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Feeding London:

An investigation into the implementation of vertical farms and how they are perceived in planning policy

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18163345

Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc Spatial Planning at University College London:

I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

Signature: Casey Virasami
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Table of Contents

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List of Figures and Tables

Abbreviations

VF - Vertical Farm(s) and Vertical Farming

FTA - Free Trade Agreement

WTO - World Trade Organisation

LA - Local Authority

LPA - Local Planning Authority

VFR - Vertical Farmer

VFM - Vertical Farm Manufacturer

NPPF - National Planning Policy Framework

CEF - Controlled Environment Farming

CE - Controlled Environment

UCO - Use Class Order

EU - European Union (EU)

CCC - Committee of Climate Change

Abstract

Dry periods combined with increased temperatures as a result of climate change are increasing the risk of severe and prolonged droughts. Current projections also estimate that global food production will need to increase by 60% by 2050 to meet the needs of the demands of a growing world population. Vertical farming (VF) is a form of infrastructure which uses artificial lighting to grow food in areas unsuitable for food production. The aims of the dissertation will seek to comprehend Planners and Vertical Farmers (VFR) experiences through interviews, and to conduct a document analysis of 34 planning policy document to identify the constraints and planning policy perception of implementation of VF, to understand whether they are a feasible solution to tackling food security in London. The findings reveal there is a significantly more support for the implementation of small-scale VF at a community level opposed to large-scale vertical farms. The research also identified a significant lack of knowledge within planners regarding the potential of incorporating VF within London boroughs. Increased corporation between the LPA and VFR and VFM to create an evidence-base planning which identifies the need for VF within London. The key constraints found related to competing land uses and affordability.

Key words: Controlled environmental farming; Vertical Farming; Food security; London; Planning Policy; Implementation; Planning.

1. Introduction

Controlled Environmental Farming (CEF) is a form of infrastructure which artificially controls the environment to grow crops (e.g. greenhouses, or polytunnels). Vertical Farming (VF) is a subset of CEF which usually combines farms, buildings, structures and technology to grow crops within a closed environment, which use LEDs and grow lights, to act as an artificial sun. VF uses sensors to monitor plants to adjust the temperature, humidity and water when required, enabling the amount of artificial arable surfaces to be stacked vertically in areas that are normally unsuitable for food production. VF is a relatively new method and furthermore, the amount of research currently is limited (Jansen, et al., 2016).

Food security is defined as 'where all people at all times have access to safe, sufficient, and nutritious food' (Postnote, 2015). The world's population has grown from 2 ½ billion in 1950 to 7 billion in 2014. The UN predicts that the world population will increase to 8.3 billion by 2050. One key arising global problem includes the long-term decreasing stock of agricultural land to feed a continually growing population. Current projections estimate that global food production will need to increase by 60% by 2050 to meet the needs of the growing world population (POSTnote, 2011).

The UK Climate Change Risk Assessment 2017, produced by the Committee of Climate Change (CCC, 2016), which highlighted domestic and international food production as one of the greatest direct climate change threats to the UK; this phenomenon is due to a warmer atmosphere holding more moisture resulting in heavier rainfall and increased frequency of flooding. Dry periods combined with increased temperatures are also more likely to result in severe and prolonged droughts. Furthermore, an increasing population directly impacts food production, farming, nutrition, and food affordability within the UK (CCC, 2016).

Currently, the UK produces around 52% of the food it consumes and imports the remainder required. In 2016, the European Union (EU) accounted for 70% of the food imported to the UK. In addition to climate change, the two other larger threats towards UK food security include Brexit and sustaining the labour workforce in the UK farming and food sectors (POSTnote, 2017). Subsequently, Brexit would involve the negotiation of a free trade agreement (FTA) between the UK and the EU. A possibility of a trade deal under the World Trade Organisation (WTO) rules can increase food prices in the UK, which threatens food affordability. The FTA prices could result in an increase of 5% on food prices, and the WTO could result in a higher 15% increase in food prices in the UK (Clutterback, 2017). Regarding the workforce labour in the agriculture industry, one in five fruit and vegetable growers in Britain said, 'they did not have enough migrant workers for the 2017 growing season, and that recruitment was worse since 2004 (Clutterback, 2017).

At the time of writing this dissertation, during the Covid-19 Pandemic, it became clear that food security in the UK became threatened in times of a global crisis, where panic buying resulted in many supermarkets shelves being empty and vulnerable groups unable to gain access to essential food items. Commentators on the subject have suggested the current pandemic exposed vulnerabilities in the food system regarding insufficiencies in the capacity of domestic food productions and labour challenges (Postnote, 2020). The FOA's Food Outlook (2020) report also highlighted 'Food markets will face many more months of uncertainty related to the COVID-19 pandemic' (FOA, 2020:3). The global recession and financial crash that began in 2007 also show how global crises can have a dramatic impact on food security (Cockrall-king, 2012).

The critical issues regarding food identified earlier have highlighted a need for the UK to transition towards a sustainable food system to increase sustainable food production, a reduction in food waste and to influence customer behaviour. Urban food production and farms have additionally risen within recent years as a response to food safety and land resource issues, sustainable living and environmental degradation due to rapid urbanization. This dissertation will focus on urban planning, which involves understanding the environment people require to live happily and sustainably (Kalantari et al., 2017) and to investigate the implementation of vertical farms as a solution to tackling food security in London and how they are perceived in planning policy by addressing the following research questions:

- Investigate how vertical farms in London are perceived in planning policy
- Explore the key constraints in the implementation of vertical farms in London
- Critically assess whether vertical farms are a feasible solution in tackling food security in London
- Formulate recommendations on whether the current policy in planning supports vertical farms in London.

Section 2 of this dissertation will investigate the existing literature surrounding food security, planning and food, the role of planners and the key constraints and benefits of vertical farming. Section 3 will outline the methodology and analytical framework. Section 4 and 5 will discuss the findings and formulate a conclusion in relation to the research questions outlined above.

2. Literature Review

This section will offer the reader a brief overview of the key theoretical background of this dissertation. It is noted there is no available literature which directly linked VF with urban planning. Therefore, the literature review will focus on the current debates in defining and achieving food security, planning and food, planning policy, and they key benefits and constraints of VF. This section will bring together key literature and identify the potential of the implementation of VF to tackling food security in London and identify current stance of UK food planning.

2.1. Achieving Food Security

The World Food Summit in 1996 describes food security as 'when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life' (FOA, 1996). To break down this definition, 'safe and nutritious' is used to emphasise nutritional composition and food safety (Pinstrup-Andersen, 2009) and 'food preferences' to foods that are culturally and socially acceptable ethical and consider religious values (Pinstrup-Andersen, 2009).

Pinstrup-Andersen (2009) also argues that food security is more complicated than the FOAs definition and that there are four dimensions required to achieve food security. The four dimensions can be described as: availability, accessibility, utilisation, and stability (Pinstrup-Andersen, 2009). Katrine Termeer (in: Kropff et al. 2013: 128), argued "food security cannot be realized by means of idealistic plans or new technologies only. It requires advanced steering strategies that involve governments as well as companies, NGOs and citizens" (Kropff et al. 2013; Candal, 2014). Further to Katrien Termeer's (in: Kropff et al. 2013) argument Candel (2014 p. 288) argued that the definition of food security is "ill defined, ambiguous, contested and highly resistant to solutions," highlighting how the current definition of food security is a problem itself, as it creates a difficult to realise definition with little solutions to how food security can be achieved.

Food insecurity in it's most extreme level is commonly recognised as a dangerous situation of hunger. Food insecurity can additionally relate to different forms of deprivation. These forms of deprivation include: material poverty, malnutrition (in both obesity and undernourishment) and socio-cultural losses (Farrell et al. 2017; Hendriks 2015). Food insecurity can additionally comprise of the loss of indigenous crop varieties and traditional ecological knowledge.

According to the London Datastore, around 21% of adults in London have a low or very low food security (GLA, 2019); 17% of parents in London have children living in low or very low food security (GLA, 2019). Being food insecure in London is defined by the GLA (2019) as: 'times a person's food intake is reduced and their eating patterns are disrupted because of a lack of money and other resources for obtaining food' (GLA, 2019). The demographic which is most impacted by food insecurity in London are single parents at 46%, Londoners in the lowest income quintile (44%), unemployed Londoners (40%), black Londoners (39%) and disabled Londoners (34%) (GLA, 2019). When comparing the definitions of food security from FOA (1996), Pinstrup-Andersen (2009), Farrell et al. (2017) and Hendriks (2015) with the GLA (2019) definition, nutrition is not a high concern; more of an emphasis is played on 'food' calorie intake on how London can be food secure, as well as, the emphasis on availability, accessibility and stability of food.

2.2 Planning and Food

The earliest study of urban planning and food is the Garden City Movement (Howard, 1902), which 'addressed the key elements food system, including; production, distribution, consumption, and recycling as an integral part of the city' (Cabannes and Marocchino, 2018). Excluding the Garden City Movement however, food issues remain 'a stranger to the field of urban planning' (Pothukuchi and Kaufman 2000: 113 and Cabannes and Marocchino, 2018: 19). Much of the academic research on urban planning has proven to ignore food issues as of yet. Furthermore, a large proportion of the research surrounding food and the urban environment primarily concentrates on architecture and design (Gorgolewski et al. 2011, Cabannes and Marocchino, 2018).

At the start of the 21st Century, Pothukuchi, Kaufman (2000), and Sonnino (2009) research concluded that food and agriculture are primarily regarded as a rural topic, identifying an urban and rural divide. The divide in the responsibility of food production has arguably misled policymakers and planners to concern urban food supply failures as rural farm failures instead of failure in distribution. The research of Cabannes and Marocchino (2018) found that urban planning in most cities in the Global South did not take into account the issue of food insecurity within the planning system. However, it is noted that some regions and cities located in the Global North have recently started to make progress in understanding urban planning and food. This principle is evident in 2014, where a survey conducted in the US revealed some local governments started to identify the food system as a 'top priority' in incorporating the food system into the planning agenda through comprehensive plans, zoning, and regulatory forms (Cabannes and Marocchino, 2018). In the UK, food has been incorporated into policy, more notably the London Food Strategy in 2006. There are however

currently no global, national, or regional legal instruments that deal with the relations between food and planning (Cabannes and Marocchino, 2018).

