# modern village.

## Agriculture Innovation Institute

**ISTANBUL TECHNICAL UNIVERSITY**

**ARCHITECTURE NON-THESIS MASTER'S PROGRAM**

## 2020-2022 FALL-SPRING SEMESTER

# About the Process.

"Economic development forms the backbone of the ideal of Turkey which is free, independent, ever stronger and more prosperous."

## Our Work...

Our thesis team consists of the architecture master students from ITU Architecture Non-Thesis Master's Program of 2020-2021 academic year.

Within the context of Architectural Design Online Studio I and Architectural Design Online Studio II, we researched about the East Marmara Region that particularly focuses on Gebze in Kocaeli.

In parallel with the research process, with the advisor of Prof.Dr.Birgül Çolakoğlu and Research Assistant Uğur Sarışen, we developed macro scale scenarios for the 21st learning spaces combined with the innovation campus of Gebze Technical University. Besides macro-scale scenarios, we designed an innovative campus that is based on bio-based agriculture as a subject, directly related to Gebze Technical University.

Our vision is to gain agricultural innovations' and its learning spaces' economic, social, and environmental prosperity for the future of Gebze Technical University and indirectly Gebze with sustainable impact on the environment.

Our mission is to strengthen agricultural production and agricultural innovation from younger to older people to work in Gebze and attract a global-regional-local community in business and enterprises about agricultural to create positive conditions for the future of Gebze Technical University; in addition, to raise awareness about the production, research and development of bio-based agricultural innovation products.

# Project Team.

## NILAY OZELER KANAN

She was born on January 10, 1983 in Ankara. She graduated from Gazi University, Faculty of Engineering and Architecture, Department of Architecture in 2006. In 2007 she started to work as an architect at the Ministry of Public Works and Settlement. In 2010, she completed her master's degree in Eskişehir Osmangazi University, Institute of Science and Technology, Department of Architecture. She had continued to work as an architect at the Ministry of Environment and Urbanization until 2016. Later in the same year, she started to work as a Research Assistant at Van Yüzüncü Yıl University, Faculty of Architecture and Design, Department of Architecture and still continues to work. In addition, she continues her Non-thesis Master's Program in architecture education in Istanbul Technical University.

## BEYZA KIRISCAN

She was born on April 20,1995 in Burdur. She graduated from Bilkent University, Deparment of Architecture in 2019. After graduation from the bachelor's degree, she attended the short-term courses and workshops. In 2020, she started her master education in Istanbul Technical University-Architecture Non-Thesis Master's Program. She continues her master program in architecture education and works in an architectural firm.

## ECEM OZTURK

She was born on April 20, 1996, in Istanbul. She graduated from Yeditepe University, Department of Architecture in 2019. Since her graduation, she has been working as an architect. At the same time, she continues her education in Istanbul Technical University Architecture Non-Thesis Master's Program.

## HOMA RAEISSI

Born in 08 March 1997 in Tabriz/Iran. Graduated in 2019 from Tabriz Azad universtiy, Architectural Engineering Design program. Started Architectural design Non-thesis Master's degree program 2020 in Istanbul Technical University.

# Content's.

**BIOBASED.**
**AGRICULTURE.**
**SUSTAINABLE.**
**INNOVATION.**
**CENTER.**

# Introduction.

Marmara region which is situated in the northwest part of Turkey with the highest population is the smallest region between seven geographical regions of turkey. Region consists of İstanbul, Tekirdağ, Edirne, Kırklareli, Balıkesir, Çanakkale, Bursa, Bilecik, Sakarya, Kocaeli and Yalova provinces.

Strategic location of the region between Asian and European continents is important. Region has coasts along the seas of Marmara, Aegean and the Black Sea. It borders Bulgaria to the northwest, Greece to the west, and other regions of Turkey to the east and west. A sea called the Sea of Marmara is located in the center of the region. Since different seas encircle the Marmara region, it has a combination of climates such as Mediterranean climate on the southern part of the region, an oceanic climate on the Black Sea coast, and a humid continental climate in the interior.

As the land is suitable and transportation of materials required for many sectors is easy, Marmara Region shines with its industry. The primary industries in this region are textile, automotive products, steel production, ceramics, processed food, paper, and white goods.

The Marmara region has one of the most fertile soils in Turkey. With its climate and rich soil, agriculture in this region is one of Turkey's most advanced. Usage of high-technologic agricultural systems and support from the Turkish government led to developments in farming. 30% of the Marmara region is used for agriculture such as wheat, corn, sugar beet, and sunflower (Marmara Municipalities Union, 2019, 10-11).


Figure 1. Maps of Marmara Regions Provinces and Development Zones (Marmara Municipalities Union, 2019, 10)

## Population and Migration

69% of the population of 3.39 million in the region is at employment age and this indicator is higher than the national average by 2% (See Figure 2). During the period from 2011-2012, the number of internal migrants was 2.317.814. In this period, 126.344 people migrated to the region and 104.803 people migrated from the region. **It has a net migration rate of 6.4% between 2011 and 2012.** When the migration statistics of the Eastern Marmara provinces for the years 2007-2012 are examined, **5.4% of the internal migration in the period of 2011-2012 came to the Eastern Marmara**.

