture), from which the alternative is usually separated.

5.1 Contribution to literature on Urban Farming

Cohen *et al.* (2012) said that urban farms act differently depending on what kind of urban farm they are. In a sense they have different business models. However, community farms, gardens and institutional farms are not run for profit and thus do not need to capture the value created for their initiators. Their purpose is often to educate, facilitate intergenerational meetings or to develop a community using very limited recourses. Creating informal work for people who are and remain unemployed, through which these people can develop their community, has a value which can be significant in terms of life quality, but which might be hard to define in monetary terms and to capture for the implementer.

The results showed that there exist commercial urban farms that have similar value propositions as many community farms, but which are run for profit and which have paying customers using their services. This accentuates the value that community farms, community gardens and institutional farms create, even if their customers seldom pay nor can pay for this value. It also shows that the main value of these farms is something other than its vegetables.

Some commercial urban farms only grow, others create and capture value with a secondary activity such as marketing, distribution, recreation or self-harvest. Therefore, any framework representation of urban farming (not including peri-urban farming) should include Cohen's community farms, community gardens, institutional farms, large production commercial farms and secondary purpose commercial farms.

Mok *et al.* (2014) presented the state of urban farming in countries all over the globe. This thesis' results do not dispute any of their descriptions, but it takes a perspective of focused attention. While Mok *et al.* tended to describe peri-urban (close to the city) and urban (in the city) production interchangeably, this thesis has had a primary focus on urban horticulture. Therefore, it further develops the picture that they presented, not least in Appendix 1. It also enriches the classification by Cohen *et al.* (2012) by a further partitioning of their commercial class into classes of large production, small production and secondary purpose, as outlined in the end of section 4.3.

Wubben *et al.* (2013) applied a business model approach when studying short food supply chains and by doing so, influenced the method choice in this thesis. Unlike much of the previous academic writing on alternative food networks, their analysis abandoned the case approach. This thesis is yet another example of that it is possible to go beyond the case

approach even when the researched phenomenon is relatively novel. Moreover, this thesis has further established the economic perspective in exploring alternative food networks, and has introduced this perspective for commercial urban farming.

When discussing commercial urban farming, the locus of discussion typically orbits around food production. As this thesis shows however, commercial urban farming does not mirror this discussion by shaping business models that focus on food production. More common are diverse value propositions and/or price premiums as tools to attain profitability.

So far, more than 50 000 articles mentioning Swedish urban greenhouse developer Plantagon have been published in a matter of years (pers. comm. Plantagon, 2014). Meanwhile, their first greenhouse still remains to be realized. This accentuates that urban farming primarily adds other primary values than food production.

In developing countries, subsistence farming can be a necessity. In war, it gives security for the farmer. However, where logistical systems work and peace reigns, urban farming primarily adds other values than food products. Therefore, one must conclude that policies aimed at food production need not favour urban farming in particular.

5.2 Strategic analysis of maturing industries

This thesis benefits analytically from an accentuation of the connection between business models and strategy. The strategic literature alone however, although warranted for analysis by Porter (1980, p. XVIII), does not seem to offer the degree of exactness that often is desired in research. In this thesis for example, it enriched the analysis as an analytical tool but did not constitute the conceptual framework. Strategy literature alone would not have been useful, mainly because the sensitive data required for an accurate analysis would have been hard to find. Therefore such analysis is best left to the entrepreneurs themselves.

However, when analysing the general business models of the classes identified, the basic notions of strategy are very useful in contextualizing the results. With them, it was possible to suggest that *small production* is a strategically unstable cluster. Moreover, it illuminated the competitive benefits that a vertically integrated distribution system gives to an integrated urban farming operation. At the same time, it raised the question of whether the sum of urban production and distribution such as that of Lufa Farms and Fresh City is more or less efficient than two separate entities in cooperation, where one is a producer and the other a distributor. Likewise, it is not certain that an autonomous distributor would find sufficient value added from an urban farm in order to choose its products over those of rural production.

The used strategy literature contextualized the results of the first parts of the analysis, where firms and variables were clustered. This contextualization crystalized suggestions for future research to be identified and motivated.

5.3 Data quality and generalizability

Most of the data sources originated from the actors being analysed, regardless whether the information was taken from their website or from the media outlet that had made a relevant interview. Having a large sample (in relation to what could be found) and not only a few cases

reduced the impact that any biased or faulty information could have had on the analysis. Such information could otherwise have resulted in a faulty classification of business models. Caution was still observed and whenever possible the information was cross-checked between sources. As a result of this quality check one firm was excluded from the sample; the information regarding this company appeared too unreliable.

The firm was BrightFarms, a well marketed firm that has collected 11.6 million USD in equity (www, CrunchBase, 2014). The only source found which was not originating from BrightFarms was a hearing before the board of supervisors in the township where the company has constructed its first greenhouse (www, Lower Makefield Township, 2014). Apparently there had been operative problems and CEO Lightfoot refused to answer most of the questions posed. It was unclear whether the anything was being grown at all and the retail stores allegedly buying their produce would give no confirmation of this via email (no answer was received). Moreover, the current production (unlike the communicated future production) was peri-urban and thus subject to delimitation.

With a global sample and a praxis to include all identified firms not subject to delimitations, this thesis is an extension of the academic writing that already has gone beyond the case approach in studying urban farming and alternative food networks. Moreover, it further establishes the economic perspective on alternative food networks, and introduces this perspective for commercial urban farming.

On the aggregated level where classes were produced, its exploratory results are reliable and generalizable. The classes can be used to theoretically define a sample of commercial urban farms and can thus be used as a framework within which to apply confirmatory research. For example, the finance measures (profit margin, return on capital employed) of urban producers, peri-urban producers and conventional producers can be compared in order to see whether certain kinds of urban farms are more profitable and in what contexts.

In hindsight, given the relatively limited sample of 32 firms, the analysis would have given more precise results if the data had been richer. Had the proxies somehow been defined to extract ordinal or (better yet) continuous information from the sample, then the clustering might have been more precise and possibly more classes been extracted. As mentioned in the method chapter however, a binary representation is the only sensible way to quantitatively represent dataset consisting of mutually exclusive dual outcomes.

The global ambitions of this business model exploratory thesis fell short of exploring systematic similarities and dissimilarities between countries and geographical regions. Most countries in the sample had three representatives or less, with USA as the only exception. Whatever dissimilarities between countries that might have been found in an analysis where the 32 firms had been partitioned according to country of origin would not have been reliable. However, the classes of business models transcended national boundaries, thus suggesting that business logic affects the choice of business model to a larger extent than any country specific factors.