Current research on food system planners has shown that food policy often focuses on health and the promotion of long-term measures to address obesity, which includes creating environments for walking, running, and cycling, together with spaces where nutritious food is readily accessible (Morgan, 2009). It has been argued by Wendy Mendes et al. (2011) that there is still an evident gap within planners' knowledge regarding food systems to be addressed (Mendes et al., 2011), as well as an increasing need for a food planning movement to be formed. There is very little literature on urban food systems planning; a majority of the existing literature focuses mainly on architecture and design for urban agricultural production, which are argued to be integral for consideration within planning (Gorgolewski et al. 2011; Hanson and Marty 2012).

2.3 Planning Policy

Whilst the study of food policy within planning is limited, there are numerous studies which have advocated planners to engage more with public health to facilitate the implementation of health promoting changes to the urban environment that help tackle obesity (Edwards and Tsouros, 2006; Butland et al., 2007). This can subsequently be used to identify the role planning policy can have on influencing public behaviour by modifying the urban environment. For example, the approach to tackling obesity-related behaviours has encouraged urban planners to work closely with public health professionals to create partnerships to create an evidence base to tackle obesity, incorporating the idea of public health into key government policy document, national policy and local plans (LP). One example of this is: Healthy Lives, Healthy People: A Call to Action on Obesity in England (Department of Health, 2011; Jebb et al, 2013; May Goodwin et al. 2014), which has been argued to have resulted in national and local stakeholders to increase awareness into the issue of obesity and to afford greater priority to policies directed at tackling obesity (Goodwin et al. 2014). A further example includes The National Planning Policy Framework (NPPF) containing a statement to 'take account of and support local strategies to improve health, social and cultural wellbeing for all" (DCLG, 2012, p. 6; May Goodwin et al., 2014). LA's LP have also increased emphasis in community health within the development of their own LPs, specifically in regard to tackling obesity through the discouragement of fast food take away within close proximity to schools (May Goodwin et al., 2014).

In LAs, LP are statutory documents which set out the boroughs strategic policies, land designations and targets on how the local area will develop in the next 10 years. Local plans are used to guide the assessment of planning application and control developments within the borough. The strategies

and policy contained within the LPs are evidence-based which have been forms from extensive data analysis and consultations (Morphet, 2011). The used of evidence-based policies had been described as descriptive and necessary for underpinning an orienting approach to planning the urban environment (Osborne and Hutchinson 2004), however, have been critiqued due to viewing individuals as consumers and for being a political process, whereby, policy can be diverted from its course to avoid future outcomes (O'Brien et al. 2008).

Studies have also highlighted how government cutbacks, decentralisation policies and urban regeneration policies which were developed to stimulate enterprise in an 'age of austerity', have created 'profound challenges to Local Planning Authorities (Heurkens et al., 2015). The challenges found include the increased dependence on property developers and investors to implement planning policies. As a result, planners have been argued to be 'market actors', whereby, planners respond to market pressures opposed to shaping markets through well-informed plans which aim to create sustainable places through public-private interactions (Barrett and Fudge, 1981; Heurkens et al., 2015; Adams and Tiesdell, 2013, 65).

2.4 Vertical Farming: The Benefits.

Much of the existing literature supports the use of vertical farming as a method that is more efficient, adaptable, and environmentally beneficial to conventional farming procedures. For example, research from Kalantari et al. (2017) found that technology improvements can enable less energy to be consumed within VF, for example, the use of greenhouses in combination with VF. Evidence shows that VF can reduce the temperature of a building through evapotranspiration, thus reducing the use of air conditioning (Kalantari et al. 2017).

In regard to water consumption, VF (specifically in aeroponic systems and hydroponic systems) uses a closed-loop system, saving up to 95% of the water used. A closed-loop system is where the air is dried to water and circulated back into a hydroponic or aeroponic system, which leaves an estimated 3-5% of water wasted. Evidence has also shown plants in VF naturally purified the wastewater through evapotranspiration, where it can then be re-purposed into drinkable water and re-used in irrigation. Various studies, including the Den Bosch project, found that vertical farms used 90% less water consumption than traditional farming.

VF has shown to reduce the surface land to produce food in cities effectively (Perez, 2014). The food produced in vertical farms has resilience to the impact of climate change and has protection from drought, heatwaves, and adverse weather conditions, as the indoor environment in monitored, controlled and managed for specific crops opposed to being reliant on the weather. In New York

City, it is estimated that a tall building which is 30-storey high (about three million square feet) can provide enough calories (2,000 cal/day/person) to feed 50,000 citizens (Despommier, 2009), however, the type of food produced was not clarified. Ankri (2010) research on a VF in Israel found that 12.5 people could be fed per day by 1 acre of open field, however; it is estimated 97 people a day could be fed by the same products area of land indoors (Ankri, 2010).

VF can additionally grow crops all year round, simultaneously producing a variety of crops opposed to traditional farming, which can only produce one crop at a time that can only be grown at a particular time of year. It is challenging to quantify space efficiency however, in a closed environment for farming some plants, for example, lettuces and microgreens have a better harvest than other types of plants comparatively (Ellingsen & Despommier, 2008). A study carried out by Perez (2014) found VF produced 23 times more lettuce than in the same amount of space within conventional farms (Perez, 2014). Further to this, Besthorn's (2013) report found Den Bosh VF project produced 3 times more crops than conventional farming methods (Besthorn, 2013).

2.5 Vertical Farming: The Constraints

The previous section of this literature review has explored the benefits of VF. Most of the existing literature that surrounds VF discusses the advantages and it has been noted there was very little that recognised the constraints within VF. This section will analyse the key literature and research found which highlighted the disadvantages of VF, to understand the overall context of VF.

Zhang et al. (2018) conducted a feasibility analysis using the central limit theorem of implementing 24 VF canteens across universities in Wuhan, China. The research found that there are financial constraints of VF implementation due to high start-up costs, which has shown to take approximately 11.5 years to break-even. The Zhang et al. (2018) research identified that VF technology is different in other countries; as such, it is difficult to understand the true value of VF methods. The text also highlights enterprises which have implemented VF have not been completely transparent, enabling it more difficult to achieve a holistic understanding of this subject. VF can additionally allow for a circular economy to be processed which can have social and the economic status of a community (Zhang et al. 2018)

Research from Kalantari et al. (2017) found that lighting can be a key issue within the maintenance of owning VF. As VF are located within buildings, they have less access to natural light. This results in the need for increased artificial light to be provided by LEDs making VF arguably comparable to greenhouse farming. This subsequently directly results within increased overall costings. The amount of increase in costings is not mentioned within the review; what is mentioned is that the total

amount of energy required to power a shift of all US agriculture to a vertical farming method would require 8 times the amount generated by all power plants in the US making the energy use a challenge in itself. This means VF cannot be used to provide all a countries agriculture and should be used as a supplement.

Lu, C., Grundy, S. (2017) investigates whether VF can help deliver environmentally and socially sustainable ways of delivering safe, nutritious food to an increasing population. The main disadvantages found were the high cost of capital expenses involved in the start-up and the operational cost which is argued to exceed traditional open-field agriculture. Other disadvantages have shown to include: the limited varieties of vegetables, fruits and pollination, the dependency on technology and the loss of jobs through automated controls and robotics, which require skilled labour. The article features two examples of VF in London; however, this is not the main focus of the article and has been placed to show where VF has been set up.

Al-Chalabi (2015) article interviewed stakeholders involved in the implementation of vertical farms and found that summer lettuces produced in VF used 5 times more energy than conventional methods due to temperature control and VF produced 2 times more energy than conventional methods during winter. The article found that stakeholders often had conflicting motives towards the implementation of VF (Kalantari et al., 2017)

2.6 Conclusion

The literature highlights the need for food security to be included into planning policy and the crucial role planning policy can play in influencing public behaviour. The literature also highlights the benefits VF can plan in tackling the issue of food security within London, as well as identifies existing constraints of VF. This dissertation will investigate how vertical farming is perceived within planning policy, constraints in their implementation and whether VF is a feasible solution to tackling food security in London

3. Methodology and Analytical Framework

This section of the dissertation will focus on the different research techniques and the analytical framework which were used to answer the research objectives.

3.1 Primary data collection:

Primary research is research that is collected first-hand, which includes investigations, observations, and surveys. Primary research methods are to gain answers to a research question when a limited range of published information (Lowe and Zemliansky, 2011). One of the key disadvantages to gathering primary research is that it is typically time consuming, opposed to when information is gathered through secondary research. The nature of this dissertation will be qualitative. Qualitative research the process of investigating a subject in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings people beings to them (Aspers and Corte, 2019). For the purpose of this dissertation, online semi-structured interviews were undertaken with planning policy officers, VFR and Vertical Farm Manufacturers (VFM), together with a document analysis which was conducted on key planning policy documents.

3.2 Data Analysis

Data Analysis can be describes as, 'bringing order, structure, and meaning to the data' (Hubbard and Power, 2003: p. 88). Barrett (2000) describes interpretation as a complex set of processes based on a set of principles and that interpretations with grounded evidence increases the validity of interpretations of results. Cho and Trent (2014) argued interpretations should be designed to generate theory, or to generalise rules, thus enabling 'better' analysis of data which aligned with the aims of a research project. A Thematic analysis is a form of pattern recognition within collected data, the emerging themes then becoming the categories for analysis (Fereday & Muir-Cochrane, 2006). A Thematic analysis will be used together with the contextualised literature review to test whether the findings from the primary research corresponded with the findings of other researchers or whether they differ from the findings of the existing literature. The findings will then be interpreted to answer the research objectives using evidence.

