URBAN ORGANIC FARMING CENTER

Adarsha, Bhaktapur

By: Anish Chhusyaki 760106

A thesis submitted in partial fulfillment

of the requirements for the

Degree of Bachelor of Architecture



Purbanchal University
KHWOPA ENGINEERING COLLEGE
DEPARTMENT OF ARCHITECTURE
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ABSTRACT

Agriculture is an important key to human development. The social bond that has grown between agriculture and humans from the early stages of human evolution is weakening. The natural resources that are now available to us, the state of the climate, the density of the population, and their needs have all altered significantly. However, in thousands of years, agriculture hasn't altered all that much. We continue to travel over vast agricultural land, apart from the people who consume it.

In the context of Kathmandu valley, urban and peri-urban agriculture have been practiced from ancient time and traditional way of life. Like many other cities across the world, Kathmandu is driving the natural world and agriculture farther away from the city. The valley's economics, ecology, and public health are seriously threatened by the present unsustainable agricultural system, which also involves a large volume of food imports and improper use of chemicals during food preparation. The economy can no longer support it due to factors including urbanization, crop failures, population expansion, and environmental changes. The only way to address food crises and future food security in a sustainable manner is to establish a farm and research facility adjacent to the communities they service. Given the sharp decline in the amount of land for agriculture available and the current demand for food, indoor vertical farming may be a preferable option to the traditional agricultural system currently in use. Therefore, the project emphasizes symbiosis of agriculture and architecture through modern agricultural systems to reconnect people with nature and solve major issues of food crisis at the same time.

Name: Anish Chhuayaki

(760106)

DECLARATION

I declare that this distertaion has not been previously accepted in substance for any degree .I state that this dissertation is the result of my own independent investigation/work, except where otherwise stated.I hereby give consent for my dissertation, if accepted,to be available for photocopying and understand that any reference to or quotation from my theisis will receive an acknowledgement.

Anish Chhusyaki
Date

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-	Anish Chhusyaki
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CHAPTER 1:INTRODUCTION

1.1. Background study

Agriculture is the cultivation and breeding of animals, plants and fungi for food, fiber, biofuel, medicinal plants and other products. Urban farming whereas represents agriculture on urban land. With growing desire for sustainable urban development it is also necessary to examine the production process which sustain the population biologically. In the context of evolving farming practices vertical farming seems to be rising popularity in urban farming area. Vertical farming is cultivating plant life in vertically inclined or stacked spaces contrary to the traditional horizontal farming. The modern idea of vertical farming uses technologies similar to glass houses, where natural sunlight can be augmented with artificial lighting. These vertical farms conduct with no soil and uses less water than in traditional farming method.

According to United Nations World Urbanization Prospects, 55% of the world population is living in the urban area, which is only predicted to grow in the next decade throughout all the urban cities of the world. People migrate to urban cities because it offers facilities and opportunities that will eventually increase their quality of life. This rise in the population of the urban area has had a reverse impact on all the resources of the cities; especially its food. The land that was once used for cultivation has now been transformed to hold some built-up space. This has led to all the urban cities being completely dependent on the suburban farmlands or imported goods to feed its ever-rising population.

Architecture evolved out of necessity: to provide shelter from the elements and to create a sense of security. Architecture commonly encompasses three of four basic necessities i.e., generally found outside the architectural realm. There is largely untapped potential in the interrelationship between agriculture and architecture, on the macro scale and the micro scale. And will propose a solution that brings the fourth element of survival within the domain of architecture using innovative design and existing technological solutions.

Agriculture in Nepal has long been based on subsistence farming, particularly in the hilly regions where peasants derive their living from fragmented plots of land cultivated in difficult conditions (Nations Encyclopedia, 2021). Nepalese agriculture is characterized by higher range of altitudes and temperature throughout the country, agriculture in Nepal has peculiar characteristics (Development Vision Nepal P. Ltd., 2018).

1.2 Problem Statement and Project Justification

Cities world is destroying green spaces for residential, commercial, and industrial development. The fast consumption of natural resources poses a threat to both food supply and the environment, highlighting the need for sustainability. The rising distance between cities and agricultural farms has led to increased fuel usage for transportation and storage of agricultural products. In addition, people are becoming estranged from nature. Finding open and green locations for good breathing might be tough.

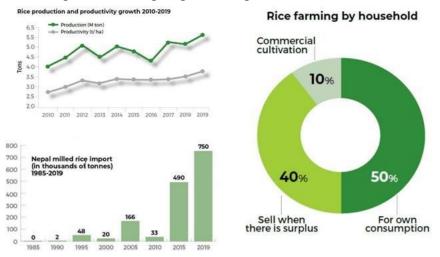


Fig 1 .Rice Production and import charts Source: Nepal agro imports at all time high Nepali Times

Another issue connected to Kathmandu's lack of community is the loss of farmland. Agriculture employs 80% of the country's inhabitants. The percentage has now dropped to 20%, and non-farming activities are fast expanding. Furthermore, the city's uncontrolled expansion has engulfed most of the farmland that originally provided as a steady source of human connection. It results in food shortages on the one hand, even when rich urban residents have adequate money. (Shrestha S. , Urban farming for community well-being in Kathmandu, 2011).



Fig 2 Decreasing of Farm land Source: Caravan DOLPO

As farmlands are sold to agricultural companies, Kathmandu Valley faces uncontrolled population expansion. This has led to a food crisis that needs to be resolved. Modern farming methods enable us to produce a significant amount of food in small spaces, making use of expensive and valuable land in cities.

In this thesis, urban farming is considered serves for community benefits, as it offers environmental, social, economic, and health benefits, as well as platform for exchange of goods, services and technology between community members and rural and urban farmers. The urban farm serves as a public gathering place for individuals from diverse backgrounds and opinions on life.

Working together in environments such as urban farms allow people to confront and manage their differences. Urban farming may not have the same societal impact as public areas, but it can suit the needs of the farmers employed there.

1.3. Research Objective

- To reduce the dependence of vegetable and fruit produce from farms or imported from other countries, thus increasing available food for families and urban dwellers.
- To make a city's economic base expand by creating economic activities through the production, packaging, and selling opportunities for food, vegetable, herbs, and fruit products.
- To provide environmental awareness through aspects such as protecting soil fertility, ensuring air and water quality, protecting urban ecological biodiversity, rainwater harvesting, water recycling, organic waste recycling, and green-neighborhood spaces.
- To reduces carbon footprints by reducing carbon emissions during the transportation of food, vegetables, and fruits from other regions or countries.

1.4 Scope and Limitations

Addressing food insecurity in urban areas by promoting local food production.

Providing employment opportunities and skill development in agriculture-related industries.

Community engagement and social cohesion through shared farming spaces.

Enhancing urban green spaces and biodiversity conservation.

Limited space and land availability in densely populated urban areas.

Challenges related to soil contamination and pollution in urban environments

1.5. Research Methodology

The project will be oriented to meet the requirements for the competition of Bachelor's Degree in Architecture. Though it is an academic requirement, it will be based on ground reality. The following methodologies will be adopted in two phases to come up with the final design.

Research phase

- Literature Review
- Case Study

This is preparatory phase for thesis project in which data, facts, spatial needs and requirements are studied focusing on the approved topic. We will study the functioning and organization of spaces through case studies. All the findings gathered in this phase will be applied in our design phase.

Design phase

- Site selection and analysis
- o Program formulation and zoning
- Conceptual design
- Design development
- o Analysis and evaluation of output design
- Preparation of architectural drawings, 3D views, model, report for final presentation

This phase will orient itself on creating proper design of thesis topic selected where the combination of all knowledge gathered from research phase would be applied. This could be batter understood from the chart below.

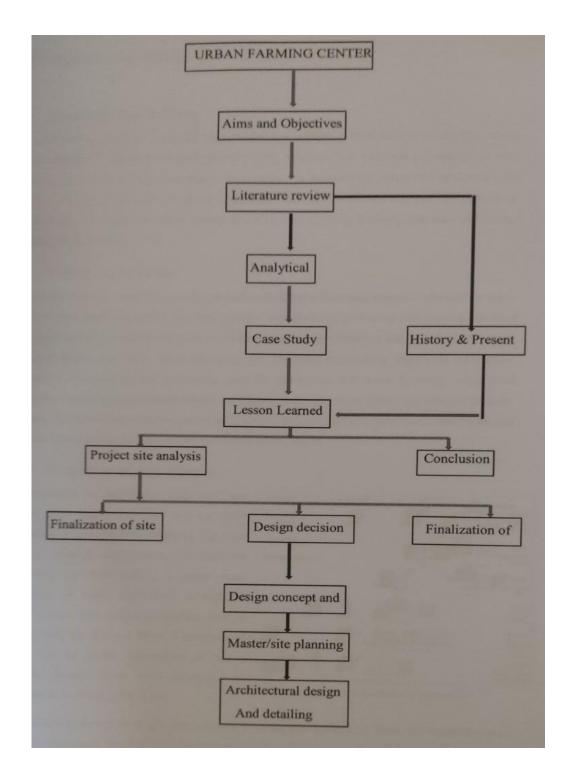


FIG 3.:RESERCH PHASE FLOW CHART

CHAPTER 2. LITERATURE REVIEW

2.1 Agriculture

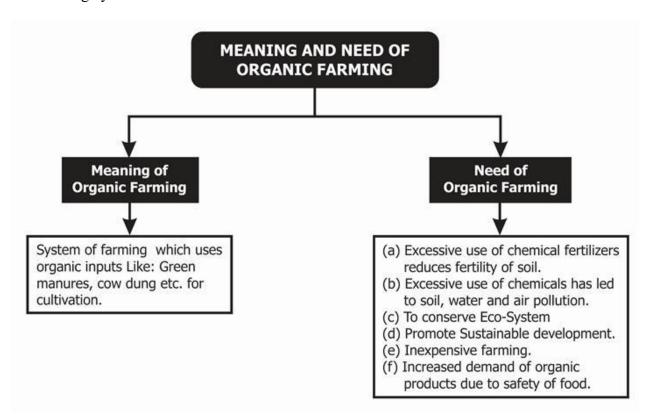
Agriculture is the production of food, fiber, timber and foliage. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that enabled people to live in cities. Agriculture encompasses more than just production, though; it also involves the inputs utilized for production, the social and environmental context of farms and their inhabitants, and the transportation and processing of commodities, later on, to make them ready for use as food, clothing, construction materials, and energy. (Agriculture, 2021)

2.2 Urban Agriculture

Urban agriculture may be defined as the cultivation of plants and the rearing of animals in and near cities. Urban agriculture is also defined as an activity producing, processing and marketing food and agricultural products in urban and suburban areas using intensive production methods and also reuse the natural resources and urban waste to produce a diversity of crops and livestock.

The current definition that is most widely accepted by international organizations like the United Nations Food and Agriculture Organization (FAO) is:

"Urban agriculture is an industry located within or on the fringe of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area."



2.3 Evolution of Agriculture

The invention of agriculture took less than 12,000 years ago, Agriculture was our great revolution. It produced surpluses as well as cities and civilizations. The cultivation of grains ended the need for nomadic food gathering, allowing for diverse crops adapted to various soils. Until the Industrial Revolution, most people were engaged in subsistence agriculture, growing crops primarily for their own consumption. However, technological advancements and global markets have driven significant shifts in agricultural practices over the past century, altering farming methods and trade dynamics worldwide (Jamal, 2015)

Table 1. Evolution of Agriculture

Technology	Timeline	Genetic Innervation
Traditional	About 10,000 years BC	Civilization started harvest from natural biological diversity, domestication of crops and animals, selection of plant materials for propagation and animals for breeding
	About 3,000 years BC	Beer brewing, cheese making and wine fermentation
Conventional	Late 19th century	Principle of inheritance by Gregor Mendel in 1865 laid the foundation of Classical Breeding methods.
	1930s	Development of commercial hybrid crops
	1940s-1960s	Tissue culture, plant regeneration, use of metagenes, transformation and transduction started.
Modern	1970s	Arrival of gene transfer technology
	1980s	First commercial product of gene transfer came.
	1990s	Field trial of GM plant varieties in 1990s followed by its first commercial release in 1992
	2000s	Bioinformatics, genomics, proteomics, metabolomics.