5.4 Avoiding bias

In this thesis, attempts have been made to avoid assumptions about the local being inherently preferable or inferior to the global, alternative neither being preferable nor inferior to conventional. A common mistake made by researchers is to presuppose that urban farming is a sustainable future agricultural strategy, mainly in terms of environmental sustainability, but also of social and economic aspects (Specht *et al.*, 2014). As noted by Born & Purcell (2006)

> *"The local trap is the assumption that local is inherently good. Far from claiming that the local is inherently bad, the article argues that there is nothing inherent about any scale. Local-scale food systems are equally likely to be just or unjust, sustainable or unsustainable, secure on insecure. No matter what the scale, the outcomes produced by a food system are contextual; they depend on the actors and agendas that are empowered by the particular social relations in a given food system."*

The local trap was avoided by observing the business models of the companies according to a conceptual framework. This made sure that I as a researcher could not choose the data that suited my own biased attitude toward local production. Using the conceptual framework also mediated the risk of receiving biased data from the participants.

5.5 Visions of urban self-sufficiency

In media, several solutions for vertical farming in urban environments have been presented. In our sample, the vertical farms all used storage shelves with artificial lighting on each level. Some companies built their (one-level) operations on roof tops while only the Japanese firm SPREAD used several floors in the same building as growing area. Enthusiasts like Despommier (2011) have celebrated vertical farming for decreasing the need for transport, increasing water use efficiency, decreasing the need for agricultural land and strengthening food security. However, many of these arguments are not necessarily relevant and true.

Transports: The land, on which any urban farm is built, is land where houses could have been built instead. That means cities expand faster, and as they do so, general travelling distances increase. Therefore a decrease in transport energy consumption for ready produce might be environmentally offset by increased general travel distances e.g. for commuters. It should be noted that rooftop greenhouses are exempt from such causality and that not all people are convinced that densification is desirable in terms of urban development.

Water, agricultural runoff: It is true that re-circulating hydroponics only consume a small share of the water needed for corresponding conventional farming and that nutrients only leave the facility through harvested produce (Hedin & Waara, 2012), though this feature is neither dependent on the proximity or distance to the point of consumption nor on the number of greenhouse floors.

Land: Hydroponic systems often give high yields per hectare relative outdoor soil growth and even more so for vertical constructions. However, there is enough land available for agriculture to feed the world now and in the future, even with a growing population (Alexandratos & Bruinsma, 2012). Locally, building vertically can make sense if local land

constraints are limiting operations expansion as can be the situation in a city or in a nation of islands like Japan or Singapore.

Food security: Even the projected world population of 9.15 billion people in 2050 is believed to be sufficiently fed from food production on conventional agricultural land (Alexandratos & Bruinsma, 2012). Food security, however, might be a valid argument pro vertical farming to at least some extent in countries with high rates of population to arable land. However, self-sufficiency as sometimes is presented as an ideal state of urban farming is associated with several economic and technological challenges.

Even though self-sufficiency is theoretically possible, Professor Sorkin (2012) at the New York City College, argues that such a solution might be at odds with larger intentions of a city. In studying the feasibility of a mostly self-sustaining city of New York, he and his team estimated that the lighting, heating and construction of alone the food production system feeding its 8.5 million inhabitants would require the power output of twenty-eight nuclear reactors.

5.6 A contrast to Dutch covered horticulture

In order to put commercial urban farming in a horticulture production context, I would finally like to contrast with an abstraction of the Dutch covered horticulture. The Dutch covered horticulture is an agricultural sector characterised by a fast dispersion of innovation (Breukers *et al.*, 2008). This is partly due to competition but also made possible by government subsidies on inventions that improve the economic and environmental sustainability. Around 51000 people are employed by the industry which produces added value of 4,6 billion € annually.

Government policies currently promote centralization, the very opposite of what commercial urban farming does. This "increases the sustainability" of the industry, according to Breukers *et al.* (2008). As the term sustainability can be and is used in many different ways, the authors were asked to elaborate this choice of words. In an email conversation, Mr. Ruijs writes,

"*By developing new concentrated greenhouse areas, old greenhouses will be replaced by new greenhouse structures. These new greenhouses are more sustainable, because they will apply new techniques and will result in less input of energy, fertilizers and crop protection and will perform better. Also working conditions will improve. At the end this will improve profitability or at least minimize an increase in production costs."* – Ruijs, 2014

Certainly, these same results would be achieved if new decentralized greenhouse areas were constructed. However, centralization offers other advantages contributing to environmental and economic sustainability. Larger greenhouses enjoy scale benefits (Hedin & Waara, 2012) and such scale benefits can be synthesized or enhanced by local collaboration around energy production and consumption (Breukers *et al.* 2008).

"Spatial concentration enables greenhouse farms to cooperate in the supply and production of energy (heat, cold, electricity and CO_2). In that case greenhouse production becomes more sustainable by a more efficient energy production and consumption and sustainable energy

(wind and geothermal energy sources) becomes more attractive. Also collective water storage and water treatment offers good perspectives." – Ruijs, 2014

Mr. Ruijs also mentions access to logistical positions as a reason for relocating some dispersed greenhouses and when greenhouses are located in the same area, even the distribution systems can benefit from scale as they serve more users in larger quantities.

"Another advantage is the planned concentration near main roads/infrastructure. The logistics of products to hubs, collection points or distribution centre of retailers can be improved." – Ruijs, 2014

Two dominating greenhouse areas, so called Greenports, exist (Breukers *et al.* 2008). Vestland, considered a rather densely populated area, is by far the largest. Consequently, there exists a competition for land between greenhouse expansion and housing construction. As an effect, the price of land raises, yet this special kind of agriculture persists spatially.

The fact that input companies and vegetable trade markets are located in Vestland is one reason why greenhouse firms prefer locating here (Breukers *et al.* 2008). Another important consideration is the good logistical position, which is especially important to consider when the products are perishables. Additionally, Vestland gets more sun than the rest of the country and this has significant effects on the plant growth. Furthermore, many of the entrepreneurs behind the firms have their families here and are invested in the community.

Continuously raising productivity and improving the market orientation of the products has been crucial in maintaining Vestland as a "Greenport" (Breukers *et al.* 2008). In some extreme cases, the high price of land has spawned some unusual solutions and greenhouses have become vertical. Mr. Ruijs writes via email,

"These examples are especially occurring in or nearby urban areas, where a big competition is on land availability. Specific examples are the water storage in a cellar underneath a production area in The Westland area, rainwater and/or heat storage in subsoil layers and multilayer production of pot plants, micro vegetables or propagation material." – Ruijs, 2014

Certainly, conventional sometimes is nothing short of a poor description for innovative.