3.3. Semi Structured Interviews

According to Brinkmann (2014), semi-structured interviews have a higher chance of focusing a conversation into themes, which are considered necessary to answer the research project. Semi-structured interviews can also make better use of knowledge as it allows for more 'leeway' on following up answers at from different angles (Birkmann, 2014). Online semi-structured interviews were selected as it can use open and closed-ended questions, enabling as much information to be

gathered about the objectives by allowing the interviewee to give more information about their experiences regarding the research questions (Biggam, 2008). An online approach was also selected due to the nature of the on-going pandemic which set up guidance to limit unnecessary face-to-face contact by utilising the use of Skype, Zoom and emails semi-structured interviews. However, it is acknowledged that interviews are often difficult to measure and quantify as each participant will provide a unique response (Birkmann, 2014) and due to the qualitative nature of semi-structured interviews the interpretation of the data collected is dependent on the researchers intensions when conducting a particular research (Birkmann, 2014)

3.4. Participants

At the time of writing this dissertation, there were no official statistics on how many VF have been established within London. Through online research four VFM were identified with experience in setting up one or more vertical farm equipment in London and four VF were identified to have been established and selling produce in London. It should be noted that the VF companies which took part in the interviews and that were established in London owned one or more farm at varying sizes and scales.

For this study one VFM, and one Vertical Farmer (VFR) participated in an online semi-interview through Zoom. Given the constraints of the Covid-19 Pandemic one of the VFR requested the questions to be sent through by email to be answered digitally which restricted the ability to gain in depth answers.

Through online research ten local authorities in London had been identified with an affiliation with VF within the borough and were interviewed. Out of the ten boroughs, six Planning Policy Officers at six different London boroughs were interviewed using Zoom and Microsoft Teams. Separate questions were prepared for the VFR, VFM and the LPA (See Appendix A). Following the interviews, all recordings were transcribed, and statements were coded into themes using Nvivo.

A breakdown of the participants is shown in Table 1:

Table 1 – showing the experience and code of the participants

Participant	Background	Interview Date
VF-1	Is the one of the founders of their VF company and focuses on establishing small scale vertical farms within London and at the time of writing this dissertation; VF-1 had two farms established.	7th August 2020

VF-2	Is employed by one of the large-scale farms established within London	Email received 30th July 2020
VFM	Is an employed by a company which specialises in manufacturing and setting up equipment for VF. At the time of writing this dissertation the VFM had established three to four vertical farms within London, located within existing offices and restaurants	23rd July 2020
LA-1	Principle Planning Officer located in an outer London borough which focuses on employment, housing, culture, health and site allocations.	12th August 2020
LA-2	Works as part of the Policy Strategy Team within an outer London borough which focuses on biodiversity, employment floor spaces.	25th August 2020
LA-3	Principal Planner within an inner London Borough which focuses on the sustainability and the environment, along with the preparation of the green infrastructure strategy within their borough.	1st September 2020
LA-4	Policy Team Leader within an inner London borough	Email received 5th of September 2020
LA-5	Comprised of a principal planner and senior planning within an inner London borough and are involved in the preparation of development plan documents, including the local plan and neighbourhood plans. The senior planner interview focussed on developing sustainability and green space policies.	10th September 2020
LA-6	Strategic Planning Officer, which works on both policy and major projects and is working into background research for the Local Plan	7th September 2020

3.5. Document analysis

Document analysis is a qualitative research technique where documents are reviewed and interpreted by the researcher to gain an understanding, find meaning and develop empirical knowledge (Bowen, 2009). Documentation analysis can be used to create a triangulation of methodologies which provides more evidence and credibility to a research project (Eisner, 1991) and reduces the impact of potential biases which can exist in a single study (Bowen, 2009). For this

dissertation, a total of 32 Local Plans/Core Strategies, the London Plan (intent to publish) and the National Planning Policy Framework, were analysed for policies/supporting statements for food growing which could be interpreted to support the implementation of VF. All result which included support for allotments only were excluded from the datasets. The supporting statements and policies gathered were coded and thematised using Nvivo. The planning permissions of existing VF in London were also analysed interpreted into a table (see appendix B).

3.6. Research Ethics

Prior to data collection, ethical clearance was sought through the University College London (UCL) to ensure the research complied with UCL's Risks, Ethics and Data Protection requirements. Consent was obtained from the all involved participants. The participants were advised that their involvement in the research project was entirely voluntary, and that they had the right to withdraw from the project at any time throughout the process without explanation. The identity of the participants has been anonymised. Consent was obtained in an electronic format, whereby the participants could sign the consent form digitally.

4. Findings and Discussion

From the information obtained from the interviews, and a document analysis several themes arose from the data collected. This chapter of the dissertation will be thematically organised based on the findings from the interviews and document analysis and will link the empirical findings to the academic literature identified in the literature review.

4.1 The Benefits of Vertical Farms and the potential to tackling food security in London

The immediate benefits of VF identified from the interviews with the VFRs and VFM included the reduced impact to soil degradation from unsustainable conventional farming practises, the reduction of CO2 footprint due to reduced food importation and consequently reduced food miles from growing food locally, as well as, the improvements to nutrition retention from food the associated reduction of time from harvesting the crops to being on supermarket shelves. The results from the interviews were consistent with the potential benefits highlighted from Kalantari et al (2017), Perez (2014). A study by Gentry (2019) also found on average food travels 2400 km from farm to plate (Gentry, 2019), which contributes 0.4 tonnes of CO2 emissions per household per year (Sanyé-Mengual et al. 2013). It is also estimated vegetables lose 30% of their nutritional value in the first 3 days of harvest and are treated with chemical preservatives preventing over ripening whilst in transit (Gentry, 2019). Hence, in regard to food security, the benefits highlighted by the VFRs and VFM, VF has the potential to increase sustainable food production in London which would be less impacted by climate change.

An additional benefit identified included the potential of small-scale VF contributing to public realm improvements and urban design as VF can be implemented in both outdoor and indoor spaces using LED lights to act as an artificial sun. One example included by VFR-1 was the potential of VF to be implemented under a bridge to 'light up' spaces which often become 'dark at night', and can 'enable plants to grow and to allow fresh veg for people that walk by and create a safe space for people where they felt unsafe before' (VRF-1). A study conducted by Valentine (1992) of women perception of crime on the streets, identified street lighting can have a strong influence on fear of crime, for example in an East London survey by Kate Painter found 73% of women were afraid to use Watney Street (an essential route between the DLR and housing estates). The respondence said they would either cross the street or run to avoid the poorly lit areas, however; when street lighting was improved 94% of people questioned stated their fear of crime reduced (Valentine, 1992), showing how the implementation of small-scale farms within the public realm could dualistically reduce the fear of crime, as well as, providing food to passers-by simultaneously. In regards to food security, by providing food which is accessible to the public meets two of Pinstrup-Andersen (2009) four

dimensions of achieving food security (availability and accessibility) and the part of the GLAs (2019) definition of food security through access to food.

Another potential benefit of VF in London was highlighted by VF-1 as a way to incorporate new greenspaces in areas which were not considered as areas of green spaces, for example, VF 'can [be] use[d in] basements to create a green environment in an otherwise derelict basement' (VFR-1). Thus, had the potential to 'add green space to… development plan[s] opposed to repurposing existing green spaces' (VFR-1). The idea to contribute VF into the public realm was also seen as a potential benefit by one local authority which was interviewed, who said; 'If you place it on the high-street, it may add to the vibrant street' (LPA-6). One VFR also highlighted VF had the potential to 'connect communities' and 'creating an experiential experience' which could 'educate' and 'create awareness' into the need for increased sustainable farming practises and the impact of current food production on 'people's health, and environment' (VFR-1). The existing literature on VF has no mention to public realm improvement, as an infrastructure which could add new greenspace to a city, or as an infrastructure which can connect communities; however, the incorporation of VF within the wider public realm offers a possibility for further research.

However, when questioned whether VF are a feasible solution to tackling food security in London, VFR-1 and VFM felt that vertical farms could not replace traditional agriculture due to the economics and practicality or producing vegetables in a CE setting; '*root vegetables make more sense to do it as we have been' (VFM), 'On an economic basis as the sun is free, and so if you can grow veg in the sun it's hard to compete with on a price basis in comparison to electronic production (VRF-1).*

For VFR-1 and VFM, VF would not be able to replace traditional agriculture 'entirely' and is an 'addition' to traditional farming in tackling the issue of food security, and to meet the demands in the production of food for London's growing population. Where VF can help in tackling the issue of food security in London is by 'helping London to be more self-sufficient and less reliant on imports of fresh produce from other countries' as, '[VF] are not affected by adverse weather conditions as we operate a Controlled Environment Farm, so we are protected from flooding and can produce food all year round' (VF-2). VF also can help in tackling food security by 'growing fast growing crops which are higher in nutritional value…[and] incorporating foods like microgreens into diets' (VFM).

One LA which was interviewed felt the VF was an 'innovative' solution which is a *'positive step forward in terms of security and in terms of provision and productive food in mass quantity'* (LA-2), this was similar to LA-4 response, that VF was 'useful as part of a collection of solutions' (LA-4), and LA-6; 'food security is a much bigger issue'.

The responses received were consistent with the existing literature which highlighted from Katrine Termeer (in: Kropff et al. 2013: 128) definition of food security which cannot be realised by new technology only, and research by Kalantari et al. (2017) which highlighted VF should be used as a supplement to current agriculture food production.

4.2 Vertical farming and planning policy

All of the LA's commented that they thought planning policy was neutral in terms of the implementation of VF, whereby, planning policy did not '*pro-actively*' support the implementation of VF, nor was planning policy seen as '*barrier*' to the implementation of VF, however; the results from the document analysis found 75% of the LPs and CS in London contained policies and paragraphs which could be interpreted to support VF, and 25% of LAs in London did not incorporate any food growing policies within their LP or CS (See appendix B).

The results from the data analysis found the most amount of support in planning policy was for small scale community food growing with 36% of LPs/CS within London supported community food growing, support for communal food growing was also found to be supported in LP (23%). Support for commercial food production had the least amount of support with only 4% of LPs/CS including a supporting policy or paragraph (see Figure 1). Support for temporary use of land for development for local food growing (14%) can be argued to support temporary use of large-scale VF in London.