Source: An agricultural technology timeline (ResearchGate.Net)

2.4 Evolution of Agriculture in Nepal

In Nepal, the economy is dominated by agriculture. In the late 1980s, it was the livelihood for more than 90% of the population, although only approximately 20% of the total land area was cultivable, it accounted for, on average, about 60% of the GDP and approximately 75% of exports.

Since the formulation of the Fifth Five-Year Plan (1975–80), agriculture has been the highest priority because economic growth was dependent on both increasing the productivity of existing crops and diversifying the agricultural base for use as industrial inputs. According to the World Bank, agriculture is the main source of food, income, and employment for the majority. It provides about 33% of the gross domestic product (GDP).

Table 2. Evolution of Agriculture in Nepal

Timelines	Details		
1974 to 1989s	Agricultural production in Nepal experienced fluctuations due to var factors, including changes in weather conditions.		
	Agricultural production grew at 2.4% annually, falling short of the population growth rate of 2.6% per year.		
	Food grain production grew slower, at just 1.2% annually. Successful increases in staple supplies like rice and corn boosted daily caloric intake per capital.		
1966 to 1989s	Rice production increased substantially from just over 1 million tons to 3 million tons, although fluctuations were common due to changes in rainfall.		
	Corn production also saw significant growth, increasing from approximately 500,000 tons to over 1 million tons.		

	Other food crops such as wheat, millet, barley, and coffee contributed minimally to the agricultural sector
1970s to 1980s	Production of milk, meat, and fruit improved, but nutritionally balanced food was still not widely available. Severe weather fluctuations affected production, yet workforce productivity gains and expanded land use boosted output.
1980s to 1990s	Around 65.6% of the population depended on agriculture, with food grains contributing 76 % of total crop production.
2008s-2009s	Increased productivity of the workforce and favorable weather conditions contributed to production gains.
	65.6% of people depended on agriculture, and only 21% of land was cultivated.

Source: Savada, Andrea Matles (1991). "Nepal: A Country Study: Agriculture"

2.5.VERTICAL FARM

A **vertical farm** is a method of growing crops in vertically stacked layers, often integrated into structures like skyscrapers, repurposed warehouses, or shipping containers. This farming technique uses **controlled-environment agriculture (CEA)** technology, where all environmental factors—such as lighting, humidity, temperature, and nutrients—can be precisely managed.

2.4.2 The Evolution of Vertical Farming

The hanging garden of Babylon poses as the earliest method to grow plants vertically.

In 1915, the American geologist Gilbert Ellis Bailey used the concept of the tall multi-story buildings for indoor cultivation.

Vertical farming as a concept was developed in the recent past. Dickson Despommier, an Emeritus Professor of Microbiology at the Columbia University. He explains that hydroponic crops could be used for chickens and fish that eat plants waste (Royson & M.P., 2018).

The first architectural design that enroll in this vision of "green architecture" can be the Immeuble Villas of Le Corbusier (1922), which provide outdoor habitation multilevel with garden terraces and was also domestic crops (Kham, 2017).

Dickson Despommier, professor of Public and Environmental Health at Columbia University, founded the concept of vertical farming. In 1999, he challenged his students to develop a design in which food could grow on the rooftops of New York. The students concluded that they could only have food for 1000 people.

Unsatisfied with the results, Despommier suggested growing plants indoors instead, vertically. Despommier and his students then proposed a design of a 30-story cylindrical building equipped with artificial lighting, advanced hydroponics and aeroponics that could produce 100 kinds of fruits and vegetables. They further outlined that lower floors would house chickens and fish subsisting on the plant waste. Although Despommier's skyscraper farm has not yet been built, it popularized the idea of vertical farming and inspired many later designs.

In 2009, the world's first pilot production system was installed at Paignton Zoo Environmental Park in the United Kingdom.

In 2013, the Association for Vertical Farming (AVF) was founded in Munich (Germany). By May 2015, the AVF had expanded with regional chapters all over Europe, Asia, USA.

In 2015 London Company, Growing Underground, began the production of leafy green produce underground in old World War II air-raid shelters.

In 2016, 3 farming systems (i.e. 40-foot local food routes containers), were developed with an integrated vision engineered with a smart natural root transfer system that is remotely monitored from California, in the USA.

The Growtainer® uses LED lights and recycles water harvested through the air conditioning. The container also supports growing root crops and leafy greens.

In 2016, Plenty, an indoor vertical farming company, began producing greens with 99% less land use to the acre of farmland, using 97% less water with adequate light and energy system.

Water is recaptured through harvesting the evaporated water through the air conditioning. The first U.S. grocery store opened in Dallas, Texas in 2016, introducing the first vertical farm in a grocery store.

In 2017, a Japanese company, Mirai, began marketing its multi-level vertical farming system. The project is now closed.

By 2017, vertical farming could be produced with traditional agricultural methods because the amount of LED lights has decreased growing times by a factor of 2.5. Additionally, this can all be achieved with 40% less energy usage, 80% less food waste, and 99% less water.

2.7. Vertical Farming in Context of Nepal

Mushroom farming was first introduced in Nepal in 1974 by the Nepal Agriculture Research Council (NARC). Initially, it started on a small scale among small farmers, with few large producers like Snow-white and Himalayan Mushroom. However, high production costs led to their closure. Currently, small farmers dominate production, yielding 300-500 kg daily. (Blogger Nepal, 2019).

In present, Hydroponics, a modern technique growing method is being used in different greenhouses. Ganesh Kumar Pandey is the first person to start hydroponics in Nepal (Manandhar, 2018).

"Using hydroponics, you can get the same yield in 5,400 square feet of land that you would get in 27,000 square feet of agricultural land,"- Ganesh Kumar Pandey Areaponic, a modern growing method, is employed in Nepal, developed by NASA in the nineties. It utilizes drums with electronic sensors and circuits to automate the process. Seeds are grown on sponges in compartments connected to the drums, which regulate nutrient supply

and plant growth. (Casesar Rana, AeroRoots Pvt.Ltd)

2.6 Method of Urban Farming

There are numerous agricultural techniques utilized in urban agriculture. Agriculture can be integrated into architecture through vertical farming, roof-top farming, controlled environment agriculture, empty lots, and guerrilla planting, becoming as prevalent as water, heating, and natural lighting (ADAM GHANGAR)

2.6.1 Roof Farming

Rooftop farming is gaining popularity in urban areas due to its ease of handling, economic viability, and numerous health and environmental benefits. It contributes to greening cities, improving waste management, enhancing air quality, and providing fresh, nutritious food.

Rooftop farming enhances urban landscapes and human wellbeing by adding greenery and providing psychological benefits like reduced anxiety and increased productivity.

It makes cities eco-friendlier by mitigating the heat island effect caused by bare roofs, thus reducing energy usage and transportation costs.

Rooftop farming increases the availability of fresh, healthy food by bringing farming into urban areas, addressing food deserts, and making wholesome produce more accessible and affordable.



Fig 5 Roof farming

2.6.2. Indoor Farming

Indoor farming is a new approach of growing vegetables and plants in controlled environments. Indoor farm systems are also known as vertical farms, greenhouses, controlled environment agriculture (CEA), and plant factories. (Stein,2021)

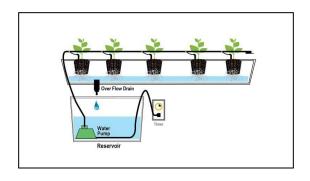
2.8 Types of Urban Farming Technologies

2.8.1 Hydroponics

Hydroponics is a type of hydroculture that involves growing plants in mineral fertilizer solutions in water, without soil (Jamal, 2015)

2.8.2 Aeroponics

Aeroponics is the practice of growing plants in an air or advanced of the hydroponic systems and can utilize one-tenth the amount of water generally necessary to grow the same crop in standard open systems. It uses 95 percent less water than conventional farming methods and requires very little area, making it an effective and efficient means of cultivating plants. (Wilson, 2012)



 $Fig~5.~Hydroponics\\ Source:~Types~of~Hydroponics~Systems:~A~Complete\\ Guide~|~The~Hydroponics~Grower\\$

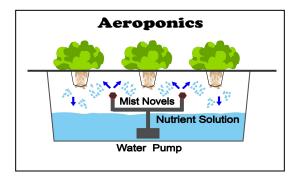


Fig 6. Working of aeroponics system

.8.3 Aquaponics

Aquaponics combines aquaculture (fish farming) and hydroponics (soilless plant cultivation). Fish feces feeds nutrients to plants, which then filter and purify water for fish. This symbiotic system includes two primary components: aquaculture for producing fish and hydroponics for growing plants, providing a sustainable way of food production in a closed-loop system.. (Jamal, 2015).

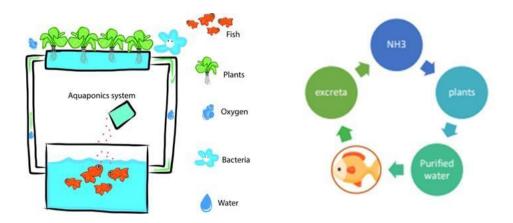


Fig 7. Working of aquaponics system

2.9 Typologies of Crop Cultivation modules

2.9.1. A- Frame Trellis

The A-Frame "trellis" design was the first successfully hydroponic system to develop a vertical orientation. Basically, the design consists of PVC pipes configured either vertically or horizontally to form a triangular extrusion of its footprint which is angled to the light sources, thus increasing available growing surface without meaningfully reducing the access of light. The primary advantage of this module design is its simplicity, as it achieves a high degree of space efficiency while utilizing technology that has been established in the hydroponic industry for decades (Szen, 2017)

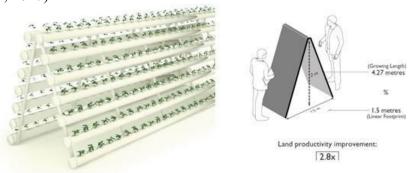


Fig 8. A- Frame Trellis Source: Sky farming by Gordon James Graff

2.9.2. Stacked Beds

Quite similar to the A-frame design, the "stacked beds" composition is extremely forthright in concept and technology. The design is merely a stacking of definitive in- line pipe beds. This system has continued to be the system of choice for most commercial vertical farm as it can allow more space for cultivation. Much like the complication of stratifying floors in a vertical farm, the design's stacked configuration does not allow sunlight to penetrate each layer, making artificial light is necessity. Hence, this growing system used up a huge portion of overall energy consumption for lighting (Szen, 2017)



Fig 9. Stacked Bed Source: Sky farming by Gordon James Graff

2.9.3. Columnar Systems

The latest variant of vertical cultivation module to emerge is the columnar design popularized by the English horticultural company Valcant. Their design, VertiCrop, consists of a series of stacked trays arranged in a staggered pattern to increase light penetration. The "columns" are then cycled along a conveyor track to a central machine that delivers nutrient solution and removes the trays for harvesting. The design boasts the highest space efficiency among the sun-fed hydroponic systems available today. (Szen, 2017)

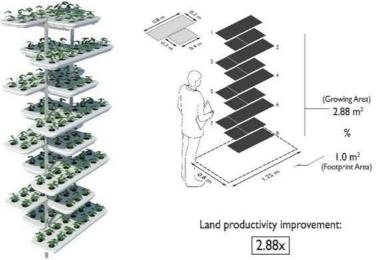


Fig 10. Columnar Systems

2.9.4. Stack Drums

Despite the fact that stack drum is the least common commercial cultivation module among the four typologies, the drum design likely offers the most promising eventual fate of indoor agriculture. It compromises of growing plants within the interior of a drum structure located around a central artificial light source, resulting in a phenomenally low space and energy use par unit of production (Szen, 2017)