If developing companies in urban farming need a benchmark for efficiency, new technology and innovation dispersion, then they can look to conventional covered horticulture. In terms of producing vegetables, there is more experience here than in the emerging commercial urban farming. Two challenges that face the disaggregated commercial urban farmers are (1) the need to synthesize economies of scale by finding and exploiting symbiotic relations with other buildings and their activities and (2) to coordinate and collaborate around technology development and implementation. Both these challenges should be priorities for developers of solutions for urban farming. The necessary coordination of development efforts will require one of the developers to take the lead in coordinating the commercial urban farmers.

6 Conclusions

Two research questions were posed in section 1.3 and those are answered in sections 6.1 and 6.2 below, respectively. Section 6.3 contains suggestions for further research.

6.1 Classification

The business models in commercial urban farming consists of three main classes that apply distinct business models. Within each class, there is further variance because any firm becomes unique through everyday adoption to its context.

Small production is the term for commercial urban farms with a production focus, which because of their small size, sell through farmer's markets rather than retail, or which grow a wide range of products in order to manage subscription programs with variety and freshness. Neither of these approaches is a sustainable business model without capturing other created values through additional revenue or decreased cost (see 6.2). Thus, this class is a temporary development stage for firms that either (1) scale up outside the city and therefore no longer engage in urban farming, (2) scale up within the city through efficient production methods to reach a volume that is interesting for retail or that (3) find alternative ways of harvesting values, thus becoming a firm with a secondary purpose which directly benefits from the urban farming activity.

Large production is the term for scaled commercial urban farms with a production focus and a narrow production line of highly perishable products, which are sold to retail and to restaurants. This is a business model which depends on the willingness of consumers to pay a premium for high quality, fresh and local vegetables.

Secondary purpose is the business approach of urban farms that besides their production get revenue or lower costs by harvesting a value other than producing vegetables. This secondary purpose can be marketing, distribution, recreation or self-harvest, all of which benefit directly from the urban farming activity.

The marketing purpose relies on creating a unique image of the underlying business. This business is often a grocery store or a restaurant but there is also a recruitment company (Pasona) in the sample which uses the same approach. The secondary purpose decreases in value if the same practice is applied by competitors and loses its novelty flare.

The distribution purpose combines the quality value of producing highly perishable products locally with the cost efficiency of producing other products rurally, while it the company still maintains the ability to offer a variety of products. Thus, it is possible to adapt a CSA/subscription model that deals with the produce from own production and the produce purchased from other companies.

The self-harvest (or producers as consumers) purpose is sensitive to competition, not least from community gardens, from which it must be differentiated. This differentiation has been done by offering activities such as a regular barbeque party, services of education or other assistance services for users.

The recreation purpose competes with other events and offers to exercise. However, such a business is diversified and thus benefits from a wide range of applicable tactical choices. The danger is that focus is lost and that this deters the quality of (either part of) the value proposition.

6.2 Strategic considerations

A good business model must be able to provide the customer with superior value and to capture this value for the innovator or implementer (Zott & Amit, 2008), as well as be hard to copy or imitate (Teece, 2010). In general, commercial urban faming is justified by the willingness to pay premium for ultra-local fresh products. The reason that small companies can compete in a market (food manufacture) which generally is to be seen as a commodity market is probably that commercial urban farming constitutes a "*niche that doesn't require economies of scale*". In fact, perhaps being local in the eyes of the consumer means not being all that big too, so that there exists some diseconomies of scale. Following the Porter hypothesis then, it is possible for small firms to be competitive and profitable in a defendable position.

The only way an urban farm can create a tangible value superior to that of a regional producer is when the good is highly perishable. Examples of such crops are microgreens, mushrooms and some other types of leafy greens. At the same time, customers pay premiums for variety. Therefore, urban farmers must access a consumer interface through which they can offer variety.

Farmer's markets are widely available but selling there is time consuming for producers. Meanwhile retail, though not as time consuming, seems to only fit larger farms. Many companies sell directly to restaurants which synthesize variety themselves, thus releasing the urban farmer from the burden of accessing an output with variation. Finally there is the possibility to sell through a subscription service for distribution. This subscription service is sometimes offered by a third party, sometimes proprietary to the farm.

Large production is sensitive to competition from new entrants as well as a decrease in the willingness to pay for urban production and high quality. Both these scenarios affect the ability to access premium prices and any development grants that may be available. Therefore, investors should study the entry deterring price at the intended location before starting their commercial urban farming. This price goes up as more competition establishes in a certain area, because the amount of grant money and premiums available per firm are likely to decrease. In order to make their business models robust to competition from new entrants, these firms need to build brand loyalty as a barrier to entry.

Self-harvest operations are difficult to keep unique as it is hard to set up barriers to entry for this low capital form of urban farming. Perhaps securing the locations with good proximity to public transport lines is a viable approach. However, this thesis contains no analysis of what room for expansion still exists and it might be long before profits go down due to competition.

Using urban farming for marketing purposes is also difficult to keep unique as no barriers to entry can be set up and the attention factor depends on the move being seen as novel and

unique. Thus, perhaps there are other more cost effective approaches to marketing. However, the capital requirement might seem steep for a marketing initiative, thus acting as a barrier to entry.

Combining urban farming with recreation as a secondary purpose can be a competitive value proposition against other offers of events and exercise, whatever the recreation offer consists of. The barrier to entry is brand loyalty if the concept is to be scaled and established in other locations. Meanwhile, the people that are working at the farm will have a strong influence on the quality of the value proposition because they will be supplying different events and affecting their quality.

When going for the distribution approach, an urban farmer establishes a mesh of pickup points for food at offices, gyms and restaurants. This mesh provides him or her with the ability to give customers convenience at a lower cost than home deliveries and can be used as a powerful barrier to entry. Firstly it is a barrier for other distribution services, but through this dominating position, the company can favour the own production over competitors'. Moreover, the super-local image of the urban farming operation might be to the gain of the local food distribution service.

6.3 Limitations

Some of the proxies presented in the method chapter had big gaps in terms of information. This was due to many respondents not answering to the emails sent and phone calls made as well as due to some respondents declining to answer any questions, either with reference to time constraints or of fear of aiding the competition. The following proxies were therefore taken out of the data set before analysis; *Lease, Equity, Grant, Crowd*. These proxies concerned different modes of finance and several respondents declined to answer, saying this information was classified.