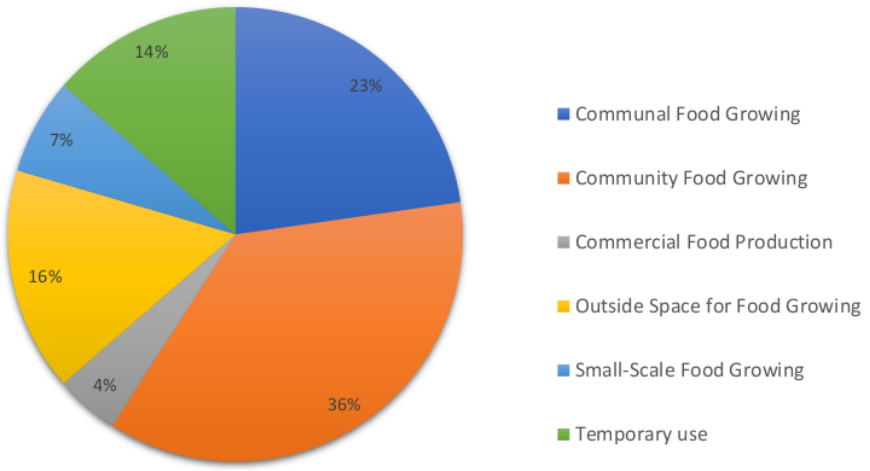
The NPPF (2019) has a policy which promotes 'healthy and safe communities' and contains a paragraph which states, 'enable and support healthy lifestyles, especially where this would address identified local health and well-being needs' and includes 'access to healthier food' (NPPF, 2019: 27) as an example of how this could be met. The NPPF (2019) also stated 'planning policies and decisions should' recognise that some undeveloped land can perform many functions, such as, food production' (NPPF, 2019: 35).

The London Plan (intent to publish) (2019) provides the strategic plan for London over the next 20-25 years and holds significant weight in the assessment of planning application (GLA, 2019). The document analysis found policies which support food growing in London 'at the local scale' where 'it can help promote more active lifestyles and better diets, and improve food security', support was also found for 'community food growing' and 'innovative solutions' for small scale food initiative, such as; 'green roofs and walls, re-utilising existing under-used spaces and incorporating spaces for food growing in community schemes such as in schools', and 'food growing' 'on a temporary basis' (GLA, 2019:374). The London Plan (intent to publish) (2019) also includes support for food growing at a macro-scale; 'providing land for food growing helps to support farming and agriculture' (GLA, 2019:374). The London Plan acknowledges that providing food closer to source 'helps to create a

sustainable food network for the city, supports the local economy, and reduces the need to transport food, thereby reducing transport emissions and helping to address climate change'.

From the interviews five of the six local authorities interviewed said they did not have policies which directly support VF as a 'business' or as a 'commercial enterprise' and one LA noted, ''If it was small scale for an area, then policy would be more supportive of it', showing how although there is support for vertical faming in most planning policy document the support it primarily for vertical farming as an initiative in benefitting the local community and as an amenity space, opposed to large-scale vertical farming which could work as an addition of increasing food security within London. The results from the document analysis found evidence that London is starting to make process in into the incorporation of food systems into the planning agenda (Cabannes and Marocchino, 2018).

Figure 1- Pie chart showing type of support for food growing in local plans in London



When the LAs were questioned whether there should be policy to address vertical farms, one LA felt that 'there could be more done to assist in terms of policy [as]…It is something forward thinking and innovative that will need to be support in general planning terms in the right locations'. However, four LAs did not believe VF should be included directly into planning policy as it had the potential to reduce 'freedom' of their local plans, as explained by one LA; 'there's quite a lot of freedom. y'know, we have general climate change policies in the local plan, and general green space objectives. Food growing is generally seen as being a good thing…I suppose it's all about adding a that sort of flexibility…[however] I don't think we'll be having detailed policies on that specific use' as 'It's all

about supporting uses and identifying what the issues would be and what we need to consider when a development comes forward'. For example, 'the National Planning Policy Framework 2012 and [has a] sort of presumption in favour of sustainable development… and, you know, positively responds to new forms of development and so on (LA-5)'

When the VFR and VFM were questioned whether they felt that planning policy supported vertical farming they all felt that 'not very much needed in terms of planning for that. It's not a new structure or a change of use'. All the farms and VFM suggested they did not require planning permission to implement their farms. One VFR said that the implementation of their farm was ''not about policy but more about demand, [for, example] a lot of developers are looking for tenants which want to be modern and want to be sustainable'. When questioned what could make the implementation of Vertical farms easier. The large-scale VFR stated that, 'government farming or tax relief' would help. For the small-scale farmer, and the small-scale VF 'anything that policy can do to influence the demand for that (VF) or subsidise that activity (VF which help the community and greening of an urban environment)'. For the VFM they felt 'The government is quite aware that food security is an issue, so there's lots of grants that available. [however]…Governments are quite slow at handling things, but for the most part its pretty good. There should be more done'.

4.3 Knowledge

Five of the six LPAs interviewed commented they were not aware of VF as a concept within the urban environment and were unsure as to whether it was within their 'local plan[s]'. One of the LAs interviewed was familiar with VF as a concept and had saw a 'trial of a hydroponic farm about 10 years ago', however, admitted they did not know whether it was 'a net good or bad thing?'

When the LPAs were questioned as to the constraints planning policy has on the implementation of VF, two LPAs identified lack of knowledge as the main constraint, for example; one LPA stated, 'Probably the information constraints as in people don't know enough or how much is needed' and another LPA, 'the biggest policy constraint is to educate planning policy or food people about it'.

The lack of knowledge of VF within the LPAs was additionally highlighted by VF-1, who had a 'conversation' with their LA on how VF had the potential to add green spaces into the LAs development plan and how 'opposed to repurposing existing green spaces' VF can 'create green environments in otherwise derelict basement'. When VF-1 explained the concept of their VF as a potential greenspace, the VF-1 described how the concept was 'eye opening' to the LA as it made them aware that they 'don't have to put these green spaces in just a park but other places like an

estate' (VF-1). The conversation VF-1 has with their local authority shows an example of how vertical farmers and manufacturers can work together to educate planners in the field to reduce this constraint.

When VFRs and the VFM were questioned as to what would have made the implementation of their easier, all the VFRs and VFM answers related to increasing awareness of food security issues through the 'the engagement of communities about the future of food production in a growing global population', for example 'TV appearances and posting on social media to engage and educate people on the importance of our mission', and by 'making the public know more about the damage in regards to current agriculture practices and perhaps the issues that are caused by their purchasing habits so whether the public know whether the food they buy is local and the damage that causes'. One VFR also highlighted how they would like 'to see more engagement with the councils to see how we can use spaces with VF', and that the 'government should educate the public, so they are more inclined to buy crops which come from better sources…A lot of the market is cost driven. Some people happy to pay for organic, however; if you don't know people won't pay for it so it's an education thing'.

In the document analysis, 56.25% of LPs/CS had one or more statement which included which indicated awareness into food security issues and the benefits of food growing (see Appendix B for full policy list). 3.1% of CS referred to 'urban farming', and 0% of LPs or CS referenced 'vertical farm'. The London Plan (intent to Publish) (2019), highlighted the need increased access to healthy food and for the provision of food growing to improve food security and mental and physical health, as well as the need to reduce; the need to transport food' by growing locally', however, it is clear from the document analysis and the interviews that there is still an evident gap within planners' knowledge regarding food systems to be addressed (Mendes et al., 2011)

4.4 Use Class Order

The Use Class Order (UCO) is one of the 'important regulatory instruments in British planning law', whereby land or buildings are categorised into different classes (Home, 1992) and as explained by one LPA, 'when you move use within a use class together to change between the different uses within a class does not constitute as development as such does not require planning permission'.

When the LPAs were asked what use class, they would classify vertical farms as, their responses contrasted (See Table 2).

Table 2- showing LPA use class classification of VF and reasoning:

Local Authority	**Use Class**	**Reasoning**
LA-1	The same use class as a farm or the B-classes	None given.
LA-2	Agriculture	did not 'think they would fall within industrial floor space or employment floor space', thus 'would form part of an agricultural use opposed to class B or industrial use' (LA-2)
LA-3	B8	'If it's selling crops from one place and distributing it to restaurants, then that would be storage and distribution'
LA-4	B2	None given.
LA-5	Sui Generis	'it's quite unique and it doesn't really sort of fit very neatly with anything else, you know, there's nothing that is particularly akin to it'.
LA-6	Sui Generis	None given.

Three LPAs felt that VF would be classed within Use Class B. Two felt that it could fall within Sui Generis. Sui Generis is a Latin term which means 'in a class of its own' (planningportal.co.uk, n.d), and two LPA felt that could fall within an Agricultural use. Following an investigation into planning consent at the addresses of existing VF (see Appendix C), only three planning permissions could be found from existing VF in London; their use fell under Class B1, B2, B8 and A3. Most planning permission for VF establish in London could not be found.

Following from the result of the use class of a VF it is clear that LPA within London are unclear on where VF would fall within the UCO, however, as highlighted by one LPA once the uptake of VF in London increase and more planning application are received the UCO can be defined onto what use VF could fall under.

When questioned whether the LPA felt vertical farms should have their own use class, one LPA thought it vertical farms should only have its own use class if it was 'up there on the spectrum of things and considered as equally important to have [a use class]', however, was sceptical VF would have its own use class 'anytime soon'. Contrarily, one local authority felt it did not 'needs its own use class but needs to be considered, [and] planners need to know about it'. Another LPA stressed the importance of defining the use class order if VF were to be assessed in urban areas in the future, and how LPA will be required to 'learn quickly' to 'understand what the use class is'. For example; 'if it did fall within use class B then it would simply for a lot of areas be considered appropriate as it would be considered to be industrial and generative of employment', hence 'understanding of the use class would be part of the consent' as it would allow VF to be assessed against 'the relevant policies' and 'won't need independent consideration'.

On the 23rd July the government announced an 'overhaul' of the UCO, which will replace the use class A1, A2, A3 and B1 into a new use Class E, and a new use class F1 and F2 from the 1st September 2020. The announcement was made two weeks before the first interview with the LAs. The interviews focused primarily on the use classes prior to the changes to the UCO, however; most LPAs felt that the new UCO 'changes how' they 'do things'.