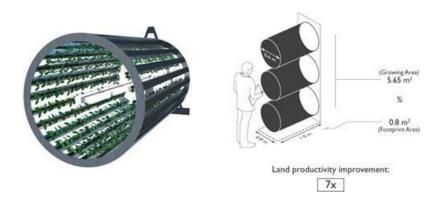


Fig 11. Stack Drums Source: Sky farming by Gordon James Graff

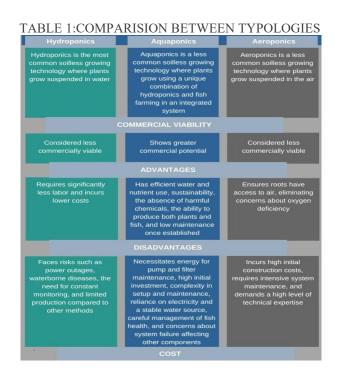


TABLE 2:VERGETABE SUITABLE FOR TYPOLOGIES

HYDROPONICS	AQUAPONICS	AEROPONICS
Arugula, Chives, Lettuce, Kale, Spinach, Spearmint, Basil, Cilantro, Parsley, Cucumber, Eggplant, Pepper, Green Bean, Tomato, Broccoli, Cauliflower	radishes, lettuce, spinach, swiss chard, tatsoi, turnip greens, herbs, watercress, radish greens, tomatoes, pumpkin, peppers, peas, green beans, and kale. Cost:1lakh to 2 lakh	lettuce, spinach, kale, basil, parsley, mint, tomatoes, peppers, and cucumbers. Cost15000-20000

TABLE 3:VEGETABLE TYPES AND REQUIREMENTS

TYPES OF PLANTS	LEAFY	FRUITS
SIZE OF GROWN BED	4.5 *1.2*0.6 M	O.3*3.9*0.4/12 PLANTS
AMOUNT OF LIGHT REQUIRED	90W FOR 16 SQ.FT	10-15 WATT PER SQ.FOOT
AMT OF WATER REQUIRE	20 LITRE FOR 40- 50 PLANTS	50 LITRE FOR 12PLANT HEAD
TEMP	68-75 AND 10 DEGREE F IN DAY AND NIGHT	18-25 AND 12-18 DEGREE C AT DAY AND NIGHT
GERMINANTI ON DAYS	14	14-21
HARVESTING DAYS	3 WEEKS TO 2 MONTHS	2-3 MONTHS
MIN SPACE REQ.	10INCH@SPACING	3SQ.FT/PLANT

2.4.7. Problems and barrier in vertical farm

Land and Building Costs — urban locations for vertical farms can be quite expensive. Some existing vertical farms are based in abandoned warehouses, derelict areas, or Superfund sites, which can be more economical for construction.

Energy Use — Although transportation costs may be significantly less than in conventional agriculture, the energy consumption for artificial lighting and climate control in a vertical farm can add significantly to operations costs.

Limited Number of Crop Species — the current model for crops grown in vertical farms focuses on high-value, rapid-growing, small-footprint, and quick-turnover crops, such as lettuce, basil, and other salad items. Slower-growing vegetables, as well as grains, aren't as profitable in a commercial vertical farming system.

Pollination Needs — Crops requiring insect pollination are at a disadvantage in a vertical farm, since insects are usually excluded from the growing environment. Plants requiring pollination may need to be pollinated by hand, requiring staff time and labor.

2.5. Components of Vertical Farm

➤ Environmental Control Units (ECU):

Monitor and sometimes adjust pH, nutrient and humidity levels

➤ Nutrient supply & control unit:

Periodic analysis of nutrient solutions and adjustments of nutrient ratios must be performed

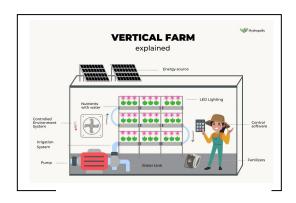


FIG 12:Components of Vertical Farm

➤ Air conditioning:

Creating optimal temperature and humidity conditions is vital for plant health

➤ CO₂ supply unit:

Carbon dioxide, or CO₂, supplies essential elements to plants for better yields

➤ Lighting:

Vital component for Vertical Farms, as it provides the only source of illumination for plant growth in a closed system. LED being mostly used.

2.5.1. Environmental control units

Environmental Control Units (ECU) monitor, and sometimes adjust, a range of indoor farm factors, for instance, pH, and nutrient and humidity levels. Companies such as Argus Controls, Auto grow and Priva offer many products, from the simplest pH monitors to sophisticated systems that track worker productivity. Several have cloud-based options that allow users to remotely access and control their farms.

2.5.2. Nutrient supply & control

In hydroponic systems, a plant's nutrient needs are supplied through the root solution and differ according to plant type and life stage. Some growers use commercially available nutrient mixes, while others choose to create their own custom mixes and view these as part of their unique approach to growing plants. Hydroponic nutrient solutions are composed of many essential elements, essential for crop growth. These nutrients are generally taken into plants in various ionic forms, such as NO₃-, H₂PO₄- or HPO₄²⁻, and K⁺. Since the reserves of nutrients for the plants are limited in hydroponic cultivation, an inaccurately balanced nutrient solution may result in an unbalanced nutrient composition in the root environment. In closed systems that re-use the drainage solution, like hydroponics or aeroponics (roots suspended in the air being misted with nutrients), the build-up of salts in the solution is managed by dramatically reducing the amount of fertilizers which are added to replenish the drainage solution. Each nutrient has a suitable concentration and relative ratios for an optimal plant growth and these are the target values of a nutrient control system.

2.5.3. Air conditioning

Creating optimal temperature and humidity conditions is vital for plant health, so growers devote a good deal of attention to selecting air conditioning equipment. A large range of options are commercially available, and the grower's selection is generally determined by a combination of initial capital cost, unit capacity and operating costs, as air conditioning typically comprises 20-30% of electricity costs. There are substantial economies of scale in air conditioning, so that larger farms have lower capital and operating costs per square meter of planted space.

2.5.4. CO₂ supply unit

Carbon dioxide, or CO₂, supplies essential elements to plants. It is common to enrich the CO₂ available in plant factories above ambient levels (to between 800 – 1200 ppm), as studies as far back as the mid-1980s have established a correlation with better yields, especially when used at certain plant life stages, and with more efficient plant water use. CO₂ is generally piped directly into the facility to reach the required level, though ventilation systems and local regulations may preclude some farms reaching the level that is theoretically optimal for the plants. There are two main techniques to supplement CO₂ – first is injecting pure CO₂ from canisters, other is to use a generator run on natural gas or propane.

2.5.5. Lighting

Lighting design is a vital component for Vertical Farms, as it provides the only source of illumination for plant growth in a closed system. Recent developments and technologies have brought LED lighting closer to the market, as the technologies have been advancing rapidly, with projections for further improvements, resulting in lower cost, increased reliability, and reduced energy consumption.

The visible spectrum is measured in minuscule wavelengths, shifting at one end from violet-blue light through green to red at the other. For decades, scientists have known that photosynthesis is optimized within the red band, but plants also need blue light waves to prevent stretching and enhance leaf color. A barely visible range beyond red, known as far red, promotes larger leaves, branching and flowering. With advances in LED technology, light recipes determining the number of hours illuminated, the intensity of photons directed at plants and the mix of colors can be finely tuned to each crop and even to each stage in a crop's life

2.10.2.1 Natural Lighting

Reflectors on each floor maximize sunlight during the day and provide LED light at night. Side reflectors around the building's perimeter and concave reflectors on each floor distribute light

to plants efficiently. as in fig (Khan S., 2017).

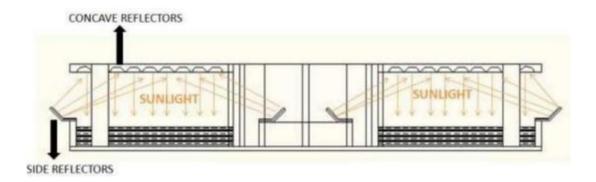


Fig 13. Use of network of reflectors Source: (Exploring appropriate form for prototype hydroponic vertical farm, 2017)

2.10.2.2 Artificial Light System

Plants grow best when provided with the same spectrum of colours (violet to red) as natural sunlight. Although some artificial lights can come close to the quality of natural light, most produce either more or less of certain colours in the spectrum (Khan S., 2017). Some of the artificial light used for indoor farming are:



Grow light – colour temp. close to sunlight (approx. 6000k)

FIG 14: Artificial Light System

Incandescent grow lights – color temp (approx. 2700k)

Fluorescent grow lights – color temp (2700k to 6500)

Fluorescent tube lights – cool white or warm white

LED grow lamps – wavelengths of light corresponding to chlorophyll's absorption peaks, energy saving

2.10. Sustainable and advance Technology

2.10.1 Anaerobic Digester (AD)

Anaerobic digestion decomposes organic waste in an oxygen-free environment, generating methane-rich biogas for renewable energy. It can effectively treat sewage-related wastewater. Despoiler's 2008 Vertical Farm project processed 13,492 kg of biological waste weekly, generating 1,123,931 kWh of power per year, exceeding the farm's electricity needs, demonstrating the possibility for sustainable waste management and energy production

Anaerobic Digester Facility

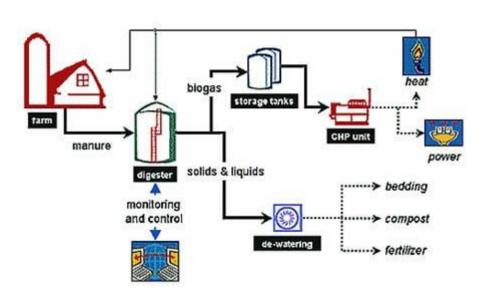


Fig 15. Anaerobic Digester Source: Anaerobic Digestion - Gulf Coast Environmental Systems (gcesystems.com)

2.10.3. Green House

Greenhouses protect plants from severe temperatures utilizing span-type and lean-to designs. Joining many greenhouses lowers heating expenses. Sunlight and artificial sources both provide heat. Temperature regulation requires ventilation through roof and end-wall openings, which are occasionally mechanized (Britannica, 2019).



.FIG 16. Green House

2.10.4. Green Roof Construction

Green roofs are vegetated landscapes installed layer by layer on a roof surface, either as loose laid or modular layers or in trays. Vegetation grows in a medium, with depths ranging from 50 mm to over a meter based on building roof capacity and design goals. Each layer serves a specific function. (Taufani, 2017)

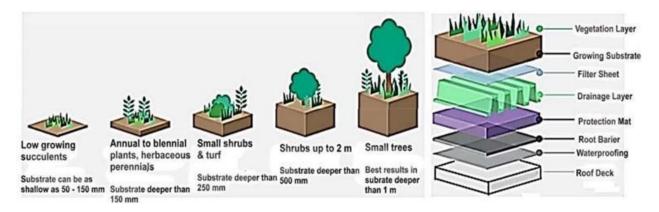


Fig 17. Green Roof Construction

2.7.9. Green Wall Construction

A green wall is comprised of plants grown in supported vertical systems that are generally attached to an internal or external wall, although in some cases can be freestanding. Like many green roofs, green walls incorporate vegetation, growing medium, irrigation and drainage into a single system (Taufani, 2017).