The proxies *Price* and *Own distribution* were also taken out. All of the firms seemed to apply some sort of premium in their offers and therefore the proxy *Price* contained no information (it was 1 for all firms). A more valuable representation of this proxy might have been to measure the actual percentage premium applied by the firms to see whether some business models seemed to require more premium than others in order to stay competitive. Due to time constraints however, it was not feasible to do this.

The proxy *Own distribution* proved ill defined, as many firms could not give a yes/no answer. Some firms said "it depends", others "we ship some ourselves and hire a third party for some" and only a few respondents exhibiting a more consistent approach. In conjunction with a scarce answering rate for this proxy, it did not seem worth looking closer at.

These findings are all things to keep in mind when doing further research on the business side of urban farming.

6.4 Suggestions for further research

The business model that includes distribution of other (regional) food in the value offering deserves confirmatory research. Are food distribution firms with their own production more

profitable than those without it? This is a question that entrepreneurs in this line of business will ask themselves. The sampling would go beyond urban farming, to look for food distribution companies with and without their own (urban, regional or other) production.

Looking at the business modes applied gives us a hint about the urban farmers' ideas about how to be the most profitable. However, it does not actually address the issue of how much money is being made at different kinds of farms, nor does this approach tell us whether urban farming is more profitable than non-urban farming. In order to investigate whether urban farmers are more profitable than non-urban farmers, firms' financial data must be accessed.

During the course of this thesis process, access to financial data was by most companies not granted. Moreover, since many of the firms in the sample of this thesis are very young it might take a few years before their results mature. However, should the dependent variable profit be seen as the function of age, size, centrality and cost of land, plus some other relevant variables, it might be possible to compensate for the effect of a firm's age for example. Variable selection and access to data would be critical considerations in the research proposal of such a study.

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Appendix 1 – presentation of all firms

This appendix contains the information in form of text which was entered into the descriptive matrix that resulted in the proximity matrices in chapter 4 and the conjunct hierarchical clustering.

Covered horticulture

Gotham greens

Value proposition: Fresh, pesticide-free, premium quality, leafy greens and tomatoes from local sustainable hydroponic rooftop greenhouse production. They work with City Harvest who reduce food waste and distribute this to charities (www, Gotham Greens, 2014a).

Supply chain organization: All the produce comes from own production. Currently, two greenhouses in New York City are operational and together yield an annual 272 ton harvest from 3250 square meters (www, Gotham Greens, 2014b).

Customer interface: The customers are retailers, restaurants and food processors in New York City that buy bulk (www, Gotham Greens, 2014c).

Financial model: Gotham Greens sell at an approximate margin of 35 % and the next step then apply their normal margins between the bulk price and the retail price (Puri, 2011). The greenhouses are financed by investors, a grant from New York State Energy Research Development Authority and a loan from New York Business Development Corporation.

Union square grassman

Value proposition: Fresh, alive, pesticide-free micro greens sprouted from organic seeds and grown locally without nutrition additional to what is already in the soil (pers. com., Borowsky, 2014b). Wheatgrass is the main product, along red radish sprouts, sunflower shoots and pea shoots. The wheat grass can either be pressed into a green juice or offered to pets that benefit in terms of improved digestion.

Supply chain organization: All the produce comes from own production (pers. com., Borowsky, 2014b). In a warehouse on Brooklyn, New York, the seeds are watered by a continuously sprayed mist and exposed to artificial lighting. Lead time is about one week and the products maintain quality another week.

Customer interface: The customers are consumers and restaurants in the New York area (pers. com., Borowsky, 2014b). The main distribution is through the farmers' market on Union Square. Consumers can get home delivery from *good eggs* that in turn buy bulk from Union Square Grassman. B2B is offered to some restaurants in the area with ordering through the interface of *farmers' web*. Even though the distributional services are purchased through other companies, Union Square Grassman does have its own distribution capacity in the form of a rebuilt school bus, which is used on the farmer's market.

Financial model: Farmers' web charge an overhead fee or get 3 % of sales through their website while the rest goes to the producer (www, FarmersWeb, 2014). In direct sales through

GrowNYC, Union Square Grassman does not pay for the selling spot but puts time and transport capacity into the selling. Stewart started the business with a 1000 $ loan from his aunt and used his personal credit card to sustain the business during the first two years (pers. com, Borowsky, 2014a).

Radicle Farm Company

Value proposition: Fresh, living, pesticide-free, premium quality, leafy greens from local sustainable hydroponic greenhouse production (www, Radicle Farm Company, 2014b).

Supply chain organization: All the produce comes from own production in Newark, New Jersey. The produce is then transported by Radicle Farm Company to customers (pers. com., Radicle Farm Company, 2014a).

Customer interface: The customers are retailers and restaurants in New York City that buy bulk (pers. com., Radicle Farm Company, 2014a).

Financial model: The company is financed by the founders to 100 % but management is looking for external investors to support future growth (pers. com., Radicle Farm Company, 2014a).

Lufa Farms

Value proposition: Carefully selected premium quality foodstuffs with a fresh, local and sustainable image including Lufa's local leafy greens, tomatoes, cucumbers and bell peppers of superior taste and nutritional value grown in a pesticide-free environment (www, Lufa Farms, 2014a). The selection is large and contains more than 500 products (www, Lufa Farms, 2014b). Lufa produce is harvested the night before it is sold, thus prolonging consumable period between purchase and the time when the vegetable spoils.

Supply chain organization: The many suppliers come from all over North America (www, Lufa Farms, 2014b), with oranges from Florida belonging to the more exotic contributions (www, Uncle Matt's Organic, 2014).

Customer interface: Lufa Farms sell to consumers and has constructed a mesh of 150 delivery points; gyms, offices and coffee shops (Lufa Farms, 2013). These are places where the people of Montreal go in their daily routines. The company in November 2013 had about 3000 subscribers for weekly food bags. Consumers can sign up for a weekly delivery that is customizable in content every week and can at any time stop the subscription (www, Lufa Farms, 2014c). This makes it similar to a CSA share but different in the sense that the agreement at any point can be cancelled.

Financial model: The primary financing comes from equity (www, Elton, 2012).

Urban organics

Value proposition: Environmentally sustainable, certified organic leafy greens and Tilapia from local aquaponic production (www, Urban Organics, 2014).

Supply Chain organization: Produce and fish are grown in their production facility East St. Paul in an abandoned brewery in Swede Hollow, St. Paul, Minnesota (www, Bluestein, 2014).

Produce is grown vertically in normal warehouse industrial racks with installed lights just over the plants at each level.