Two LAs did not comment on new UCO given the timeframe of the announcement. One LPA raised concerns of the planning reform as it would 'reduced control' of designated areas, for example, one LPA argued, ' I think putting your As and B1 into the same new class E will make it difficult to protect office space. If office space can change into shops, cafes, restaurants then the policies we have to protect offices, such as, clusters and town centres which are designated areas to retain office spaces all of this is going to become difficult to protect in the future unless we put Article 4s on these sites which I don't think is practicable and if every LPA did this it'll undermine central government's intensions which is to enable uses to change quickly in response to the situations we find ourselves in. So, I think in the future it's going to become difficult for councils to protect office spaces class B1a and its change of use is no longer considered development so we're a bit undermined'.

4.5 Space, competing uses and site designations

Five out of six LPAs mentioned space being a key constraint into the implementation of VF in London. For example, one LPA said 'If you're looking at London specifically then the key issue is space as VF would be competing with other use classes and it's not that it's not feasible as an idea…any space which could be used for VF could be used for shops hence more competition for space' (LPA-1). Another LPA noted how their borough, being an inner London borough had 'immense pressures on it's built environment space to support housing and employment as well as a thriving

tourism industry; and as such does not lend itself particularly well to urban agriculture. While there are localised pockets of schools and housing estates that grow limited food or house fruit trees and beehives, which the council supports, unfortunately this is limited by the nature of the city'(LPA-4). Another LPA also noted that 'land is expensive in London. [thus] It is whether someone will be able to cover the costs of their land building these farms which are energy intensive, I imagine' (LPA-5).

From the interviews two of the LPAs interviewed were concerned about the impact a VF could have within their designated commercial zones and employment land, for example, one LPA said; '- the difficulty is we have we have planning policies which protect employment side… and I guess one of the difficulties is that this kind of use could be quite readily accommodated on industrial estate, but the job densities are probably going to be very, very, very low, though it's great for the environment, it's not necessarily so good in terms of job creation' (LPA-5), this was also highlighted by LPA-2; 'If it was to be considered as an industrial use it would open a pathway into pretty much any of our protected commercial zones… it doesn't generate much space for employment as much of the space would be used to growing crops. It would take up a lot of floor space with little employment which clashes with the spirit and intension of these employment policies', especially as the London plan. This constraint was also highlighted in research by Lu and Grundy (2017) which highlighted the loss of jobs through automation as a constraint for VF.

4.6 Assessment of a Vertical Farm

During the interview the LPAs raised concerns in regards of the assessment of an application, for example, one LPA argued, 'when you have a new use like this or something that is undefined it makes it difficult to plan for it as you don't know what your considerations are' (LA-2). For example, 'would there be traffic impact, how many people are coming and going' (LA-3), 'you don't know what the impact will be on the local environment, the residence, for the site itself, it would be learned from availability and cost probably' (LA-5), or the impact the development would have on the local character of an area; 'if it is a stand-alone, big box warehouse it wouldn't look as attractive and may ruin the dynamic', and 'safety and security concerns' if there were 'kids nearby'. One LA was concerned in regards to the cost of VF if it was used as an amenity to the community, 'It is seen as something good, a beneficial add-on that we could do, but it will probably come at a cost' and 'who would be monitoring the VF if they are introduced into the public realm', and 'who would be monitoring the VF if they are introduced into the public realm'.. 'if its outdoors you have a big onus on occupiers making it happen, whilst the outside of the buildings would be on management group of the site for example a living wall wouldn't be up to the occupiers managing it, it'll be up to

whoever is managing the site and if a VF was proposed within a commercial area within an existing estate the VF would have to go through a 'consultation engagement process'. However, LA-2 stated, 'it is likely to generate confusion in the short term till LA become more use to it and understand how to consider them'.

From the document analysis, only 6.25% of LP/CS in London referenced the assessment of applications which involve the provision of food growing (see Appendix B for policy lists), The LP which included a statement on how food growing could be assessed could be interpreted as generic planning consideration, for example; how storage facilities for equipment must be assessed to ensure there are 'no detrimental impact on the character, appearance and amenity of the surrounding area, and to equality of access and security' (London Borough of Hackney, 2020: 154). For another LPA in London there was a policy stating; 'In some cases initiatives such as the use of incidental open space on housing estates for food growing may not require planning permission. This would depend on its scale and form, and the extent to which it would change the character and function of the open space' (London Borough of Lambeth, 2015: 103). The London Plan also highlights how highlighted how 'consideration should be given to the historic use of the land and any potential contamination' (GLA, 2019: 374).

4.7 Technical Constraints

The main constraints felt by the VF and VFM were attributed to technical issued when implementing vertical farms, opposed to planning policy issues. For example, 'The initial cost of setting up' was a 'big factor' in implementing the farms as well as 'choosing the right site' and 'choosing the correct equipment for growing' for the VM, the main constraints to implementing vertical farms was due to the amount of power and internet a site has' and that the implementation was 'all dependant on the space', thus the 'main issues [identified] are logistical opposed to the planning aspect'. The high start up costs of VF was also identified from existing literature where Zhang et al. (2018) found it took an average of 11.5 years for a VF to break-even.

4.8 The future of VF in planning policy

The LPAs interviewed were generally supportive of the idea of VF, for example, one LPA commented, 'it sounds like it's not a bad idea' and 'you've got beehives on roofs and that food growing taking place around there and I guess, you know, hydroponics is perhaps the next the next chapter'.

However, four LPA highlighted how there would need to be an 'evidence-base planning' to increase planning policy support on VF, to enable the LPA to know how VF would 'contribute' to food security

and what is needed to 'achieve' its 'delivery in existing national policies', it was also highlighted a 'methodology' for an evidence-base would need to be formulated to understand 'the rationale for it to be included into the local plan (e.g. allotments and why they are in the Local Plan)'. The lack of evidence-base planning was argued to be a 'fundamental obstacle for this type of development'. However, Katrien Termeer (in: Kropff et al. 2013) noted how food security requires the involvement of governments, as well as NGOs to steer strategies, and Edwards Tsouros, (2006) highlighted how planners and private companies can work together to form evidence-based strategies for incorporating policies which can influence public behaviour. Thus, indicating LPA, VFM and VFM could work together to incorporate VF into planning policy.

Furthermore, when discussing the idea of VF in planning policy with in the interviews with the LPAs, two LPAs said that VF would not require their own policies as it would be a case of 'tweaking what is already there' , whereby, VF 'could be incorporated into existing benefits under our own definition of VF'. LA-3 noted that the 'easiest way' to incorporate VF would be plan would be in the environment section in the food policy or open space policy', however this is providing VF as not being 'commercial in nature' (LA-3).

One LPA interviewed suggested that VF could be integrated into the London Plan when measuring the biodiversity net gain or ecological net gain in new development, and how 'maybe we could implement something similar with food, or integrate the food aspect into the biodiversity matrix and say that if you're providing food, then it's actually not only good for the kind of habitats and biodiversity but it's also can be beneficial for the people' (LPA-6), this was similarly suggested by VFR-1 who argued that, 'Policy wise if there was a clear link on light is understanding the carbon footprint of fresh veg when it comes to your plate and how that could be offset by VF would be quite interesting, whereby, policy can support that economically and through a green agenda, urban farming should be supported opposed to traditional agriculture due to its net benefit. Opposed to comparing apples to apples compare the carbon footprint of both productions would be interesting' (VF-1).

One LA felt that the implementation of VF was more about 'demand and supply' and 'it will need both the public sector and the private sector to be being joined up and on board and sort of seeing it is a is an inherently good thing' and that planning policy had the potential to increase demand in a certain industry; 'Policy could honestly flip that around. If there is policy saying there is need/demand and we should be doing this, then it might open the market more'.

However, One LPA interviewed noted how budget cuts to the LAs resulted in experts being lost which specialised in food growing; 'We used to have a sustainability specialist who was strongly keen

on the idea of food growing, but due to budget cuts we have all become generic planners no one is specialised in anything', LPA cutbacks have been identified as a constraint from Heurkens et al. 2015).

5. Conclusion and Recommendations

The aim of this dissertation was to investigate the implementation of vertical farms as a solution to tackling food security in London and how they are perceived in planning policy the conclusions and recommendations have been summarised below under the headings of the research questions which formed the foundations of this research.

5.1 Research Findings

- **Investigate how vertical farms in London are perceived in planning policy**

Planning policy has been argued to be neutral in terms of the implementation of VF in London with 75% of LP supporting food growing. However, the results revealed that most of the support in planning policy in London was for the implementation small-scale community food growing initiative (which can include VF), and support for large-scale VF are limited mainly to temporary uses of land awaiting development. Furthermore, there increasing support in the intent to publish London Plan (2019) which directly encouraged macro-scale local food growing to support current agriculture and demand for food. All the LPA interviewed were largely supportive of the idea of VF, however, would require an evidence-base to be established for increased support through the partnership with LPA, VFR and VFM to understand why VF is needed.

- **Explore the key constraints in the implementation of vertical farms in London**

The key constraints identified for the implementation of VF in London relate to increasing awareness into the concept of VF within planning and the wider public. The awareness into VF and food security also directly relates to how a VF would be assessed within planning and whether planning permission would be required. The results showed inconsistencies within how VF is defined within the use class order which makes the assessment of VF difficult as the UCO defines where VF sits within planning policy and the planning considerations required. Land affordability and competing use classes within London is another constraints for the implementation of VF in London due to the pressures from historic land and spaces for housing and employment, and the threat VF may pose on existing land use designations, whereby, VF has the potential to undermine planning policies especially if the UCO is undefined. Other constraints also include management of VF, the cost, and energy issues.

- **Critically assess whether vertical farms are a feasible solution in tackling food security in London**

In terms of economics VF would not be able to replace traditional farming as it is more economical to grow certain foods (e.g. root vegetables) using traditional agricultural methods. However, VF can be used as part of a collection of methods to increase food security in London. VF can aid tackling food security by quickly growing crops which have a high nutritional (e.g. micro-crops), which can be incorporated into people's diets. Additional benefits of VF being incorporated into the public realm improvement in urban design and the possibility of converting derelict, un-used spaces into green spaces could be used to increase access to healthy food as part of a solution, however; concern over management and funding will need to be addressed.