2.9.6. Green façade construction

A green façade is created by growing climbing plants up and actors the façade of a building, either from plants grown in garden beds at its base or by container planting installed at different levels across the building. Climbing plants can attach directly to the surface of a building, or they can be supported on an independent structure of the building (Taufani, 2017)

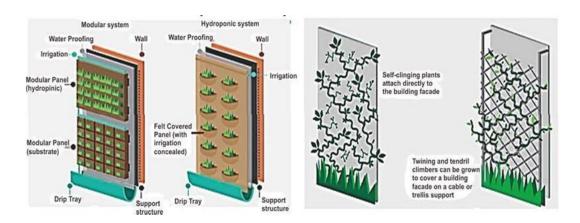


Fig 18. Green Wall and Facade Construction

Source: (Urban farming construction model on the vertical building envelope to support the green buildings development in Sleman, Indonesia, 2017)

2.0. Literature review inference

- Urban farming provides opportunities to enhance community well-being.
- Socio-cultural, environmental, health, economic and educational benefit of urban farming.
- Indoor farming reduces water usage by 70%.
- Growing system can yield 5 times or more crops or vegetables in same area of agriculture field.
- Vertical farming in Nepal started in 1974 as Mushroom farming.
- Vertical farm consumes lot of energy so need to build sustainable.
- There is increase in healthy and conscious food consumption giving vertical hydroponic farms a scope to develop

2.12.1 General Related Office

2.12. Office Spaces

2.12.1.1. Conference Room

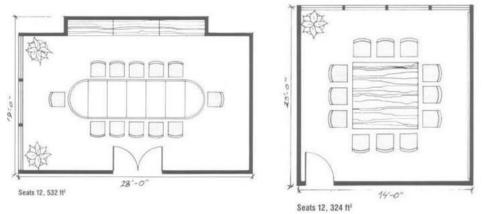


Fig 19. Plan of 2 directional module Source: (Time-Saver Standards fot Interior Design and Space planning, 1992)

For conference and seminar room

15 Net Square feet =For groups of 6 or less

20 Net Square feet =For Groups of 6 to 20

18 Net Square feet =For Groups of 12 or more than 12

2.12.1.2. Administrative office

Administration is one of a research institute's most important parts. A complicated institution like a research facility could not function without administration capable of organizing the organization. The principal duties of the administration encompass accounting, recruiting and supervising staff, procuring lab equipment or supplies, and preserving the complex system architecture.

Support Space	Functional Area		
Filing Cabinet	1 sq. m. per filing cabinet		
Storage Rooms	1 sq. m. per shelving unit		
General Work Area	5 sq. m.		
Photocopier Area	5 sq. m.		
Computer Room	Space determined on a case by case		
First Aid Room	Provided under the regulation of the Safety Act		
Reception Area	Based on functional needs, visitors, security, etc.		
Meeting Room	4-5 people: 11.15 sq. m. 6 – 7 people: 13.90 sq.m. 12 people: 22.3 sq.m.		
Coffee Counter	1.16 sq. m. per department		

3.2. Training facilities

The training facility will be having all the spaces and facilities that an individual requires to learn urban farming.

3.2.1. Seminar halls/training room

Vocational training is required before the class does any practical workshops as the urban farming and growing plants on building involve sophisticated knowledge and newer technology which would generally require theoretical study. The seminar can host such study seasons for a small group of people. Seminar halls generally have 20–50 seats that can be arranged in various configurations per requirement. Since the events are hosted for a small group of people at a time, the sessions are highly interactive.

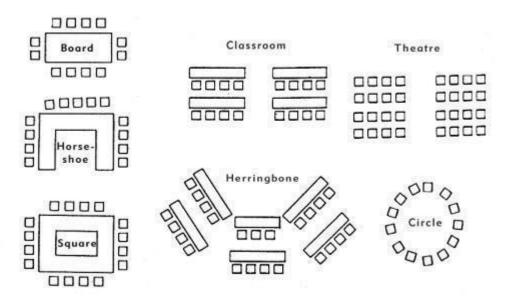


FIG:20 SEATING ARRANGEMENT

While designing a seminar hall, the following things need to be considered:

- The seating should be movable so that various arrangements can be done.
- The seminar hall should be provided with a movable projection screen or board.
- The sound should reach each member of the audience with equal amplitude.
- The light level in a windowless room should be 600 lx.
- The standard size of a seminar hall should be 0.2–0.25 sq. m / seat.

3.2.2. Workshops

In workshops, people can gain practical knowledge of the various urban farming techniques and technologies. These workshops can be hosted on either the indoor rooms or on the farming plots and designated spaces in the building specified for workshops and experimentation. The following are some design guidance on designing workshops:

- The flooring must have adequate strength and stability to withstand loads of soil and heavy machinery.
- The flooring should have a smooth surface to allow easy movement of equipment.
- The storage facility should be attached to the workshop for easily access.
- All the workshops should be provided with pipes and electrical power cables.
- Proper natural or artificial lighting must be provided in all indoor workshops.
- The fire hazard in workshops should be countered with providing fire hydrants, fire extinguishers, and water sprinklers.

3.3. Networking facilities

By the means of market stalls, restaurants etc., the facility will familiarize people with the products grown using urban farming and its newer technology and help them adapt to it. This place will also be used as a space that will help introduce farmers and consumers. Apart from that, it will also sell products from local farmers to encourage the local economy.

3.3.1. Market area

Properly managed market stalls attract people to engage in economic activities which will thus make way for social activities. Hence the market stall plays a vital role in the networking.

3.3.2. Cafes and itineraries

Cafes and itineraries will serve the market and facility visitors a variety of food eat and place to stay to enjoy and spend more time within the facility. This place will use food that will be grown within the restaurants or grown through urban farming, giving the visitors ideas and inspiration to start their own urban farming related business and work.

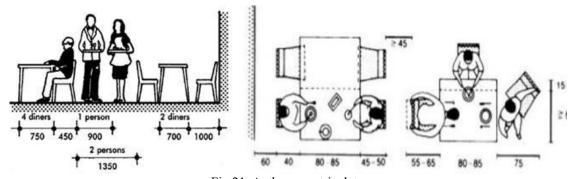


Fig 21. Anthropometric data Source: (Architects' Data, 2002)

2.13. Parking

Type of Vehicle	Length	Breadth	Height	Turning Radius
Motorcycle	2.2m	0.7m	1m	1m
Standard Car	4.7m	1.75m	1.5m	5.75m
Fire Engine	6.8m	2.5m	2.8m	9.25m
Standard Bus	11m	2.5m	2.95m	10.25m

General Design Consideration:

Parking Spaces for Car: 1.80m x 4.6m to 2.5m x 6m

Space required for 90-degree car parking: 20-22 sq. m. per car Space required for 45-degree car parking: 23-26 sq. m. per car

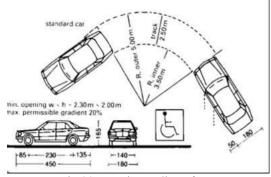


Fig 22. Turning radius of car Source: (Architects' Data, 2002)

General Turning radius of Truck/ Bus:

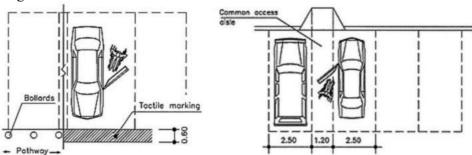


Fig 23. Consideration for universal access Source: (Architects' Data, 2002)

Single-Unit Truck | Bus - 20' WB. Outer Radius: 42'-43.5' | 12.8-13.26 m. Inner Radius: $28'4" \mid 8.64$ m.

Passenger Turning Path - 90° Outer Radius: 19'2" | 5.85 m.

Semi-Trailer Truck - 40' WB. Outer Radius: 40'-40'10" | 12.2-12.4 m. Passenger Turning Path - 180° Outer Radius: 24'-25'6" | 7.31-7.77 m.

4. a. Storage Space

Storage Spaces	Small Sized (up to 100 people)	Medium sized (up to 250 people)
Dry goods/ food store	0.13 - 0.15 sq. m.	0.12 - 0.14 sq. m.
Vegetable store	0.08 - 0.10 sq. m.	0.06 - 0.08 sq. m.
Daily supplies	0.04 - 0.06 sq. m.	0.03 - 0.04 sq. m.
Chilled goods storage	0.04 - 0.31 sq. m.	0.21 - 0.26 sq. m.

CHAPTER 3. CASE STUDY

4.4 NATIONAL CASE STUDIES

4.4.1 Hydroponics Nepal

• Address: Tokha, Nepal

• Type: Privately owned business

• Site area: 2.5-3.28 sq. m approx.

• 4 greenhouses each of 165.27 sq. m approx.

• 1.54 km from Tokha bazar

• In-site module manufacture



Objective:

- To study about the soil-less farming concept prevalent in context of Nepal
- To study about hydroponics market and its availability in Nepal
- To study about the technology available in the market

Hydroponics Nepal, the pioneer of the soil-less farming technology in context of Nepal. They also offer training and demonstration of the hydroponic system at our office and farm in Dhumbarahi and Tokha, Kathmandu. They have established a training facility with full functioning hydroponic and aeroponic greenhouses containing the right temperature and humidity. The greenhouse also constructed with water circulation system meaning that the water usage is lower than conventional solutions.





FIG 24: HYDROPONICS AND AEROPONICS SYSTEM

The main mission of Hydroponics Nepal is to introduce simple and affordable hydroponic farming solutions to every Nepalese household to help them increase food production, incomes and improve health conditions.

The system produces red/green lettuce, bokchoy, cabbage, kale and other fresh greens of 10 to 12 varieties. The hydroponic system produces daily 4/5 kg of harvest which is preferably sold to hotels, special needs patients and health conscious people at the rate of 400 per kg. The system uses automated water rotation system so less labor is required in the production. Other than that the systems used are NFT systems and nutrients are made locally.



FIG 25:SAMPLE SET MODULE

A small hydroponic module is used within the greenhouse as a sample batch so as to obtain the desired optimal produce. Other than that the company also offers paid visits on Thursdays, installation and consultation service and training services for those who are interested in the system. The space also accommodates several rooms for office for the farm manager, training or meeting rooms, and a storage room for seeds and nutrients.

Overall the hydroponics market is said to be increasing day by day as people are more leaning towards the healthy food source and the expansion of the farm is anticipated according to the chief executive director Mr. Nilmani Sapkota. The extension project is said to house in site restaurants, aqua culture and open space as an overall development of the site.

3.1.2. Agro Farm House

3.2.2.1. Project Description

Location: Thecho, Lalitpur

Category: Mixed Use Commercial

Area: 40 Ropani Owner: Anwesh K.C



FIG 26 :Agro Farm House

3.2.2.2. Introduction

Agro Studio is a visionary innovator of hydroponics, aquaponics, and integrated soilless technology, with the goal of building a more adaptable and durable food system in Nepal. The company's specialty areas include consulting, producing, installing, and distributing specialized hydroponic vegetable and fodder systems to small and medium-sized farmers, ensuring that they have access to an excellent and affordable method of farming sustainably.





Fig 27. Strawberry Farming

3.2.2.3 Research on

- Plan Zoning
- Space relation
- Design Components

3.2.2.4 Target Group

- Visitors
- 56 houses of Baluwatar, Kathmandu
- Supplies vegetable, fruits etc to various resturant and café.

3.2.2.5 Site Features

Surrounding: Agricultural land

The space has been divided into public, semi public and private

The building is oriented according to the climatic conditions. It is south faced and having maximum vegetation from the front side.

It consists of 4 Guest house for visitors, open space, kitchen and dining space, kids area, family area etc

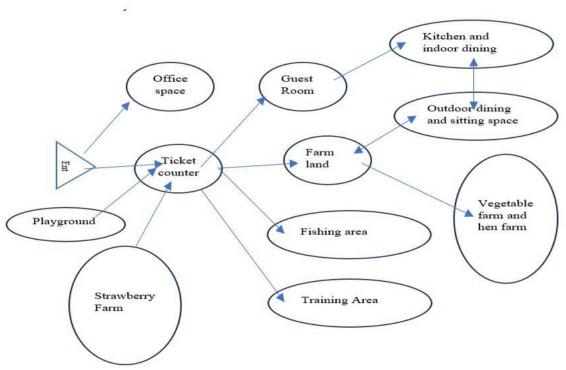


Fig 28. Bubble Diagram

3.2.2.6. Services

a. Training

There are provisions of training service to every farmer from beginner's level. The session varies from two to four hours and includes all elements of the innovative farming technology: to the technical and business aspects of hydroponic, Aquaponics farming etc



Fig 29. Training Block

b. Accommodation for visitors:

Guest houses are often provided by individuals or organizations as accommodations for guests, visitors, or tourists who need a place to staytemporarily. The organized has provided guest house for people visiting from out of town who may not have their own lodging arrangements. It consists of two types of guest house as shown in fig.