Customer interface: The produce is sold through the grocery store chain Lunds & Byerly's in St. Paul (www, Bluestein, 2014). Whether it is their own transport or one from a third party varies from time to time (pers. com., Closmore, 2014).

Financial model: 300 000 $ in grants and loans from the city of St. Paul have been used to undertake investments, plus some additional equity from private backers (www, Bluestein, 2014).

FarmedHere

Value proposition: Fresh, locavore, certified organic leafy greens from aquaponic production in as well as a basil vinaigrette made with FarmedHere produce (www, farmedhere, 2014b). It's an aquaponic operation, which means fish is also produced, though FarmedHere declined to say what this is used for.

Supply Chain organization: All the greens and all the fish are grown in their own production in Flanagan (93 m^2), Englewood (372 m^2), and Bedford Park (8361 m^2). By growing vertically, the total effective growing area is 14 000 m^2 (www, Meinhold, 2013).

Customer interface: The produce is sold through super markets in Chicago (www, farmedhere, 2014a).

Financial model: No grants or subsidies have been used, and equity has been the primary source of financing (www, Beytes, 2014).

Sky Greens

Value proposition: Delicious, high quality, organic fresh leafy greens from environmentally sustainable production close to the city (www, Sky Greens, 2014c). The produce is sold at an approximate 10 % premium (www, Krishnamurthy, 2014). Ex-offenders can, through the organization SCORE, can obtain meaningful work on the farm (www, Sky Greens, 2014a).

Supply chain organization: Production 22 km from downtown Singapore in a rural area where land still comes at a premium (www, Krishnamurthy, 2014). This fundamental factor makes Sky Green not so different from low density urban vegetable production. Sky Greens operates a high rise greenhouse, in which nine meter high towers uses the potential energy of collected rainwater to slowly turn the towers plant boxes toward the sun and back. In this way, the sunlight stress on the plants is relieved, yet all plants get access to sunlight. In case of a long period with little rain, water can be pumped up to the high reservoir. The daily production is about 1 Mg.

Customer interface: Sky greens sells through FairPrice Finest (retail) to consumers in Singapore (www, Sky Greens, 2014b).

Green sense farms

Value proposition: Pesticide-free, non-GMO, high quality lettuce, herbs and micro greens (www, GreenSense Farms, 2014a).

Supply chain organization: Production is located in the southern industrial outskirts of Chicago and is LED-lit, indoor and vertical in common warehouse shelves (www, GreenSense Farms, 2014b).

Customer interface: Green sense farms sells to retail firms and restaurants (www, GreenSense Farms, 2014a).

Spread

Value proposition: Delicious, pesticide-free and highly safe lettuce, sold at 5-10 % premium (www, SPREAD, 2014b).

Supply Chain organization: The produce grows in their own *Nuvege* vegetable factories; fully enclosed environments where produce is grown vertically in normal warehouse industrial racks with installed lights just over the plants at each level (www, SPREAD, 2014b). The factory has four floors with plants and no sunlight enters the building. The effective grow area is 25 200 m^2 and the factory is located on the fringe of Kameoka, west of Kyoto (www, SPREAD, 2014a).

Customer interface: The produce is sold in bulk to department stores, major grocery stores, hotels, restaurant, and amusement parks around Japan (www, SPREAD, 2014b). Another branch of the company group is responsible for transports (pers. com., SPREAD, 2014c).

ComCrop

Value proposition: Leafy greens, tomatoes and Tilapia from a local hydroponic rooftop production by a company directing 20 % of their business attention to social work, including offering volunteer opportunities to students (www, Todayonline, 2014) and donating some food to the food bank that distributes food to people in need (www, ComCrop, 2014b). Prices are at a premium, but justified according to management because of increased freshness (www, Todayonline, 2014).

Supply chain organization: 100 % of the produce comes from ComCrop's 560 m^2 rooftop farm in central Singapore (www, Todayonline, 2014).

Customer interface: The produce is sold to restaurants and hotels (www, Todayonline, 2014) and consumers can receive home deliveries via the third party site GoFresh (www, Comcrop, 2014a).

Gardenstate Urban Farms

Value proposition: Sustainably grown microgreens (www, Popovitch, 2014).

Supply Chain organization: All the produce is grown in the simple 1000 m^2 hydroponic greenhouse in East Orange, New Jersey (www, Popovitch, 2014).

Customer interface: The produce is sold to restaurants in the area (www, Popovitch, 2014).

Nihon Advanced Agri Corporation, Nagahama Factory

Value proposition: The Tsubrina leafy green with salty taste and increased nutritional value (www, Mama's farm, 2014b) which also is sold in a condensed form as dietary supplement pills (www, Mama's farm, 2014a).

Supply Chain organization: The plants are grown in 182 m^2 planted area in a warehouse where common industry racks make production vertical (www, METI, 2014). However, to expand production, they have started buying the production service from other firms who produce according to their instructions; some of them urban, others not (pers. com., Takahasi, 2014).

Customer interface: The Tsubrina is sold to wholesalers, supermarkets, restaurants locally and in big cities like Tokyo and Osaka (pers. com., Takahasi, 2014). Each facility supplies directly to the customers close to it; sometimes local customers get deliveries by Nihon themselves, but mostly the transport is purchased from a third party.

Financial model: The project is a part of Nihon's portfolio, a company with around 45 million Yen in capital (www, METI, 2014). Its exact financing composition therefore is not specific, but rather a part of the corporation's financing plan.

Fresh City

Value proposition: Grocery items from a large selection of over 500 local, organically made, Fairtrade and specialty items, delivered home to the doorstep (www, Fresh City, 2014c).

Supply Chain organization: More than 180 firms and farms including Fresh City themselves, mostly American, but some as far as South Africa, make up the supplier base for Fresh City (www, Fresh City, 2014d). Fresh City themselves farm on 24 000 m^2 soil and in 12 000 m^2 greenhouse in Downsview Park, Toronto (www, Fresh City, 2014b). Further downtown, they have a location for packing and sending out orders.

Customer interface: Customers change the content of their food bags online, set a delivery schedule and gets the deliveries home to the door (www, Fresh City, 2014c). The customers are consumers in the Toronto metropolitan area (www, Fresh City, 2014b). Just recently, they established their five first pickup points (www, Fresh City, 2014a).

Financial model: Fresh City Farms Incorporated used Kickstarter in 2013 to raise 20 000 $ with the goal of setting up a supply chain with procurement from 100 farmers in the Toronto area by 2015, which they have succeeded in doing (www, Kickstarter, 2013). Fresh City Farms Inc. together with a local food distribution company called 100 km Foods Inc. and a preservation company (jam, pickles) called Stasis Preserves received 102,800 $ in grant for setting up a joint warehouse in Toronto, to manage their supply chains (www, Newsroom, 2014).