5.2 Recommendations

- **Formulate recommendations on whether the current policy in planning supports vertical farms in London.**

This research recommends the following to enable more support for VF within London

- Increased corporation between Planners, VFR and VFM to create and evidence-based planning to be adopted highlighting the need for VF within London and at what scales to enable the inclusion and feasibility of incorporating VF within London.
- The UCO will need to be defined to enable to VF to be assessed under the correct policies throughout London. The result have indicated inconsistencies in the definition, and whether it falls within the new Class E.
- It is acknowledged existing planning policy is broad enough to offer support to the implementation of VF, however, there is evidence of policies which can be 'tweaked' to enable increased support of innovative food growing initiatives within LPA Policy documents following the findings of an evidence-based planning once established.
- Further investigation into the implementation of VF into the public realm would be require to see whether small-scale VF are feasible in regards to management, funding and whether they are used.

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Appendices

Appendix A –

Interview Questions

Vertical farmer/manufacturer:

- Can you tell me about your role?
- How did you get started in your business?
- When did you establish your farm/business?
- Do you know of any other vertical farms in London inspiration/who did you research. Did you talk to each other.
- Do you believe vertical farms are a feasible solution for tackling food security and resilience in London
- What problems have you encountered when implementing your vertical farms? – divide these into tech and planning problems.
- What could have made these problems easier/how could these problems be solved? – divide these.
- Do you think current policy supports your business?
- Where do you see the farm in the next few years? As in what are your short term, medium term and long term ambitions for how the business will develop/ are they are planning to expand
- What policy requirements would be required for this (e.g. would they require more space ect).

Local Authority (Planning Policy Officer)

- Can you tell me about your role in planning?
- What are your thoughts of vertical farms as a feasible solution to tackling food security/resilience.
- What use class would you classify vertical farms as? (Sui Generus, B1, B2 , industrial, ancillary).
- Do you believe current policy supports vertical farms
- Do you believe there should be policy to address vertical farms/should planning policy address vertical farms as a special case if it is classified as industrial
- What constraints do you think planning policy has in relation to implementing vertical farms (e.g. does current policy support vertical farms).

Appendix B – Policies contained within Local Plans in London in relation to food growing

LA	Policy	Notable Policies and Statements in Document
London Borough of Bromley (2019) Local Plan	None.	None.
London Borough of Waltham Forest Local Plan (2019)	Policy 58	G. Encouraging food growing within the borough and the protection of existing allotments to support the provision of new food growing spaces.
	Policy 89	B. Development proposals will be expected to contribute to the supply, quality and accessibility of private and communal spaces on which to grow food and flowers. This may be in the form of financial or on-site contributions. On-site contributions must be supported by a maintenance plan at application stage.
	17.29	The Council welcomes the expansion and improvement of existing allotments and community food growing schemes.'
	17.39	Spaces such as allotments provide positive physical and mental health benefits to residents through healthy lifestyle adjustments such as the opportunity to produce and consume fresh healthy food, spend time in the open air and meet with others.'
	17.31	The Council will encourage food growing and community gardening initiatives on existing open spaces and temporarily derelict land where short or medium term development is not planned.
Earling (2012) Development (or Core) Strategy 2026	None.	None.
City of Westminster (2016) Westminster City Plan	None.	None.
Camden (2017) Camden Local Plan	4.14	The cost of housing is a significant issue for residents in Camden, where increased cost can lead to difficult decisions between heating and healthy food.
	6.55	Temporary provision of open space. Sites awaiting development can sometimes make short term contributions to open space provision. We will strongly support the temporary use of cleared sites for public open space during the construction period where this can meet local needs. Such sites provide a potential location for local food growing projects
London Borough of Lambeth Local Plan (2015)	P.2.73	safeguarding allotments and encouraging small-scale local food production on other appropriate sites;
	P. 2.95	In order to become strong, safe, healthy and self-reliant, communities need local spaces that can accommodate a wide range of community activity.. Community activity contributes positively to community cohesion and wellbeing and can include the aspiration for community gardens and local food production.
	Policy D4	(xv) local food production and growing
	Policy H5	(c) Communal amenity space should: (V) incorporate sustainable landscape principles and practices, including effective water management, efficient energy use, use of sustainable materials, and promotion of biodiversity and, where appropriate, food growing;
	Policy EN2	(a) The use of land and buildings as new allotments, orchards and for local food growing spaces and production will be supported, including the temporary use of vacant or derelict land or buildings and the use of incidental open space on housing estates and other open space areas, where this does not conflict with other policy objectives or land use priorities. (b) The incorporation of community gardens, allotments, orchards and innovative spaces for growing food, including green roofs, will be encouraged and supported in major new developments where possible and appropriate, particularly where there is demand for food growing space in the vicinity of the application site.
	9.9	The inclusion of food growing opportunities in new developments extends beyond the conventional provision of gardens and allotments. It might include the creative use of roofs, walls and balconies where external space is limited, and landscaping with productive plants that produce fruit, nuts or seeds rather than ornamental trees and shrubs.
	9.10	In some cases initiatives such as the use of incidental open space on housing estates for food growing may not require planning permission. This would depend on its scale and form, and the extent to which it would change the character and function of the open space. The acceptability of such proposals would also depend on the impact on the availability of open space for general amenity use by residents.
	9.11	The temporary use of vacant land and buildings for food growing will be supported where it would not have an unacceptable impact on the amenity of adjoining areas arising from the scale and nature of the activity through noise, disturbance or noxious smells

	9.13	Where provided, the identified space for food growing may be secured through planning condition or section106 agreement. Existing allotments are protected under policy EN1.
London Borough of Bexley (2012) Bexley Core Strategy	None.	None.
London borough of Havering (2017), Havering Local Plan: 2016 – 2031	8.7.5	The Council is supportive of innovative ways of providing food growing and gardening opportunities, particularly through community gardens and dedicated growing spaces within in new developments
London Borough of Redbridge (2018) Redbridge Local Plan 2015 – 2030	5.4.4	There are many innovative ways of providing amenity space including well integrated terraces, balconies and loggia, community gardens, winter gardens and green roofs. These can provide quality, functional space, space for community interaction, local food growing.
	Policy LP36 -	The Council will maintain and enhance and where possible increase the amount of land used for sustainable food growing and gardening by: (d) Working with partners and local communities to identify sites with potential for local food growing and gardening projects; Implementation: 2 The Council will support and encourage new community food growing spaces as part of the landscape provision within residential development.
London Borough of Barking and Dagenham (2010) Core Strategy	Bc10:	The Council will promote the objectives of the Mayor's Food Strategy and encourage developments and other initiatives to provide fresh fruit and vegetables in the Borough, particularly in Barking Riverside and locations with existing deficiencies. This will include support for the continuation and improvements of the Borough's markets, and the retention and expansion of allotments in the Borough.
Newham (2018) Local Plan	SP2	The need for new or improved health facilities, (as per INF8) and importance of protection and promotion of local access to health and other community facilities and employment, including sources of fresh, healthy food in line with Policies SP6, SC1, INF8 and INF5;
	2.18	Access to healthy food may be promoted through ... Allotments and community food growing projects on opportunity sites (sites awaiting development, and Strategic Sites) may also contribute to this agenda (see Policies INF7 and SC1 and the Infrastructure Delivery Plan (IDP).
	SC1 - f	Development should take advantage of linked opportunities in sustainable design and minimise conflict between different strands, notably through: iv. The opportunity to integrate food growing, including consideration as a temporary use.
	SC1 - c	Improve opportunities for food growing, including through the protection and creation of allotments and other local growing space'
	5.6	Improving energy security through maximum use of locally-available energy sources plays in to the Council's wider Resilience agenda, as does the prioritisation of local supply in other forms including food growing, labour, and other resources. As per the three strands of sustainable development, improving resilience overall is likely to have beneficial environmental, economic, and social effects.
	5.12	Allotments and other local growing spaces should be part of the green infrastructure open space offer on larger sites. Existing spaces should also be protected, promoted and positively managed, including through enhancing / intensifying opportunities for food growing.
	6.97	Opportunities for food growing, including as 'meanwhile' uses that do not jeopardise the overall redevelopment of allocated sites, are encouraged in line with local resilience aims.
Tower Hamlets local plan (2020)	None.	None.
Southwark Council (2011) Core Strategy	Strategic Policy 11	Protecting woodland and trees and improving the overall greenness of places, including through promoting green corridors, gardens and local food growing.
	5.93	Local food growing and composting help promote healthy lifestyles and reduce the environmental impact of food consumption. We are looking at ways to encourage local food growing and composting in Southwark, including how existing spaces may be used. It will be important for new development to include opportunities for local food growing, community gardening and composting where possible.
Lewisham (2011) Core Strategy Development plan document	3.5	To contribute to economic growth and address deprivation issues, the Council will need to continue to facilitate the strong growth in the number of small businesses, support creative industries, focus on the economic potential of town centres, local shopping areas and small parades (including street and farmers' markets), and better use underused employment areas. Identified growth areas include a range of diverse business services, and the creative and food industries.

