P4 Reflection

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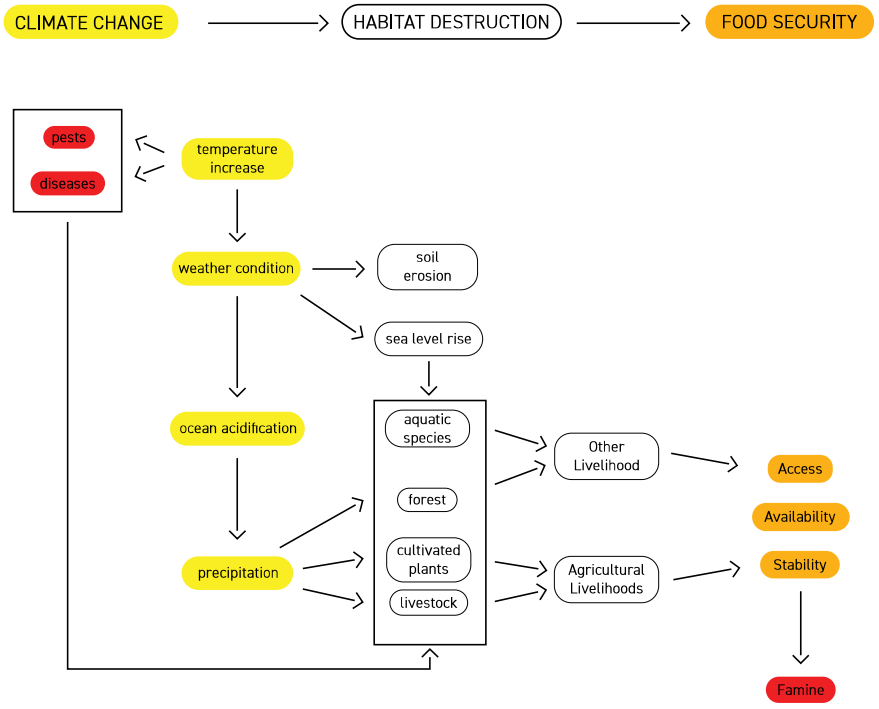
Introduction

This is a personal reflection on my master's thesis process and outcome. The reflection is structured into three categories: why, how, and design outcome. The first two categories explore the problem's relevance and the investigation process, which took approximately half a year. The third category outlines the design process for implementing the results from the preliminary investigations. The thesis serves as a continuous exploration of what works, what alternative paths can be taken, and the consequences of each decision, all in addressing the pressing issue of food security in desert climate countries.

First Category: WHY

This is the argument for why this problem is worth investigating and designing to solve a large part of the human aspect: food. The most prominent relevance for a vertical farm project is for desert climate countries like Qatar, Kuwait, Bahrain, and Saudi Arabia. In this thesis, the site focus is in Doha, the capital city of Qatar. The country has no arable land to grow food, and for a very long time before the discovery of oil, it sold harvested pearls and raised horses to buy food and water. Historically, they have been importing food and water from neighboring countries like Oman and Iran, but because of the growing global climate change and geopolitical conflicts, there is an urgent, immediate need for food security. In my graduation plan for P2, I created a diagram to show the domino effect of climate change, which is not slowing down, but extreme weather events are becoming frequent. Events like floods and droughts destroy arable land and aquatic species, destroying livelihoods and limiting food accessibility and affordability. These recent conflicts through manmade and natural events can cripple any nation's food security, but even more so to countries that do not have the soil conditions to grow food. However, with the potential of vertical farming and aquaponics, there is hope for a more secure food future.



P2 Diagram for climate change domino effect.

Among the various types of vertical farms discussed in my graduation plan, I chose to focus on aquaponics. This method relies on a fish-plant symbiosis in which crops provide nutrients for the fish while the fish contribute nutrients for the crops. While growing fish and plants in a desert environment may seem impractical, this approach is motivated by dietary preferences. Qataris are known for their love of seafood, and most of their dishes have an abundance of rice. Two main ingredients facing climate severity globally and the continuously advanced technologies make it possible to harvest energy and water in the desert.

Second Category: HOW

The methodologies' results indicated a need to create a balance between human and automation designs. Vertical farms are usually associated with industrial plants, away from the human population, to grow food in a controlled environment with no added value to the site context. The extensive research and practical relevance indicate that for vertical farms to grow within the city landscape, they must create a social function to attract users. Food is a social function embedded in every facet of every civilization's identity and culture. Separating food production in an industrial plant away from the city also pulls away from the social aspects it could create. This outcome indicates vertical farms are not only a place to grow food at an astronomically high yield that could never be achieved in a traditional farming practice but also to create affordability, accessibility, and social connections for the urban landscape.

There are three main disadvantages when starting a vertical farm: high startup cost, high technical knowledge, and high energy requirements. After analyzing the largest vertical farm in Dubai, the most cost-effective and environmentally friendly method is prefabrication. The problem I saw with this method used for the farm in Dubai is that they used steel and concrete, two construction materials with heavy carbon emissions to create. Although it was praised for budget control and project duration, for a nation to be more independent from growing geopolitical conflicts, it is necessary to use local materials as much as possible, preferably 90% of the materials. From this crossroad, this project was looking at whether it would use steel and concrete like this vertical farm in Dubai or use local materials like clay, sandstone, and limestone. All materials extracted from its source produces carbon emissions and that creates an ethical dilemma as carbon emissions also affects other livelihoods. The choice of construction materials for the vertical farm in Doha is a critical decision that can significantly impact the project's carbon footprint, durability, and overall sustainability. This also questions if I should create vertical farms for Doha and use primarily concrete and steel. It will only worsen climate change, further accelerating destructive behavior toward our food sources in their natural environments. It is relevant in architecture to think critically about how every step of the design process influences a negative or positive effect on the world, not only for the users. Bridging engineering and architecture environmentally and sustainably also brings the same effect for future generations, and this created another scenario of how this project could evolve for future generations' needs by moving certain building materials to create a larger space or removing the facade without heavy equipment.

Third Category: DESIGN OUTCOME

The second half of the thesis was to formulate all the research into design strategies. All of the research outcomes have been used. However, there was a dilemma of whether it is more important only to have vertical farms and not social landscapes to feed everyone within a 15-minute walking radius. Alternatively, is it more important to grow food and create a social tissue for a city with few social functions? It was important to address the Qatar National Vision 2030, which was found at this crossroads, to determine how the project could be relevant in a worsening climate change and geopolitical crisis and see its relevance within the country's agenda. Their National Vision blueprint, a crucial guide for the country's development, helped the project to align with the country's needs. Its architecture was another challenging aspect of whether to recreate the sharp edges of architecture populated in all desert cities or to re-engineer and recreate for modularity, flexibility, and cost efficiency for this and future generations while strictly following their seven urban principles.

Nearing P4, the project is almost at its full potential where it could be an attractive proposition for the country highlighting Human, Social, and Economical Developments. Approaching P5, I have two reflection questions that relate to the content of my thesis:

Will the design and social functions adapt well to other desert climate countries, or is this only a design best suited for Qatar?
How can the design and technological implementation effectively balance the need for affordable and accessible food with the ethical considerations surrounding the choice of materials and technologies?