Green City Growers (Cleveland)

Value proposition: Local leafy greens from a socially responsible company branded with the customer's own brand on the package (www, Green City Growers, 2014b). GCG is owned by

a cooperative and offers all employees the chance to buy a share of the company after working a certain time (www, Green City Growers, 2014a).

Supply chain organization: The lettuce is grown in a 13 000 m^2 hydroponic greenhouse in Cleveland city (www, Green City Growers, 2014b). By having the workers buy in to the business and its dividends, the idea is that the workers do a little better because of their sense of ownership (www, Green City Growers, 2014a).

Customer interface: The produce is branded according to the customer's specification before shipment to these grocery stores and food service companies (www, Green City Growers, 2014b).

Greens & Gills

Value proposition: High quality micro greens, basil and tilapia fish from local aquaponic production (www, Greens & Gills, 2014).

Supply chain organization: Everything comes from their small production setup in the incubator The Plant in a former industrial building in Chicago (www, Serious Eats, 2014). The microgreens are grown on common industry racks, vertically to make use of the space, while the basil is grown on floating rafts, all in conjunction with the fish.

Customer interface: The customers are high-profile restaurants and specialty retail stores (www, Greens & Gills, 2014).

The Urban Mushroom

Value proposition: Organic, locally grown, gourmet mushrooms (www, Hoop, 2014).

Supply chain organization: The entire production is located in an industrial area of Wyoming (www, Hoop, 2014).

Customer interface: They sell mushrooms on CSA, through farmers' markets, through speciality retail, directly to restaurants and to restaurants through an intermediary procurement service called Farmlink (www, Hoop, 2014). Moreover, one of the farmers markets is structured so that the customer pre-orders online and a few days later pick up the groceries at central "pick-up night" (www, West Michigan Cooperative, 2014)

The Vinegar Factory

Value proposition: Leafy greens and fruits (including figs) from organic methods roof top production to the gourmet marketplace just below, from local production heated by waste heat from the bakery in the same building (Andersson, 2013). The vegetable production also serves as a disposal for compost waste.

Supply chain organization: Four greenhouses on the roof of the gourmet shop with the largest one spanning 360 m^2 produce vegetables to be sold downstairs (Andersson, 2013). This means they have their own distributional capacity.

Customer interface: The restaurant's customers see the face of *The Vinegar Factory*, not of the urban production, because this is an internal part of the company (www, Greenroofs.org, 2014)

Financial model: Because the urban production in this case is a part of the underlying restaurant business, the financing of the production is simply a part of the financing of the restaurant, and therefore not distinct. However, the rooftop placement can be seen as the urban farm leasing land for free from the stores below and having a produce purchase agreement with the same.

Urban Choice Mushrooms

Value proposition: Locally grown gourmet mushrooms (www, Urban Choice Mushroom Farm, 2014).

Supply Chain organization: 100 % production in an industrial area of Richmond (www, Urban Choice Mushroom Farm, 2014).

Customer interface: The mushrooms are sold to restaurant and can be found at farmers' markets (www, Urban Choice Mushroom Farm, 2014).

Open air growers

Brooklyn

Value proposition: Fresh leafy greens, fruits, mushrooms and honey with a great diversity from local organic production (www, Brooklyn Grange, 2014c). It's also possible to rent the roof for events (www, Brooklyn Grange, 2014a) and Brooklyn Grange hosts open events several times per week in the summer, including weekly yoga, lectures, courses and farmers' markets in the "herb-scented breeze" (www, Brooklyn Grange, 2014b).

Supply chain organization: All the produce, around 23 Mg annually on 10 000 square meters, comes from own production in Brooklyn, New York where two rooftops are home to the farm (www, Brooklyn Grange, 2014e).

Customer interface: The customers are bulk buying retailers, restaurants and caterers in New York City as well as consumers that buy from farmers' markets (www, Brooklyn Grange, 2014c). They also provide an arrangement where consumers buy CSA shares of the farm to receive produce and other farm products weekly. They manage their own deliveries for the most local restaurants but use a third party for the bulk of wholesale orders (pers. com., Brooklyn Grange, 2014f).

Financial model: Brooklyn Grange is financed through a combination of loans, equity, crowd funding and grassroots fundraising events (www, Brooklyn Grange, 2014c). The roofs are leased from their respective owners for 10 years and 20 years respectively. Because the farm is taking up water from heavy rains, thus relieving the city's sewers, Brooklyn Grange has received a grant for construction expenses of 592 730 USD (www, City of New York, 2012). The soils are assumed to annually capture 5700 cubic meters of water.

Greens City Growers (Boston)

Value proposition: Green City Growers offer the construction and maintenance of farms on, at or near stores/restaurants and residential buildings to provide hyper-local organically grown produce with great taste (www, GCG Boston, 2014b). The customer can choose what produce is to be grown and whether the farm should have chickens. Apart from the direct benefit of production, the customer can get the benefits of a green roof and companies' sales benefit the attention spurred by a novel initiative (www, GCG Boston, 2014a). Moreover, employees get a "collaborative environment" and can be educated in growing practices.

Supply chain organization: The land is owned by the customer who also pays for the green roof installation. The garden is then tended to by GCG as agreed while the produce is used by the customer. For bigger construction projects, certain services are procured from other companies.

Customer interface: The customers are hotels, restaurants, retail stores and consumers (www, GCG Boston, 2014b).

Financial model: The customer invests in the construction and also pays for the maintenance of the farm if required. This keeps capital needs very low. However, they have gotten microloan from Sprout lenders which then was needed to enable back-office upgrades (www, Sprout lenders, 2013).

Germantown Kitchen Garden

Value proposition: Local, fresh, organically grown vegetables (www, Germantown Kitchen Garden, 2014b).

Supply Chain organization: All the produce comes from the 2000 m^2 soil garden in Germantown, Philadelphia (www, Germantown Kitchen Garden, 2014a).

Customer interface: The produce is sold in a weekly on site farm stand and to a few restaurants in the area (www, Germantown Kitchen Garden, 2014a). Germantown Kitchen Garden uses their own pickup trucks to deliver (www, Germantown kitchen garden, 2014c).

Financial model: The team behind Germantown kitchen garden used their own money (equity) to buy land and simple hand equipment and got a small support from PHS city harvest growers alliance that supports many of the local farming initiatives in the city (www, Germantown kitchen garden, 2014c). Profits have been reinvested in the operation and the team currently has relied on secondary jobs on the side for income.