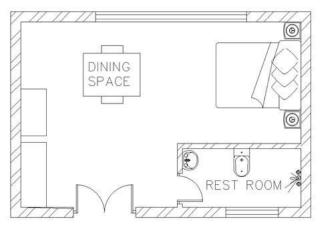




Fig 30. Layout of Guest Bedroom

Fig 31. Guest House

3.2.2.7 Building Material

Green house = iron and steel structures, Bamboo structures Other buildings = steel frame structure with brick walls

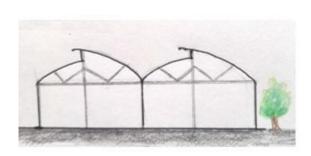


Fig 32. Farm Structure



Fig 33. Hydroponics Structure

3.2. Regional Case Study

3.2.1. The Green Path Organic State

3.2.1.1. Project Description

• Location: Urgahalli village, Musore Road, Bangalore, India

Category: Mixed used commercial

• Area: 200 Acre

• Architect: Satya Pakash Varanashi

• Project: 1995- present

Initially building was used as the banking and office purpose but later on it converted into organic footprint by renovating it.



3.2.1.3. Target Group

Bangalore residents.



Fig 34. The Green Path Organic State Source: Google Image

3.2.1.4 Introduction

Building is oriented according to the climatic condition. It is south faced and having maximum vegetation from the front side.

Terrace farming is in cooperated within the building and covers 60% of the total germination

In the north side stores, preparation room and fire escape is provide.

It is fully owned private firm. The main purpose is to provide fresh food for Bangalore residents.

There are 40 different types of vegetables are grown which are exported to outside India.

Presently the site is used as the greenhouse farming, eco lab and well-furnished super stores

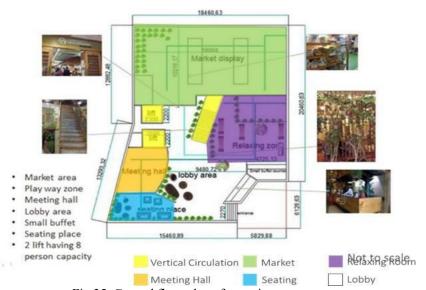


Fig 35. Ground floor plan of organic state Source: (Mixed use vertical farming complex, 2016)

3.2.1.5. Lighting and Ventilation

Some special light provision is given which emits UV rays at some extent.

Light is covered with petals or by some other means to give the continuous sense of the vernacular interior.

Concave lens type collector is used at some places which gives sufficient light to Interiors

Small openings are provided above lintel level and work as the exhaust for the heat and odors.

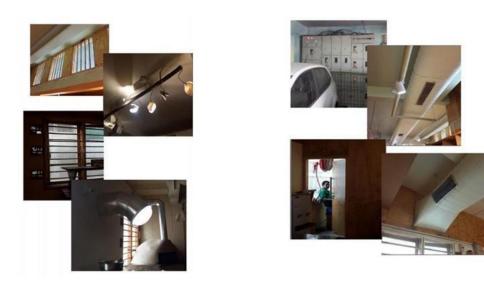


Fig 36. Lighting and Ventilation and HAVC system Source: (Mixed use vertical farming complex, 2016)

3.2.1.6. HAVC and fire fighting

The interior is totally air tight with the mechanical means.

Duct lines are used for the mechanical ventilation and air conditioning.

Two outlets and 2 inlets are provided at every floor for distribution of air.

Generator room is provided at the basement and AHU units are provided at the top roof level.

Fire safety room provided at every floor with the water hydrants and Hose reel.

3.2.1.7. Laboratory

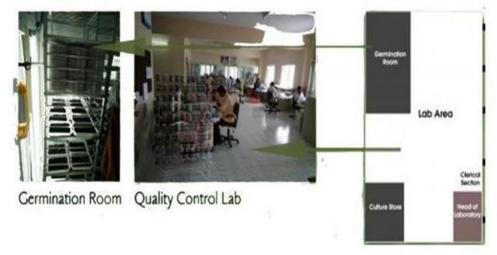


Fig 37. Laboratory Source: (Mixed use vertical farming complex, 2016)

Germination room is totally dependent on artificial system and require 16 hrs. of lighting with a temp of 30 -20 c and 90% humidity.

There are certain vertical methods are used for growing of the plants. Trays system is used for vertical stacking of the plants.

The facility runs throughout the year and serves to a total 40 types of vegetables grown in controlled greenhouse conditions

3.2.1.8. Farming Technology

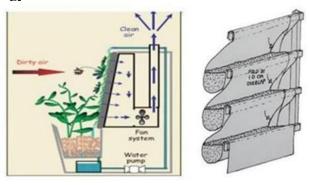


Fig 38. Farming Technology Source: (Mixed use vertical farming complex, 2016)

Living wall system is used in the design placed at the south side of the building to have

advantage from the natural lighting.

Steps are formed through the wooden joist and filled up with the thatch and fodder and irrigated through sprinklers.

Combination of hydroponics and evaporative cooling is used in this building to have clean and cool air and also saves energy (Pandey S., 2016).

3.2.2. Pasona Group Office

3.2.2.1. Project Description

Location: Tokyo, Japan

Category: Office building

Area: 2,15,000 sq ft

Architect: Kono architect, Noe York

Project Year: 2010 A.B.



Fig 39. Pasona Group Office

Source: (Pasona Urban Farm by Kono Designs, 2013)

Project type: Renovation and

Refurbishing

Context: Urban

Concept: Health, agriculture and environment

3.2.3.2 Research on

Growing Method and Construction Human psychology

3.2.3.3 Target Group

Public People

4.3.1 Introduction

The project consists of a double-skin green façade, farming facilities integrated within the building. The green space totals over 43,000 square feet with 200 species including fruits, vegetables and rice that are harvested, prepared and served at the cafeteria within the building. It is the largest and most direct farm-to-table of its kind ever realized inside an office building in Japan.

4.3.2 Planning

Building is 9 storey commercial building having simple rectangular plan. Ground floor plan is for public and rest of the floors are office space & private.

There is rice paddy and broccoli field at the main lobby; big text to entrance. These crops are equipped with metal halide, Havel fluorescent, and LED light to enhance.

An intelligent climate control system monitors humidity, temperature and irrigation system. Artificial light and breeze balance during office hours and optimize crop growth during afterhours. This maximizes crop yield and annual harvests.

Ground floor has a small restaurant within the lobby space and public exhibit of indoor farming to show the process of urban farming especially for the new generation.

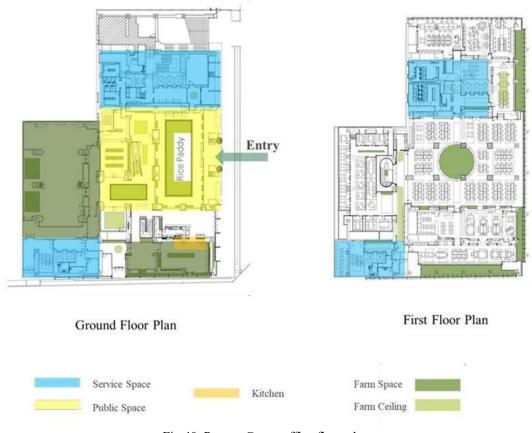


Fig 40. Pasona Group office floor plan Source: (Pasona Urban Farm by Kono Designs, 2013)

4.3.3 Façade

The building has a double-skin green façade where seasonal flowers and orange trees are planted on small balconies. From the outside, the office block appears to be draped in green foliage.

The double-skin green façade features seasonal flowers and orange trees planted within the 3' deep balconies. Partially relying on natural exterior climate, these plants create a living green wall and a dynamic identity to the public. However, Pasona believed in the benefits of urban farm and green space to engage the public and to provide better workspace for their employees.



Fig 41. Wall section

Balconies shade and insulate interiors, with operable windows for fresh air and reduced heating/cooling loads.

The facade is enhanced with a deep grid of fins for added depth and volume.

3.2.3.5. Interior and indoor farming techniques



Fig 42. Hydroponics



Fig 43. Rice paddy filed

Pasona HQ integrates hydroponic and soil-based farming into office spaces, with crops like tomato vines, lemon trees, salad leaves, and bean sprouts coexisting with workers.

To overcome low ceiling heights caused by structural elements, building services were rerouted to the perimeter, allowing exposed ceilings between beams.

Pasona HQ's urban farm enhances mental health, productivity, and relaxation for city

Lighting fixtures discreetly installed along beam edges create a large light cove, achieving 30% energy savings compared to conventional ceiling-mounted lights.

3.2.3.7. Participation

At Pasona HQ, employees engage in crop maintenance and harvesting with agricultural specialists, fostering social interaction and teamwork. This involvement instills a sense of responsibility and accomplishment as they contribute to cafeteria crops. Programs also empower students with farming case studies and management skills, promoting farming as lucrative professions. Pasona's urban farm initiative in downtown Tokyo aims to reverse farmer decline and ensure sustainable food production, addressing the need for agricultural education and practice in urban areas.



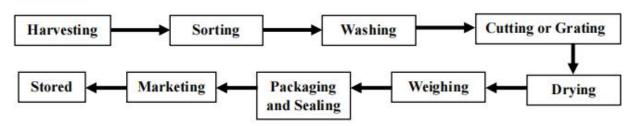
Fig 44. Conference Room Source: (Pasona Urban Farm by Kono Designs, 2013)

3.2.3.8. Conclusion

Pasona Urban Farm is a distinctive work environment that highlights the advantages and innovations of urban agriculture to involve the larger Tokyo community while encouraging increased productivity, social engagement, and sustainability in the future (Andrews, 2013)

Chapter 4. PROGRAM FORMULATION

Flow Chart



S.NO.	DESCRIPTION	AREA/UNI	NO.S	AREA(SQ.M.)
1	4 WHEELERS	18	15	270
2	BICYCLE	1.4	76	106.4
3	TRUCK	30	2	60
	TOTAL		4.	36.4

ADMIN	NISTRATION			8	
S.NO.	DESCRIPTION	AREA/PERSO N	NO. OF USERS	NO.S	AREA (SQ.M.)
1	DIRECTOR'S OFFICE	18	1	1	18
2	CHIEF MANAGER'S ROOM	18	1	1	18
3	STAFF ROOM	6	4	1	24
4	SALES DEPARTMENT	6	4	1	24
5	MAINTENANCE DEPARTMENT	6	3	1	18
6	ACCOUNT SECTION	6	3	1	18
7	RECEPTION & FOYER			1	60
8	CONFERENCE HALL	2.5	136		340
9	STORE ROOM		1	1	10
10	TOILETS				
	MALE		4	100	20
	FEMALE		4		20
2	TOTAL	3			570

TRAIN	TRAINING FACILITIES					
S.NO.	DESCRIPTION	AREA/PERSO N	NO. OF USERS	NO.S	AREA(SQ.M	
1	THEORY ROOM	2.4	30	2	144	
2	PRACTICAL ROOMS	3	15	1	45	
3	EQUIPMENT STORE	30	1	1	30	
4	REST ROOMS	50			100	

SOLAR REQUIRED

URBA	N FARM							
S.NO.	DESCRIPTION	AREA N	/PERSO	NO. O USER		NO.S	AREA(SQ.M.
1	HYDROPONICS FARM	300		1		6	1800	
2	AEROPONICS FARM	200		1		3	600	
3	WAREHOUSE	100		1		1	100	8
4	PROCESSING AND PACKAGING	300		1		3	900	
5	STORAGE	100		1		3	300	
6	PREPARATION ROOM	50		1		2	100	
	1	ГОТА	L			-10	3800	
INTER	ACTIVE SPACES						8	1
DISPL	AY -MARKET		80					
S.NO.	DESCRIPTION		AREA/P	ERSO	NO.		NO.S	AREA(SQ.M.
1	OPEN MARKET SHO	OPEN MARKET SHOP			178.6		1	410.78
	TOTAL		100					410.79
CAFE	TERIA							
S.NO.	DESCRIPTION		AREA/P N	ERSO	NO.		NO.S	AREA(SQ.M.
1	DINING AREA		1.3		100		1	130
2	KITCHEN		20%		ŝ			52
3	STORE ROOM		20%					52
4	DISH WASHING AR	EA	5%		8			13
5	COUNTER		5%					13
	TOTAL							260

S.No.	Description	Area/	No.of	Nos	Area
		Person	Users		(Sq.m)
1	Shared bedroom	2.4	2	4	160
2	Kitchen	18		1	18
3	Dining	30	12	- 1	30

Chapter 5. ABOUT THE SITE

Site Introduction

• Site location: Adharsha, Bhaktapur.