	3.5 – 3.10	The Core Strategy can play an important role in providing opportunities for people to live healthy lifestyles and improve well-being. ... Health is far more than the absence of illness, rather it is a state of physical, mental and social well-being. A person's health is therefore linked not only to age and gender but also to wider factors such as education, employment, housing, social networks, air and water quality, access to affordable nutritious food, and access to social and public services in addition to health care. It is about lifestyle: physical exercise, improved diet, cleaner air, and mental well-being through stress reduction, engagement and socialisation (including employment)
	7.29	There is a strong recognition of the importance of creative industries to the borough's economy, with these activities currently clustered in parts of Deptford, New Cross and Forest Hill. Business services and food manufacturing and services are also identified as having significant growth potential.
	4.9	New development throughout the borough will meet the challenges of climate change, flood risk, the need for renewable and low carbon energy, and the use of sustainable materials and construction practices. Accessibility and inclusiveness, and design to reduce crime and the fear of crime will be at the heart of the design of new developments. The provision of new green space will be emphasised in local recreation and children's play space, and new initiatives for urban food growing and the provision of allotments. Biodiversity in new developments will have been enhanced wherever possible through the provision of on-site open and amenity space including the use of living roofs and walls.
	12	m. promoting and supporting local food growing and urban agriculture
Croydon Local Plan 2018	6.29	Private and communal outdoor amenity space can assist in mitigation of climate change with vegetation that contributes to biodiversity and space that is multi-functional; for socialising, play, and sport, food growing and gardening.
	6.167	The design of a development can also promote access to healthy food opportunities by providing food growing opportunities whilst protecting existing facilities.
	SP7.5	b. Supporting food growing, tree planting and forestry, including the temporary utilisation of cleared sites; and encouraging major residential developments to incorporate edible planting and growing spaces at multiple floor levels; and c. Ensuring landscaping is flexible so that spaces may be adapted for growing opportunities.
	para. 9.7	The concept of productive landscapes goes beyond food production to include community gardens, sustainable forestry, urban farms and urban agriculture plots, where commodities such as flowers can be produced. Productive landscapes encourage healthy eating... regeneration of derelict or underused urban spaces (which can improve the perceived or actual safety of an area), increased community cohesion and the potential for economic development through learning new skills and exploring commercial options for dealing with surplus produce.
	Para. 9.25	Incorporating productive landscapes into the design and layout of buildings and landscapes provides opportunities for local food growing, supports the creation of healthy and active communities, improves the quality of open spaces and enhances biodiversity. Productive landscapes can take the form of allotments, community garden & growing spaces, green roofs & walls and productive planting.
	10.53	The Strategic Policies of the Croydon Local Plan support the use of vacant buildings and cleared sites by cultural and creative industries and community uses. It also supports their use for food growing and tree planting.
Sutton (2018) Sutton Local Plan 2016-2031	Policy 25: b	The council will encourage and support the provision of community-run and managed allotments and community food growing spaces in major new developments where practicable.
	POLICY 21: 21.3	The council will therefore look at a range of measures when assessing planning applications in order to promote health and well-being and attempting to reduce health inequalities: access to open space and nature; [includes] access to healthy food, climate change and the minimisation of the use of resources.
	Policy 25: 25.7	The council will through this policy encourage developers to provide opportunities for community growing food spaces and the council will welcome innovative solutions to achieve this objective within major new developments, wherever this is practicable and does not compromise other policies of the plan.
Merton Council (2011) Core Planning Strategy	Policy CS 13 . f	Safeguard our existing allotments and encourage the use of land for growing food.
	23.2	Combating climate change is a priority for Merton. As set out in Chapter 5 'Issues and Opportunities', Merton's Core Strategy will address the impacts of climate change and accommodate new development sustainably. Climate change has social and economic impacts worldwide; Merton's residents and workers are affected by higher energy bills, food supply and more extreme weather events.
Wandsworth (2016) Wandsworth Local Plan: Core Strategy,	None.	None.

The Royal Borough of Kensington and Chelsea (2019) Local Plan	Chapter 24	The ecological footprint in the borough is 6.39 global hectares per capita, which is the second highest in London (The London average is 5.48 and national average is 5.30). The primary contributors in the borough are food (28 per cent) and housing (21 per cent)161. This, together with the greenhouse gases emitted during the transportation of food and manufacture of packaging, makes food production close to its consumption an important consideration for the borough. There is opportunity, even in small developments, to use private garden space, green/living roofs and sheds to facilitate small scale on-site food production, and larger developments present different opportunities.
	CE1	f. require development to incorporate measures that will contribute to on-site sustainable food production commensurate with the scale of development.
Hammersmith & Fulham (2018) Local Plan	OS5 10.15	Where opportunities arise, space for local food growing should also be encouraged, for example through creative use of green roofs, walls and balconies. This could be for individual gardeners or organisations including schools who want to grow food for themselves and/or the local community.
London Borough of Richmond Upon Thames (2018) Local plan	LP 30	A. The Council will support development that results in a pattern of land uses and facilities that encourage: 4. Access to local healthy food, for example, allotments and food growing spaces.
	LP 32 - 8.5	Allotments and food growing spaces. The Council will protect existing allotments and support other potential spaces that could be used for commercial food production or for community gardening, where possible.
	8.3.8	New development should provide, where possible, opportunities for households to own or have access to space to grow food, for example roof or communal gardens or allotments.
	8.5.5	Where appropriate, the provision of new allotments or other food growing space, alongside the provision of other private, semi-private and public open spaces, will be supported if opportunities arise as part of new developments.
Royal Kingston (2012) Core Strategy	Policy CS 2	Promote local food growing by encouraging development proposals to include appropriate spaces for residents to grow their own food and the establishment of community gardens for community food growing
	6.15	The promotion of local food growing in the Borough will have numerous benefits for residents and supports the objectives of the Kingston Plan. It will reduce the carbon footprint of food production by minimising CO2 emissions produced from transporting food and therefore is beneficial for air quality and the reduction of pollution levels. It supports healthy living by enabling residents to make more sustainable food choices, protects local ecosystems and helps generate new communities.
London Borough of Hounslow (2015) Local Plan 2015-2030	GB4	Green infrastructure network The multifunctional, interdependent network of open and green spaces and green features (e.g. green roofs). It includes the Blue Ribbon Network but excludes the hard-surfaced public realm. This network lies within the urban environment and the urban fringe, connecting to the surrounding countryside. It provides multiple benefits for people and wildlife including: flood management; urban cooling; improving physical and mental health; green transport links (walking and cycling routes); ecological connectivity; and food growing. Green and open spaces of all sizes can be part of green infrastructure provided they contribute to the functioning of the network as a whole'
	GB8 -	We will encourage the continued use of allotments and agricultural land, and promote new, innovative uses of green space for local food growing, including community farming, gardening and orchards, and commercial food production. (c) Working with partners and local communities to identify sites with potential for local food growing and supporting projects that promote community gardening, farming and orchards; and (d) Supporting initiatives for commercial food production.
	7.16	The use of green space for local food growing has many benefits, by promoting more active, healthy lifestyles, adding to local residents' connection with and sense of ownership of local green spaces and supporting wider sustainability benefits. Promoting agriculture and commercial food growing, and encouraging farmers to adopt environmental stewardship schemes, can also help improve the biodiversity value of urban fringe areas and the Green Belt.
	GB8 -	the Mayor of London and the Big Lottery's Local Food Fund. Its goal was to create 2012 community food growing spaces across London by 2012, and to date has created 2182 spaces. It offers practical support and training to individuals and groups wanting to grow their own food. There are also a number of farms in the borough, largely located in the west, in the Green Belt, but there is also agriculture present further east, at Osterley and Syon Parks.
London Borough of Hillingdon (2020) Local Plan Part 1	8.27	The London Plan (2011) encourages farming and land based sectors in the Green Belt to allow enough land for food production. A policy on food production will be addressed in the Hillingdon Local Plan: Part 2

	EM4	Protecting informal recreational spaces including allotments and promoting participation in food growing opportunities
Hillingdon (2020) Local Plan Part 2	6.6	Vertical gardens will be encouraged in urban areas. These can promote local food growth, as well as biodiversity improvements, which can often be overlooked when developers are maximising land take in an urban setting.
Harrow Council (2012) Harrow Core Strategy	None.	None.
Brent Council (2010) Core Strategy	None.	None.
London Borough of Barnet (2012) Barnet's Local Plan (Core Strategy)	12.9	12.9.2 We recognise the benefits for health, community cohesiveness and our local landscape from making better use of our land for food growing. We support the Mayor's Capital Growth Initiative to create 2,012 new community food growing spaces in London by end of 2012 and are keen to promote sustainable local food production given our significant and well used allotment holdings and extensive former agricultural lands.
	CS7:	enhancing local food production through the protection of allotments and support for community food growing including the Mayor's Capital Growth Initiative.
Enfield Council (2010) The Enfield Plan Core Strategy 2010-2025	8.87	In addition, a Food Strategy for the Borough will be developed to draw together all aspects of food production and consumption and how they are delivered locally. This Strategy will look at improving existing allotments, and new informal growing spaces, through the diversification of existing open spaces and new community growing spaces.
Haringey London (2013) Haringey's Local Plan Strategic Policies 2013 – 2026	SP4 4.1.1	The biggest impact on individuals and communities will be the increasing risk of floods, droughts and heat waves. This will have implications for people's health, safety and comfort, food production, biodiversity and infrastructure. Risks in London are set out in the Mayor's Adaptation Strategy.
	6.3.13	The Council will seek to protect, and where possible, through development opportunities, increase the allotment space and promote and encourage sustainable food growing in the borough.
	6.3.16	In addition, A Sustainable Food Strategy for Haringey is being developed with the objectives of: ▪ Increasing individual and community food growing;
Islington (2011) Islington's Core Strategy	3.6.8	An Open Space and Green Infrastructure Strategy will be developed to further explore the above interrelated issues including open space, biodiversity, local food production and climate change adaptation. This strategy will encourage the development of highly multi-functional open spaces, and be accompanied by an action plan to demonstrate how they will delivered.
	Policy CS 15	E. Supporting local food production through the protection of existing food growing sites. Opportunities for new food growing spaces will be sought elsewhere including from new private developments
Hackney (2020) Local Plan	LP46	G. Allotments and Food Growing i. The Council will protect existing allotments and support the provision of new food growing spaces.
	11.7	New food growing initiatives are encouraged on existing open spaces and temporarily derelict land where short or medium term development is not planned. Consideration must be given to facilities such as storage of equipment and composting, ensuring that there is no detrimental impact on the character, appearance and amenity of the surrounding area, and to equality of access and security.
Royal Greenwich Local Plan: Core Strategy with Detailed Policies (2014)	4.7.28	Community food growing is important, not only in helping to provide people with healthy local food, but also because it involves exercise, fresh air and interaction with the natural environment which has proven to be positive for mental well-being.

Appendix C – Planning Permission for Existing Vertical Farms

Planning reference	Description	Use Class	Decision
99/1183	Change Of Use To Class B8	B8	Granted
61147	Change of use of warehouse (use class B8) to church (use class D1)	B8	N/A
DC/17/103990	The change of use of the part of the existing ground floor and containers to A3 use, installation of new shop front and doors and the continued B2/B1 use for the existing building	A3/B2/B1	Granted

Appendix D – Information Sheet and Consent Form

Information and consent form

Project Title: Are vertical farms a feasible solution to tackling food security in London? A study into the implementation of vertical farming within London.

Researcher: Casey Virasami

Introduction

You are being invited to take part in a research project being undertaken by a Masters student from the Bartlett School of Planning, University College London (UCL).