Stone's throw urban farm

Value proposition: Fresh, delicious and juicy vegetables from pesticide free soil culture (www, Stone's throw urban farm, 2014a). Meanwhile, the companies that lease land for free to stone's throw urban farm get landscape beautification and land upkeep in return.

Supply chain organization: All the produce comes from own production that yields 18 Mg annually from 9100 m^2 (www, Stone's throw urban farm, 2014b).

Customer interface: The produce goes to a farmer's market and several restaurants (www, Stone's throw urban farm, 2014b). Consumer can buy CSA shares from an agricultural cooperative in which Stone's throw urban farm is the initiator-stakeholder and one of the suppliers. Consumers then receive weekly deliveries (www, Stone's throw urban farm, 2014a).

Financial model: Most of the land is not owned but leased free of charge from land owners of vacant plots. The land owners get landscape beautification which in turn has a value in terms of property values around in exchange for the allowance to farm the land (www, Stone's throw urban farm, 2014b). Kickstarter was used to gather 15 000 USD for initial investments (www, Kickstarter, 2012) and the company has received several grants of various sizes, most lately their biggest yet for 60 000 USD to build a greenhouse, two passive greenhouses and pedestrian-friendly gathering spaces (www, Knight's Foundation, 2014).

The Ledge Restaurant

Value proposition: The roof top urban farming of *the Ledge* yields greens to be used as inputs in the restaurant business, a marketing effect of growing the restaurant's vegetables on the roof as well as the benefits of a green roof (www, Greenroofs.org, 2014).

Supply chain organization: Production on the roof of the restaurant corresponds to 75 % of the restaurants needs at peak harvesting season, the developers offer consultation and help the restaurant employees to grow (www, Greenroofs.org, 2014).

Customer interface: The customers of the restaurant see only the face of *the Ledge*, not of the Urban production, because this is an internal part of the company (www, Greenroofs.org, 2014)

Financial model: Because the urban production in this case is a part of the underlying restaurant business, the financing of the production is simply a part of the financing of the restaurant, and therefore not easily definable.

Alternative value offerings

Salt water shrimp

Value proposition: Fresh, unfrozen, premium quality shrimp from local sustainable aquaculture (www, The Salty Prawn, 2014).

Supply chain organization: Juvenile shrimps are delivered in batches of 30 000 from Florida and grown in South side Chicago for about 4 months (www, Cora, 2014). The production is still not ready for continuous production.

Customer interface: The intended customers are restaurants in Chicago that buy bulk, though regular sales have not started (www, Cora, 2014). They have their own distribution capacity but a significant amount of sales is picked up on site by customers (pers. com., Xeros, 2014).

Financial model: The entire funding was an equity from the two founders (pers. com., Xeros, 2014).

Bee Urban

Value proposition: Selling the possibility to host bee hives on company premises in order to enhance the CSR commitment by supporting biodiversity and pollination services in the area (www, Letser, 2014). As a bonus, customers receive 20 kg of honey per hive and year in jars with own logo. They also offer non-urban-farming related activities such as garden design, made to maximize biodiversity, and sell honey from exhibition hives through a few premium quality grocery stores (www, Bee Urban, 2014b).

Supply Chain organization: Bee hives are installed on customers' roofs and attended every ten days (www, Lind, 2014). When it is time for harvest, frames are taken to the main offices where 20 kg of honey is harvested (www, Bee Urban, 2014). The rest is left for the bees as winter nutrition. The placement of the hives is to be seen as a lease with a negative price.

Customer interface: Interested organizations take personal contact with the company and sign a contract for an annual sponsorship (www, Bee Urban, 2014a). Sponsors get a mention on the website and jarred delivery of their honey. Bee Urban uses electric bikes for people transportation and biogas cars for deliveries (pers. com., Bee Urban, 2014c).

Financial model: Private persons can donate money to finance exhibition hives in downtown locations in Stockholm, resembling a crowd funding effort (www, Bee Urban, 2014a). Equity is used just enough to satisfy the legal requirement of a stock company, as customers pay for the year's service in the start of the year (www, Allabolag.se, 2014).

Pasona

Value proposition: The temporary staffing and recruiting agency Pasona has rebuilt their head employees. Moreover, the project intends to spark interest in agricultural production, creating a new market for their staffing service offer (www, Innoplex, 2014).

Supply Chain organization: The plants are grown inside the office building and are taken care of by Pasona employees with the help of one agriculture specialist hired specifically to tend to the plants and keep things neat (www, RocketNews24, 2014).

Customer interface: Plants are served in the employee cafeterias and employees can serve themselves to fruits and vegetables growing in the building (www, Innoplex, 2014).

Financial model: The project is a part of Pasona's portfolio, a company with around 5 billion Yen in equity. Its exact financing composition therefore is not specific, but rather a part of the corporation's financing plan.

Sorado Farm

Value proposition: Grow your own vegetables in a garden along the subway line, different prices for different locations (www, Soradofamu, 2014). The service includes equipment, seedlings and assistance.

Supply Chain organization: Service production.

Customer interface: Facebook, Twitter and Website is used for digital communication (www, Soradofamu, 2014).

Omotesando Farm

Value proposition: Grow your own vegetables on a roof top in a commercial and residential area in Tokyo, prices range from 170 $ to 250 $ per month (www, Tokyo greenspace, 2009).

Supply Chain organization: Service production.

Customer interface: The farm advertises on yahoo Japan to reach out to customers who then register online (www, Tokyo greenspace, 2009).

City Farm

Value proposition: Grow your own vegetables on a roof top in a commercial and residential area in Tokyo; including club membership and priority access to the roof top BBQ. Price for 3 m^2 is around 70 $ per month (www, City Farm, 2014).

Supply Chain organization: Service production.

Customer interface: Facebook, Twitter and Website is used for digital communication (www, City Farm, 2014).

Ballard Bee Company

Value proposition: Selling the possibility to host bee hives for pollination services and 4 kg of honey each year, cost is 120 $ per month April – September (Ballard Bee Company, 2014a). They also sell supplies and bees, host apiary events and education as well as consult others for bee keeping (www, Ballard Bee Company, 2014b).

Supply Chain organization: Bee hives are installed in back yards and are attended throughout the year (www, Ballard Bee Company, 2014a). This is a lease with a negative price.

Customer interface: Interested organizations take personal contact with the company and sign a contract for an annual sponsorship (www, Ballard Bee Company, 2014a). The honey which doesn’t go to the hosts is sold through retail and directly to consumers through their website (www, Ballard Bee Company, 2014c)(www, Ballard Bee Company, 2014d).