• Site area: 11444.2 Sq.M (22-4-1-2.39)

• Current Use: Vegetable Market • Access: 8 m wide road and araniko highway.

• Site surrounding: Residential area farm land.

Suryavinayak Municipality Building and Planning By-laws:

• Zone: Residential area • Ground Coverage: 50%

• FAR: 3.5 • Set back: 3M

ROW: 25M FROM CENTER LINE OF

HIGHWAY

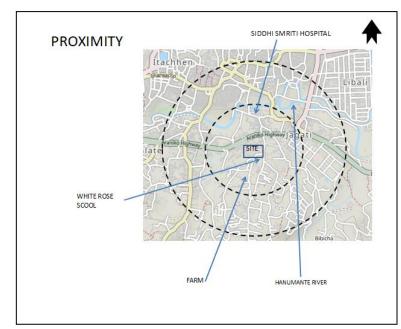
OPEN SPACES:4% OF TOTAL SITE AREA

ACCESIBILITY









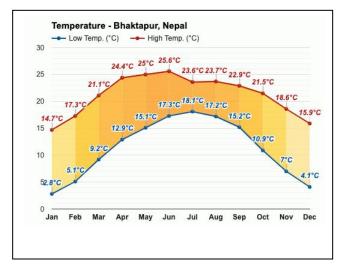
Proximity

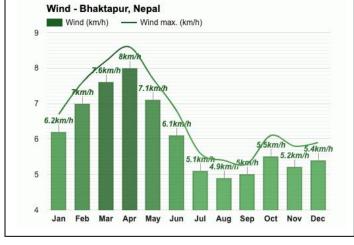
• Educational: 0.5 KM • Hospital: 0.5KM

• River water resources: 0.5-1KM

• Farm: 0.5KM

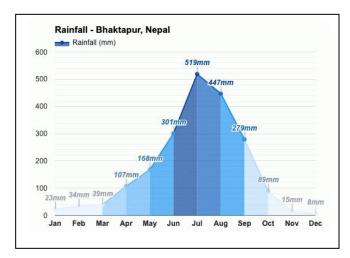
CLIMATE ANALYSIS



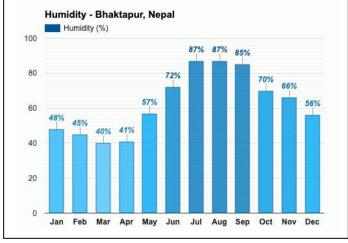


The month with the highest average low temperature is July (18.1°C). The coldest month (with the lowest average low temperature)

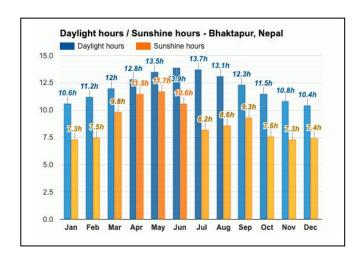
The windiest month (with the highest average wind speed) is April (8km/h). The calmest month (with the lowest average wind speed) is August (4.9km/h).

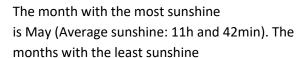


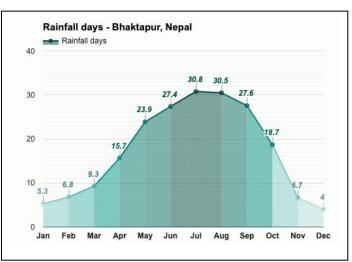
The wettest month (with the highest rainfall) is July (519mm). The driest month (with the least rainfall) is December (8mm).



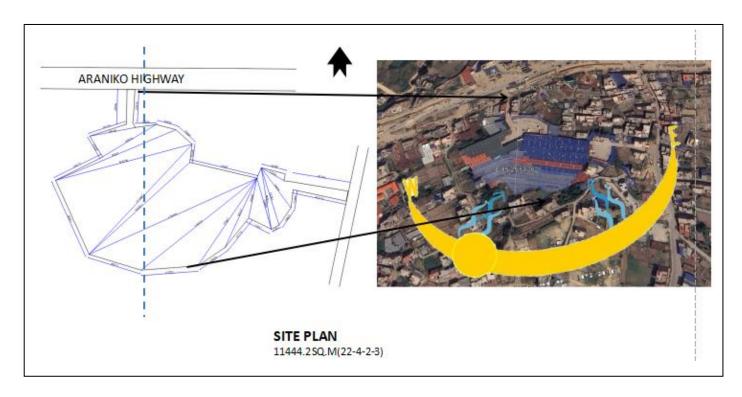
The months with the highest relative humidity are July and August (87%). The month with the lowest relative humidity is March (40%).







The month with the highest number of rainy days is July (30.8 days). The month with the least rainy days is December (4 days).



SWOT ANALYSIS

STRENGTH

- Enough Solar Gain
- Easy accessibility
- Vegetables plants available nearby

WEAKNESS

 FLOODING CAN BE CAUSED DUE TO HIGH TERRAIN IN SOUTH SIDE OF SITE

OPPORTUNITY

 Gradual contour for water supply.More residence are increasing.

THREAT

Pollution du to the main highway of high density traffic i.e smoke,dust,and noise.



Fig 45 :access to highway



Fig 46; gradual contour

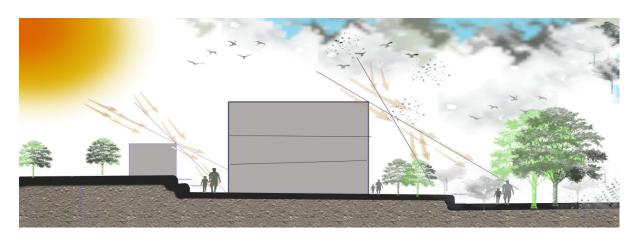


FIG 47: SITE SECTION AT X-X

SITE PHOTOS



Chapter 6. Concept and Development

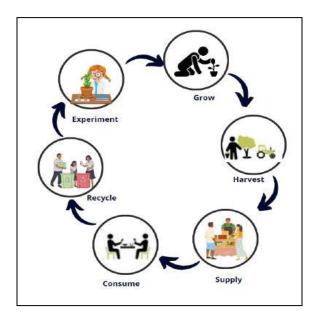
CONCEPT DEVELOPMENT

Key Words : Accessibily, Production, Research, Sustainability, Urban Agriculture .

Focused on the definiation of Urban Agriculture "to grow, process, and distributing food in and around urban areas.

Cycle of agriculture and food:

Growing ----- Harvest ---- Packaging ---- Supply--- Consume ---- Recycle ---- TRAINING. The above keywords are the first conceptual guide lines . By analyzing the leywords, Cycle of agri culture and food is derived as a concept for the project. It guides the form , services, structure, emphasizing and creating a sense of community within building with open plazas, market place and food outlets, and placemaking for the locals.



CONCEPT

ROTATION OF SOLAR



ZONING

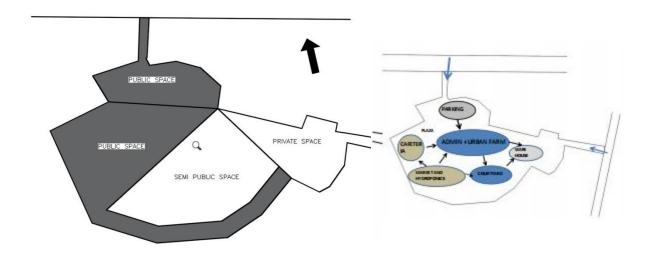
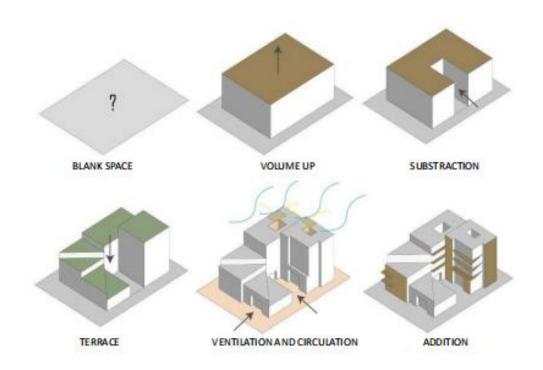