Before you decide whether or not to participate it is important for you to understand why the research is being conducted and what participation will involve. Please read the following information carefully, feel free to discuss it with others if you wish, or ask the research team for clarification or further information. Please take time to decide whether or not you wish to take part.

Why is this research being conducted?

The aim of this project is to investigate whether vertical farming is a feasible solution to tackling the issue of food security by investigating the implementation of vertical farms. The main objectives are;

- Identify implementations of vertical farms in London
- Explore the key constraints in the implementation of vertical farms in London
- Critically assess whether vertical farms a feasible solution in tackling food security in London using case studies
- Formulate recommendations on whether the current policy in planning supports vertical farms in London.

Why am I being invited to take part?

You are being invited to take part in this project as your expertise within this field will be extremely beneficial in order to gather qualitative research for my dissertation. I am looking to gain an insight into your role, motives, and issues encountered within the industry of vertical farming in relation to planning policy.

Do I have to participate?

Participation is entirely voluntary. If you do choose to participate and then change your mind, you may withdraw from the research at any time with no consequences and without having to give a reason.

What will happen if I choose to take part?

If you do choose to participate, you will be invited to a virtual interview to explore the issues highlighted above. The interview will be conducted through a mutually agreed online platform (E.G.

Zoom/Skype/Microsoft Teams). The interview will last approximately 30 minutes and will be audio recorded (and transcribed at a later date) with your consent. Any audio collected for this research will be used only analysis and no one outside the project will be allowed access to the original recordings.

What are the advantages of taking part?

The immediate benefit in participating in this project is to have time to reflect on your contributions to vertical farming and food security. It is hoped that this project will inform key policy makers on whether current planning policy supports vertical farming and whether more incentives are required in order to support the industry. There is no financial incentive or reward is offered for taking part in this research.

What are the possible disadvantages of taking part?

We anticipate no significant disadvantages associated with taking part in this project. If you experience any unexpected adverse consequences as a result of taking part in the project you are encouraged to contact the researcher as soon as possible using the contact details on page 3 of this information and consent sheet.

If I choose to take part, what will happen to the data?

The interview data will be anonymised at the point of transcription and identified by a general identifier (e.g. 'Planning officer A' or 'Vertical Farmer B' or a suitable pseudonym). A record of participant identities and any notes will be kept separately and securely from the anonymised data. All data and information affiliated with this project will be securely stored on an encrypted computer drive and physical documents will be stored securely on University property.

The data will be only used for the purposes of this research and relevant outputs and will not be shared with any third party. The anonymised data will be utilised in the written dissertation produced at the end of this project, and this dissertation may then be made publicly available via the University Library's Open Access Portal, however no identifiable or commercial sensitive information will be accessible in this way.

What will happen to the results of the research project?

It is anticipated that the data collected in this project will be included in the dissertation produced at the end of this project, submitted for the award of a Masters degree at University College London (UCL). You will not be personally identified in any of the outputs from this work, and attributions and quotations will be anonymised. If you would like to receive an electronic copy of any outputs stemming from this project please ask the contact below who will be happy to provide this.

Contact Details

If you would like more information or have any questions or concerns about the project or your participation please use the contact details below:

Primary contact	Casey Virasami
Role	MSc Spatial Planning Student
Email	casey.virasami.18@ucl.ac.uk
Supervisor	Tse-Hue Teh
Role	MSc Dissertation Supervisor
Email	t.teh@ucl.ac.uk

Concerns and / or Complaints

If you have concerns about any aspect of this research project please contact the MSc student contact the student in the first instance, then escalate to the supervisor.

Informed Consent Sheet

Title of project

If you are happy to participate, please complete this consent form by ticking the boxes to acknowledge the following statements and signing your name at the bottom of the page.

Please give the signed form to the researcher conducting your interview at the interview. They will also be able to explain this consent form further with you, if required.

1.	I have read and understood the information sheet.	☐
2.	I agree to participate in the above research by attending a virtual interview as described on the Information Sheet.	☐
3.	I understand that my participation is entirely voluntary.	☐
4.	I understand that I may withdraw at any time without giving a reason and with no consequences.	☐
5.	I agree for the interview to be audio recorded.	☐
7.	I understand that the intention is that interviews are anonymised and that if any of my words are used in a research output that they will not be directly attributed to me unless otherwise agreed by all parties.	☐
8.	I understand the data from this project will be considered for repository in the UCL Open Access repository as described on the Information Sheet but that this will be anonymised data only.	☐
9.	I understand that I can contact the student who interviewed me at any time using the email address they contacted me on to arrange the interview, or the dissertation supervisor using the contact details provided on page 3 of the information sheet.	☐

Participant name:
Signature:
Date:

Researcher name:
Signature:
Date:

Appendix E – Risk Assessment

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

UCL

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION MSC SPATIAL PLANNING
LOCATION(S) HOME WORKING
PERSONS COVERED BY THE RISK ASSESSMENT CASEY VIRASAMI

BRIEF DESCRIPTION OF FIELDWORK No Fieldwork is proposed. The dissertation will be conducted remotely from home.

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? Heatwaves - Risk Medium Stress - Risk Medium Slips, trips and falls - Risk Low

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	work abroad incorporates Foreign Office advice
☐	participants have been trained and given all necessary information
☐	only accredited centres are used for rural field work
☐	participants will wear appropriate clothing and footwear for the specified environment
☐	trained leaders accompany the trip
☐	refuge is available
☐	work in outside organisations is subject to their having satisfactory H&S procedures in place
☒	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Ensure I am well hydrated and keep the house well venitlated to mitigate any risks associated with heatwaves. Will ensure I take breaks throughout the work day to reduce the risk of stress. To mitigate the risk of slips, trips and falls I will ensure my work space is kept tidy.

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life Fire Risk - Risk Low Flood Risk - Risk Low Burglery Risk - Risk Low

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
☐	fire fighting equipment is carried on the trip and participants know how to use it
☒	contact numbers for emergency services are known to all participants
☐	participants have means of contacting emergency services
☐	participants have been trained and given all necessary information
☐	a plan for rescue has been formulated, all parties understand the procedure
☐	the plan for rescue /emergency has a reciprocal element
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EQUIPMENT	**Is equipment used?**	**Yes**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

Laptop - Low Risk
Voice Recorder - Low Risk
Phone - Low Risk

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	the departmental written Arrangement for equipment is followed
☐	participants have been provided with any necessary equipment appropriate for the work
☒	all equipment has been inspected, before issue, by a competent person
☐	all users have been advised of correct use
☐	special equipment is only issued to persons trained in its use by a competent person
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	**Is lone working a possibility?**	**No**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	the departmental written Arrangement for lone/out of hours working for field work is followed
☐	lone or isolated working is not allowed
☐	location, route and expected time of return of lone workers is logged daily before work commences
☐	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
☐	all workers are fully familiar with emergency procedures
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH	**The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.**
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Covid-19 Virus - Risk High

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ an appropriate number of trained first-aiders and first aid kits are present on the field trip
- ☐ all participants have had the neoessary inoculations/ carry appropriate prophylactics
- ☐ participants have been advised of the physical demands of the trip and are deemed to be physically suited
- ☐ participants have been adequate advice on harmful plants, animals and substances they may encounter
- ☐ participants who require medication have advised the leader of this and carry sufficient medication for their needs
- ☒ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Interview are done virtually through Zoom to avoid face-to-face contact and ensure governemnt guidelines can be followed.

TRANSPORT	**Will transport be required**	**NO** ☐	**Move to next hazard**
		YES ☐	**Use space below to identify and assess any risks**
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low? No transport is required.		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ only public transport will be used
- ☐ the vehicle will be hired from a reputable supplier
- ☐ transport must be properly maintained in compliance with relevant national regulations
- ☐ drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
- ☐ drivers have been trained and hold the appropriate licence
- ☐ there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
- ☐ sufficient spare parts carried to meet foreseeable emergencies
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	**Will people be dealing with public**	**No** ☐	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ all participants are trained in interviewing techniques
- ☐ interviews are contracted out to a third party
- ☐ advice and support from local groups has been sought
- ☐ participants do not wear clothes that might cause offence or attract unwanted attention
- ☐ interviews are conducted at neutral locations or where neither party could be at risk
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER	**Will people work on or near water?**	**No**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**

e.g. rivers, marshland, sea.

Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ lone working on or near water will not be allowed
- ☐ coastguard information is understood; all work takes place outside those times when tides could prove a threat
- ☐ all participants are competent swimmers
- ☐ participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
- ☐ boat is operated by a competent person
- ☐ all boats are equipped with an alternative means of propulsion e.g. oars
- ☐ participants have received any appropriate inoculations
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	**Do MH activities take place?**	**No**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**

e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.

Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ the departmental written Arrangement for MH is followed
- ☐ the supervisor has attended a MH risk assessment course
- ☐ all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
- ☐ all persons performing MH tasks are adequately trained
- ☐ equipment components will be assembled on site
- ☐ any MH task outside the competence of staff will be done by contractors
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	**Will participants work with substances**	**No**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ the departmental written Arrangements for dealing with hazardous substances and waste are followed
- ☐ all participants are given information, training and protective equipment for hazardous substances they may encounter
- ☐ participants who have allergies have advised the leader of this and carry sufficient medication for their needs
- ☐ waste is disposed of in a responsible manner
- ☐ suitable containers are provided for hazardous waste
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	**Have you identified any other hazards?**	**No**	**If 'No' move to next section** **If 'Yes' use space below to identify and assess any risks**
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		

CONTROL MEASURES **Give details of control measures in place to control the identified risks**

Have you identified any risks that are not adequately controlled?			**Move to Declaration** **Use space below to identify the risk and what action was taken**
	NO	☒	
	YES	☐	

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? No

If yes, please state your Project ID Number

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

- ☐ I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
- ☒ I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR

SIGNATURE OF SUPERVISOR DATE

BPLN0039_19_20 - 18163345 - An investigation into the implementation of vertical farms and how they are perceived in planning policy

GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

PAGE 38

PAGE 39

PAGE 40

PAGE 41

PAGE 42

PAGE 43

PAGE 44

PAGE 45

PAGE 46

PAGE 47

PAGE 48

PAGE 49

PAGE 50

PAGE 51

PAGE 52

PAGE 53

PAGE 54