Natürlich Wild

Value proposition: Grow your own organic vegetables in the city, Natürlich Wild prepares the field in spring, plant, fertilize and finally split the field into rentable partitions (www, Selbsterntegarten.at, 2014a). After the beginning of May, the land is the responsibility of the tenant who tends to the plants and harvests (www, Natürlich Wild, 2014b). By farming together as a family and with others, the customers get a social activity with educational value. In the autumn, Natürlich Wild again takes over and prepares plots for next year.

Supply chain organization: Natürlich Wild provide land, water, equipment and basic services (www, Natürlich Wild, 2014b). Another part of the business is that they nurse plants of chilli, tomatoes, peppers, berries and other vegetables to use in the Selbsternte and to sell (www, Natürlich Wild, 2014a).

Customer interface: Customers are the consumers, who do most of the work themselves to grow their vegetables. The farm is close to the subway, so that they can transport their harvest away easily (www, Natürlich Wild, 2014c).

Financial model: Part of a bigger farm, financing irrelevant. However, as the payment for the season is made up front, this moves a part of the revenue on the farm earlier in the year.

Selbsterntegarten.at

Value proposition: Grow your own organic vegetables in the city, Selbsterntegarten.at prepares the field in spring, plant, fertilize and finally split the field into rentable partitions (www, Selbsterntegarten.at, 2014a). After the beginning of May, the land is the responsibility of the tenant who tends to the plants and harvests (www, Selbsterntegarten.at, 2014b). In the autumn, Selbsterntegarten.at again takes over and prepares plots for next year. By farming together as a family and with others, the customers get a social activity with educational value. The fee is 165 USD for 40 m^2 or about 240 USD for 80 m^2 per season. Shovels and watering equipment are available for use.

Supply chain organization: Selbsterntegarten.at provide land, water, equipment and basic services (www, Selbsterntegarten.at, 2014b).

Customer interface: Customers are the consumers, who do most of the work themselves to grow their vegetables. The farm is close to the subway, so that they can transport their harvest away easily (www, Selbsterntegarten.at, 2014c).

Financial model: Part of a bigger farm, financing irrelevant. However, as the payment for the season is made up front, this moves a part of the revenue on the farm earlier in the year.

Appendix 2 – Raw data after exclusion of proxies with scarce data

Category		Value proposition									Supply chain organization			Consumer interface						
Variable	Loca	Leaves	Fruits	Fish	Animal	Environ	Organic	Social	Quality	2-purpose	Centrality	Vertical	Roof to	Market	Retail	Rest.	Home del.	CSA	PPA	Country
The Salty Prawn	Alt	0	0	1	0	1	0	0	1	0	2	0	0	0	0	1	0	0	0	US
Bee Urban	Alt	0	0	0	1	1	1	0	0	1	3	0	1	0	0	0	0	0	0	SWE
Pasona	Alt	1	1	0	0	1	0	0	1	1	3	1	1	0	0	1	0	0	0	JP
Soradofarm	Alt	1	1	0	0	0	0	1	0	1	3	0	1	0	0	0	0	1	0	JP
Omotesando Farm	Alt	1	1	0	0	0	0	1	0	1	3	0	1	0	0	0	0	1	0	JP
City Farm	Alt	1	1	0	1	0	0	1	0	1	3	0	1	0	0	0	0	1	0	JP
Ballard Bee Company	Alt	0	0	0	1	1	0	0	1	1	0	0	0	0	1	0	1	1	0	US
Natürlich Wild	Alt	1	1	0	0	1	1	1	0	1	2	0	0	0	0	0	0	1	0	US
Selbsterntegarten.at	Alt	1	1	0	0	1	1	1	0	1	2	0	0	0	0	0	0	1	0	US
Gotham greens	In	1	1	0	0	1	0	1	1	0	3	0	1	0	1	1	0	0	1	US
Union square grassman	In	1	0	0	0	1	1	0	1	0	3	0	0	1	0	1	1	0	0	CAN
Radicle farm company	In	1	0	0	0	1	0	0	1	0	2	0	0	0	1	1	0	0	0	US
Lufa Farms	In	1	1	0	0	1	1	0	1	1	2	0	1	0	0	0	1	1	0	US
Urban Organics	In	1	0	1	0	1	1	0	1	0	2	1	0	0	1	0	0	0	0	SG
Farmed here	In	1	0	1	0	1	1	0	1	0	2	1	0	0	1	0	0	0	0	US
Sky Greens*	In	1	0	0	0	1	0	1	1	0	1	1	0	0	1	0	0	0	0	JP
Green sense farms	In	1	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	SG
Spread	In	1	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	US
Comcrop	In	1	1	1	0	0	0	1	1	0	3	0	1	0	0	1	0	0	0	JP
Gardenstate Urban Farms	In	1	0	0	0	1	0	0	1	0	2	0	0	0	0	1	0	0	0	US
Nihon Advanced Agriculture	In	1	0	0	0	0	0	0	1	0	2	1	0	0	1	1	0	0	0	US
Fresh City	In	1	1	0	0	1	1	1	1	1	2	0	0	0	0	0	1	1	0	US
Green City Growers Cleveland	In	1	0	0	0	0	0	1	1	0	2	0	0	0	1	0	0	0	0	US
Greens & Gills	In	1	0	1	0	0	0	0	1	0	2	1	0	0	1	1	0	0	0	US
The vinegar factory	In	1	1	0	0	1	1	0	0	1	2	0	1	0	1	0	0	0	1	US
The Urban Mushroom	In	0	1	0	0	1	1	0	1	0	2	1	0	1	0	1	0	1	0	US
Urban choice mushrooms	In	0	1	0	0	0	0	0	1	0	2	1	0	1	0	1	0	0	0	US
Brooklyn Grange	Out	1	1	0	1	1	1	1	1	1	3	0	1	1	1	1	0	1	0	US
Green City Growers Boston	Out	1	1	0	1	1	1	1	1	1	2	0	1	0	1	1	1	0	1	AT
Stone's throw urban farm	Out	1	1	0	0	1	1	0	1	1	2	0	0	1	0	1	0	1	0	AT
Germantown Kitchen Garden	Out	1	1	0	0	1	1	1	1	0	2	0	0	1	0	1	0	0	0	US
The Ledge	Out	1	1	0	0	0	1	0	1	1	2	0	1	0	0	1	0	0	1	US

Figure 6 Raw data presentation, because of the limited room on one page, the proxy variables with many missing data points were not included in the figure.