FIG 48 :ZONING WITH SHADOW CAST

FORM DEVELOPMENT



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ANNEX

3D VIEWS

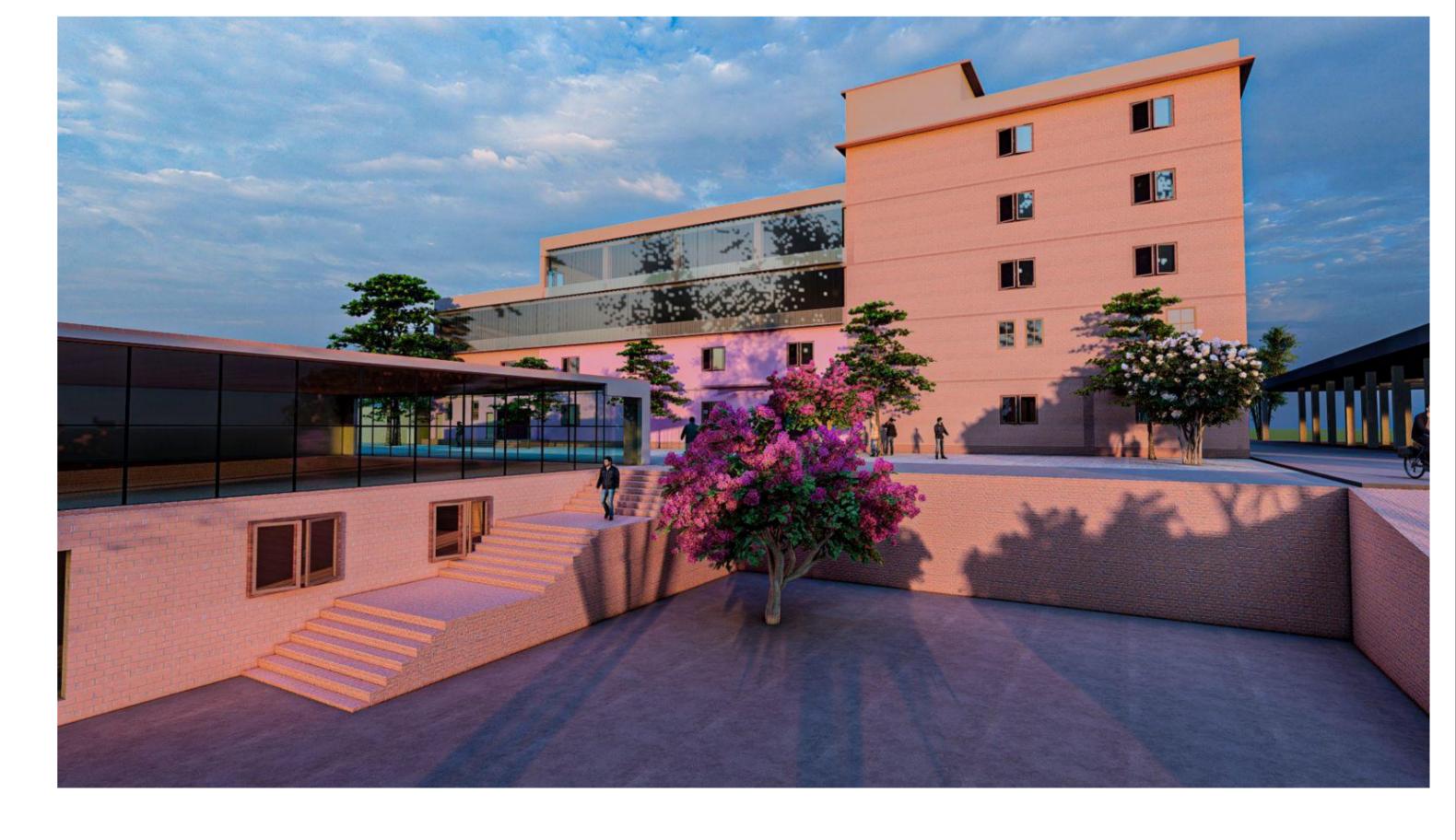


VIEWS FROM ENTRANCE OF TRAINING CENTER



COURTYARD AND TERRACE VIEWS





OPEN MARKET VIEW

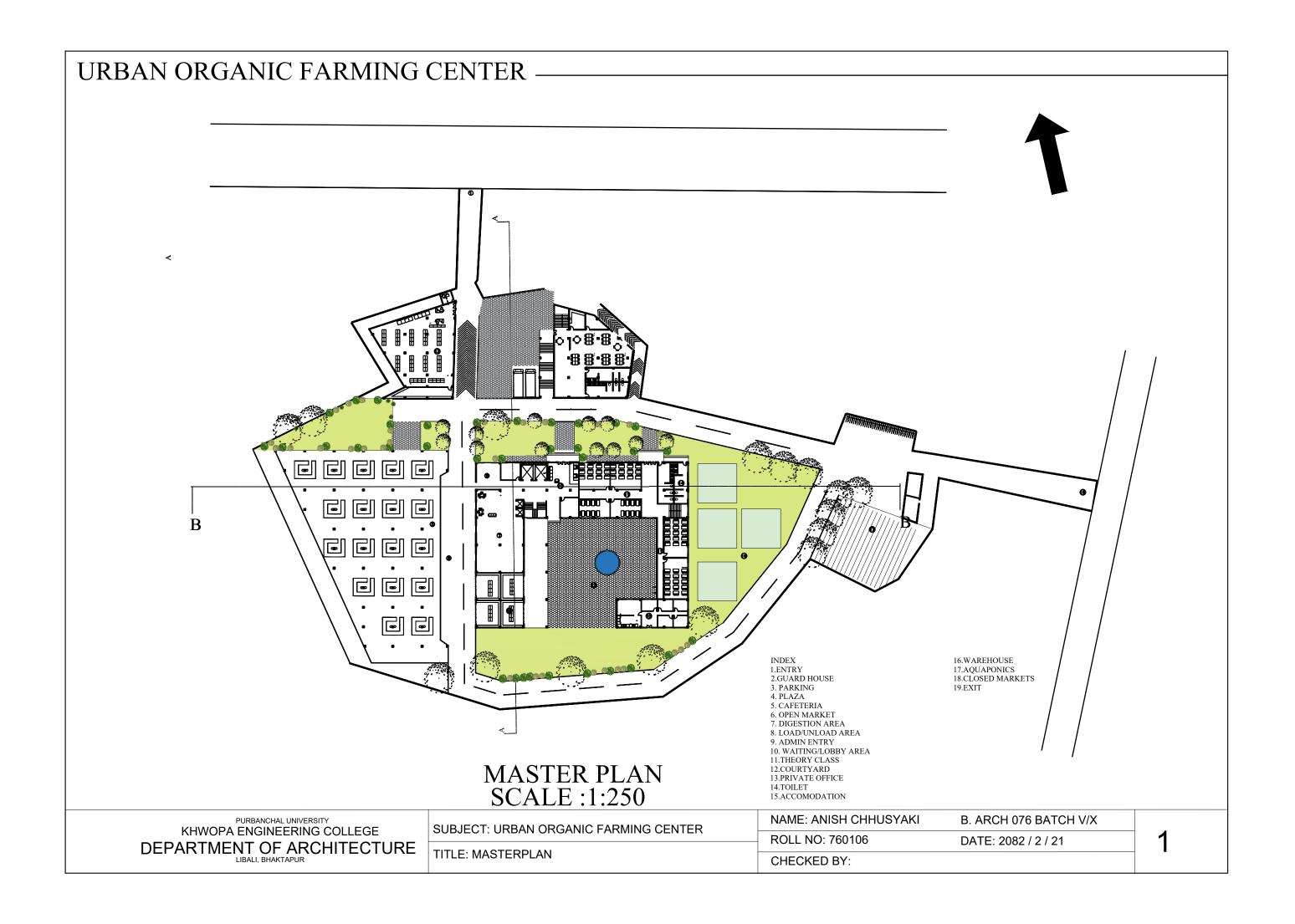
3D MODEL

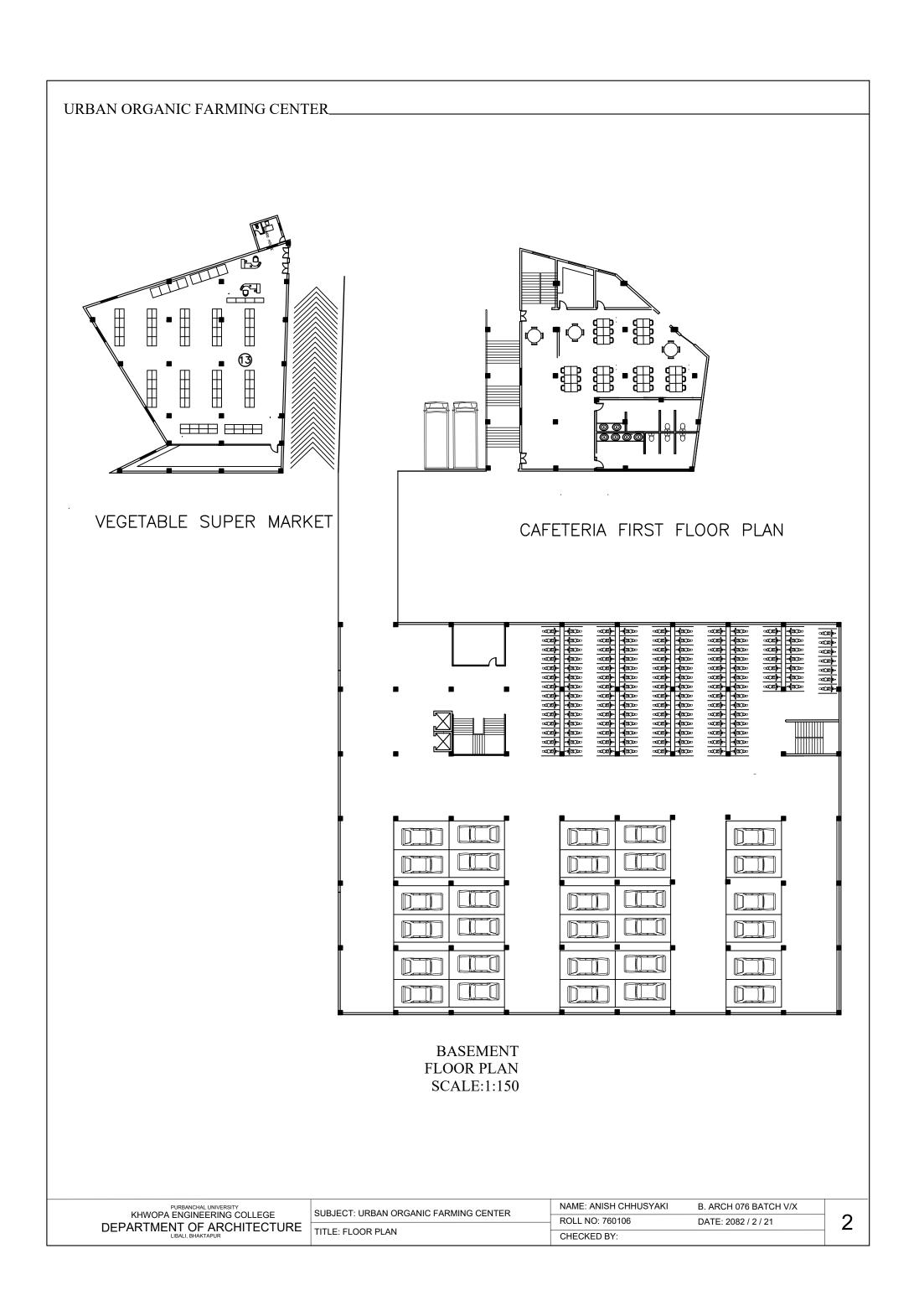










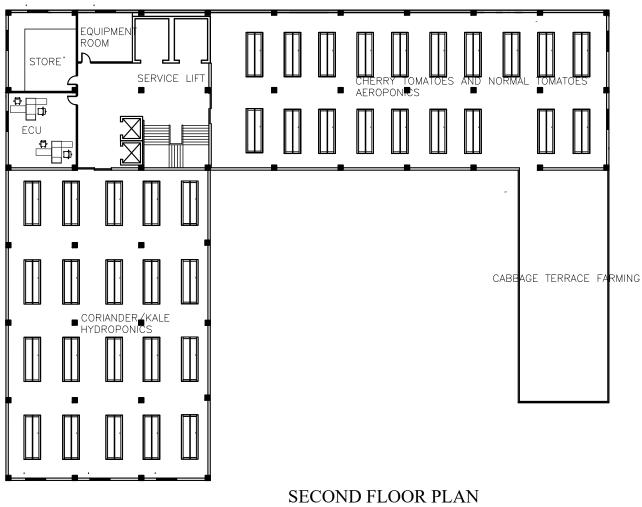


DEPARTMENT OF ARCHITECTURE

SUBJECT: URBAN ORGANIC FARMING CENTER	NAME: ANISH CHHUSYAKI	B. ARCH 0/6 BATCH V/X
SOBSECT. ONDAN ONCANIC LANGING CENTER	ROLL NO: 760106	DATE: 2082 / 2 / 21
TITLE: FLOOR PLAN	CHECKED BY:	SCALE: 1:150



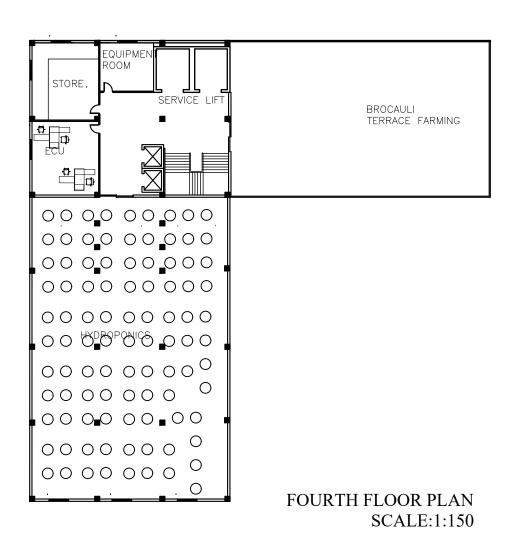
FIRST FLOOR PLAN SCALE:1:150



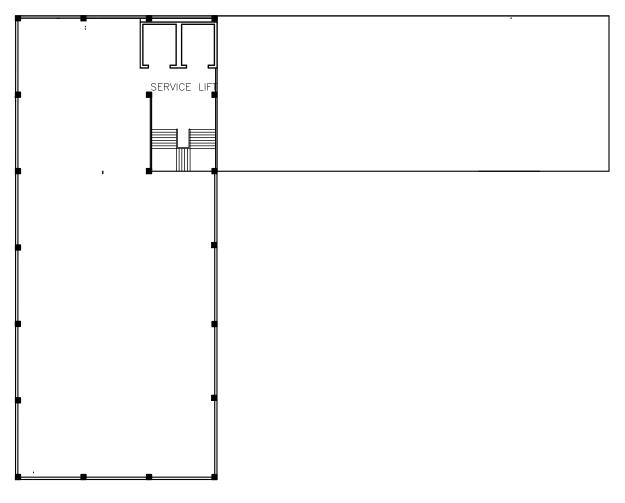
SECOND FLOOR PLAN SCALE:1:150

URBAN ORGANIC FARMING CENTER STORE STORE SERVICE LIFT CAULIFLOWER TERRACE FARMING CAULIFLOWER TERRACE FARMING

THIRD FLOOR PLAN SCALE:1:150



6



FIFTH FLOOR PLAN SCALE:1:150

INDOOR FARMING MODULES







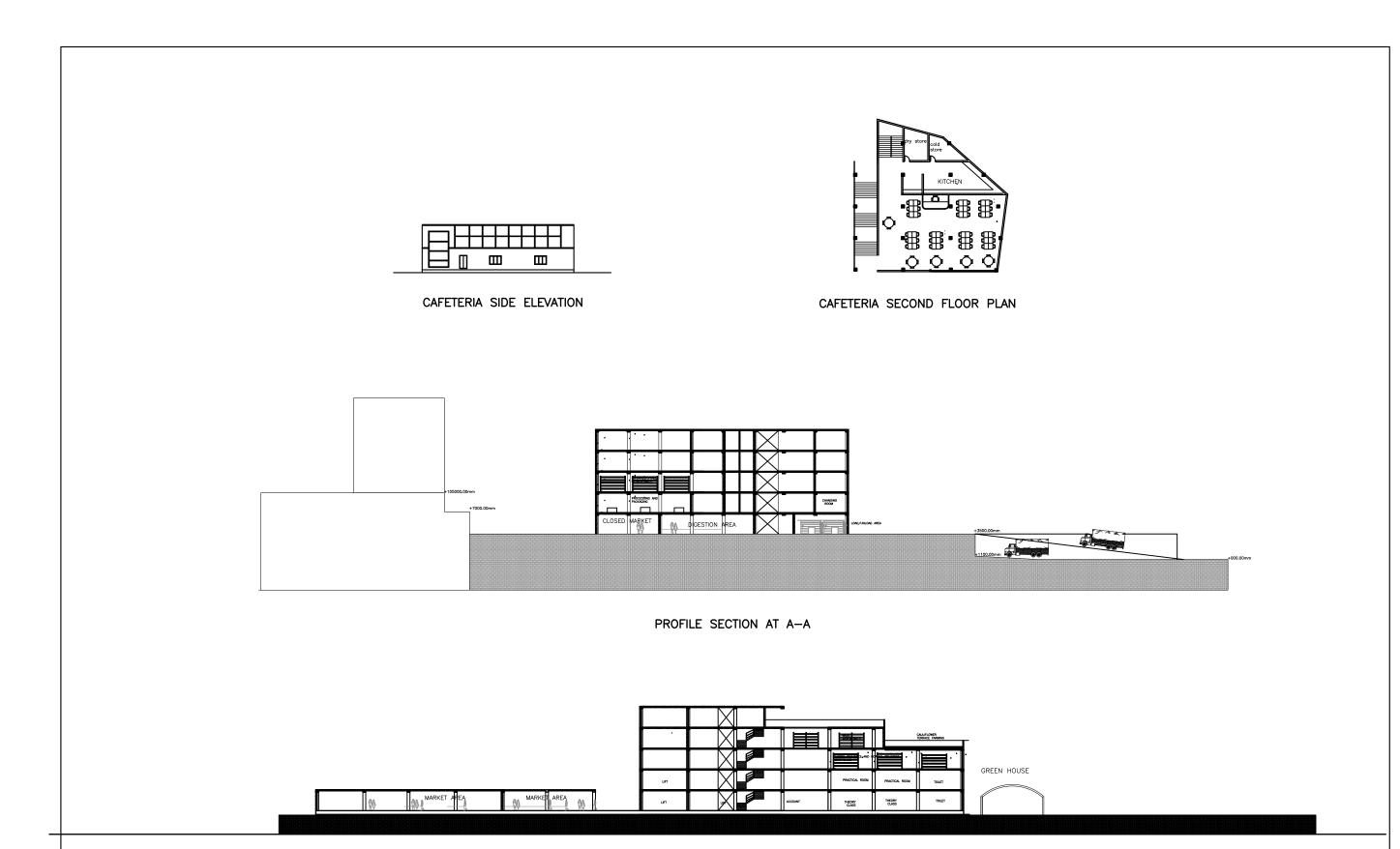


OPEN MARKET

PURBANCHAL UNIVERSITY
KHWOPA ENGINEERING COLLEGE
DEPARTMENT OF ARCHITECTURE

SUBJECT: URBAN ORGANIC FARMING CENTER	
TITLE: FLOOR PLAN	

NAME: ANISH CHHUSYAKI	B. ARCH 076 BATCH V/X
ROLL NO: 760106	DATE: 2082 / 2 / 21
CHECKED BY:	



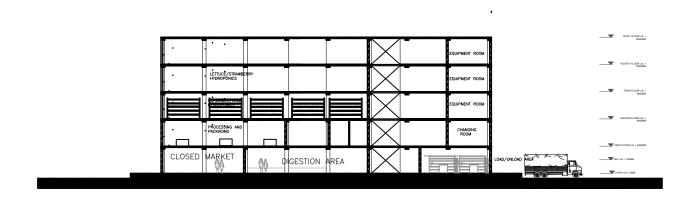
PROFILE SECTION AT B-B

PURBANCHAL UNIVERSITY
KHWOPA ENGINEERING COLLEGE
DEPARTMENT OF ARCHITECTURE
LIBALI, BHAKTAPUR

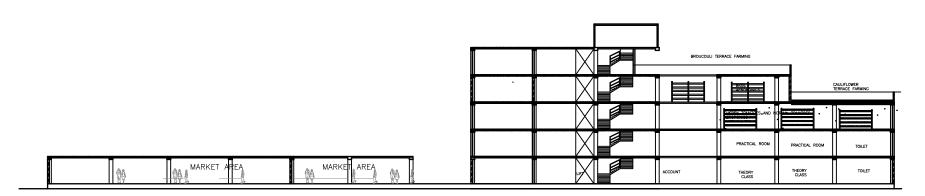
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GODDEGT: GREATH GREATHING TANKING GENTER	ROLL NO: 7	
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TITLE: SECTION	CHECKED I	

NAME: ANISH CHHUSYAKI	B. ARCH 076 BATCH V/X
ROLL NO: 760106	DATE: 2082 / 2 / 21
CHECKED BY:	SCALE: 1 : 250

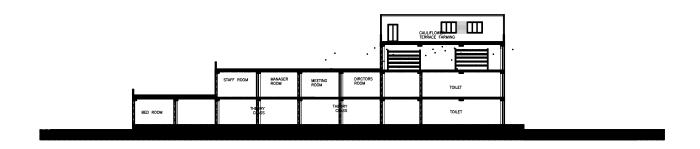
3



SECTION AT X-X

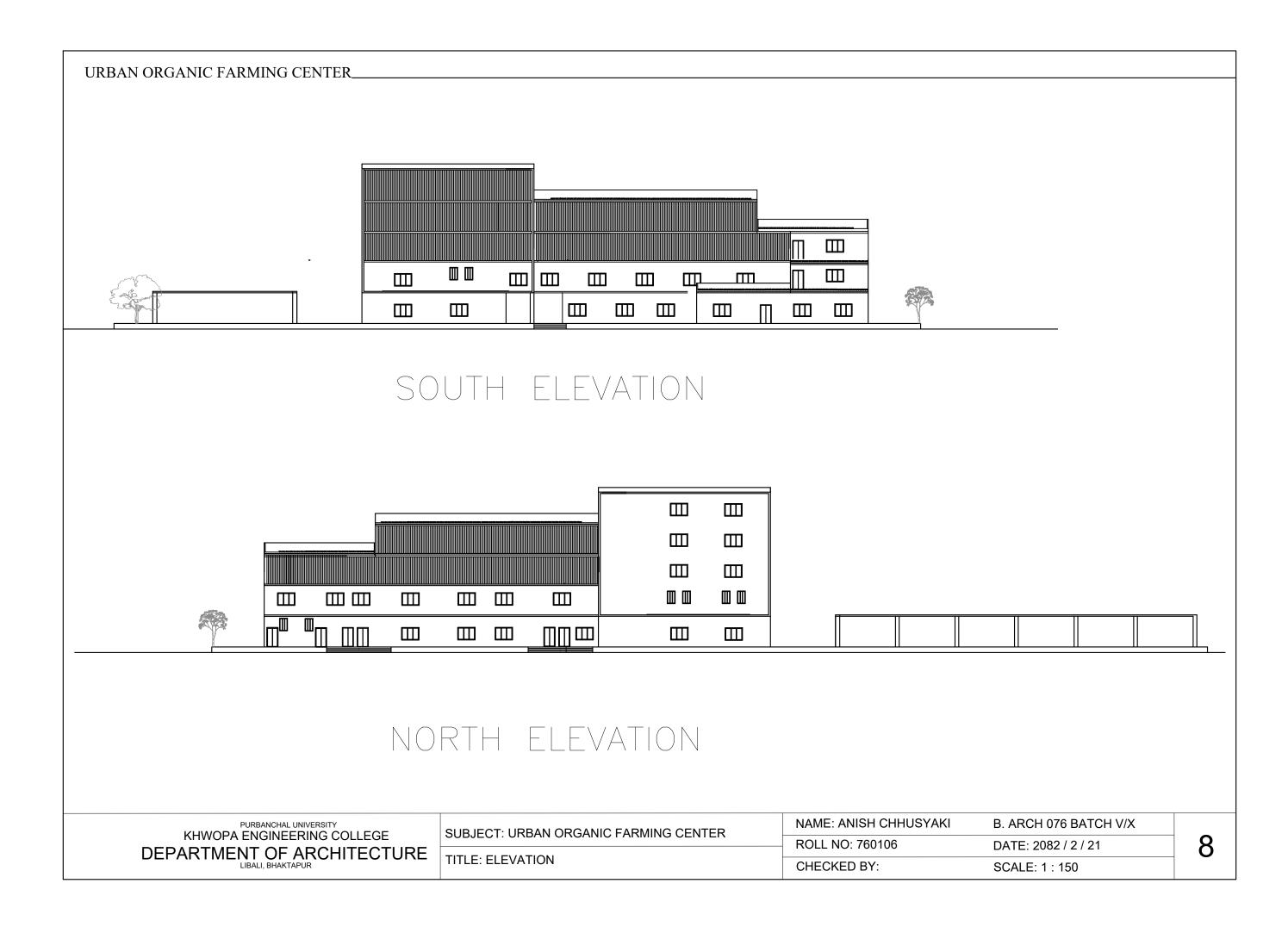


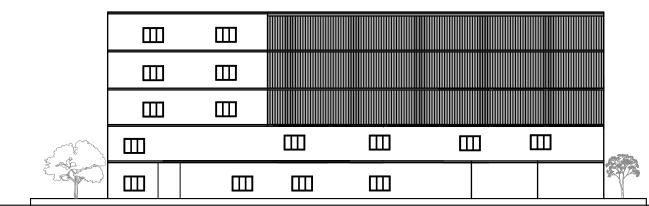
SECTION AT Y-Y



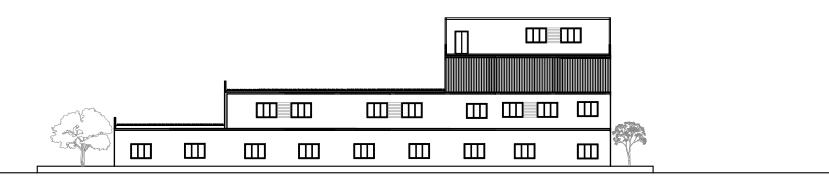
SECTION AT Z-Z

SUBJECT: URBAN ORGANIC FARMING CENTER	NAME: ANISH CHHUSYAKI	B. ARCH 076 BATCH V/X
	ROLL NO: 760106	DATE: 2082 / 2 / 21
TITLE: SECTION	CHECKED BY:	





WEST ELEVATION



EAST ELEVATION

PURBANCHAL UNIVERSITY
KHWOPA ENGINEERING COLLEGE
DEPARTMENT OF ARCHITECTURE
LIBALI, BHAKTAPUR

SUBJECT: URBAN ORGANIC FARMING CENTER	
TITLE: ELEVATION	

	NAME: ANISH CHHUSYAKI	B. ARCH 076 BATCH V/X
_	ROLL NO: 760106	DATE: 2082 / 2 / 21
	CHECKED BY:	SCALE: 1 : 150