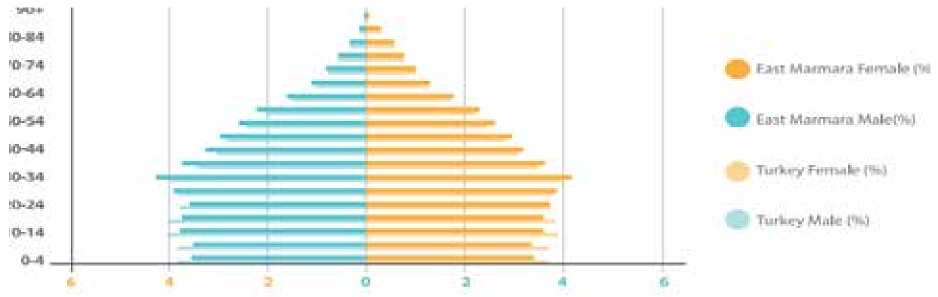



Figure 2. Population Distribution of Turkey and East Marmara by Age Group-Gender (The East Marmara Development Agency, 2015, 46)

Figure 3. Demographic analysis

## Region’s Contribution to Economy

Services, industry and agricultural sectors accounted for 57.1%, 36.1% and 6.9% of the Gross Value Added (GVA) produced in the region in 2011, respectively. In 2001, the share of region in total national GVA and its position among the NUT-2 (Nomenclature D'unités Territoriales Statistiques-İstatistiki Bölge Birimleri Sınıflandırması/Düzey 2) regions are as follows: 4th place in service sector with a rate of 5.65%, 3rd place in industry with a rate of 8.24%, and 9th place in agriculture with a rate of 4,79%. In the light of this data, the region has a great contribution to the Turkish industry and its contribution in service and agricultural sectors are well above the national averages (See Figure 4).

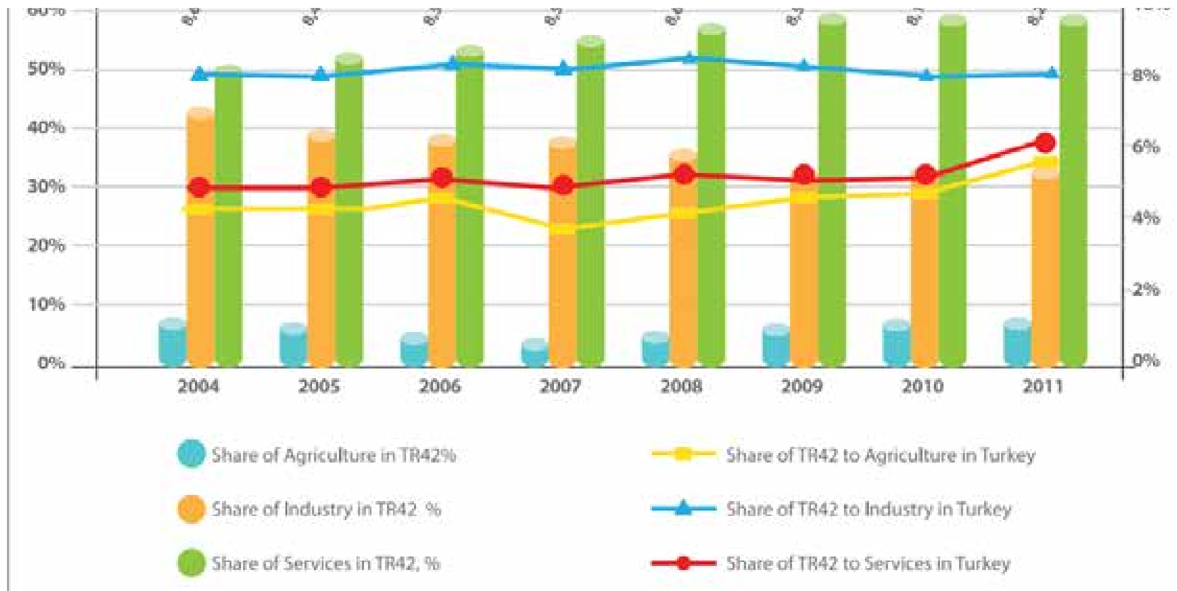



Figure 4. Contribution rate of the region to the economy based on sectors (The East Marmara Development Agency, 2015, 51)

# Our Evaluation

Knowing the agricultural potential of the region is very important for the design of an agricultural innovation institute. Even though agricultural activities are the sector with the lowest economic contribution in the region, it has the 2nd highest rate in Turkey. **Accordingly, the design of the agricultural innovation institute can be related to the agricultural activities in the region.**

When we look at demographic issues such as population and migration, the fact that the population without education in innovation is in the majority is an indication that the industry, which has made a rapid introduction to innovations in the region, has not been able to establish a common awareness and communication language with the public. From this point of view, **the agricultural innovation institute can organize training activities such as agriculture, production, agricultural technologies, marketing, maintenance of agricultural products** within the scope of Gebze Technical University, and can meet the needs of the region in this regard.

The Eastern Marmara Region is a region that preserves its natural values, uses strong industry and R&D studies, uses environmental technologies, has a high innovation perspective, uses the coastal-city tourism potential, can provide **social integration with the people of the region,** and where people want to live for many years with their children. Studies and decisions should be made with this perspective.



"We are offering an experience that combines innovative agriculture approaches and 21st centuries learning spaces."

# +1 The East Marmara Region

The vision of the Eastern Marmara Region is defined as follows (The East Marmara Development Agency, 2014, 1; The East Marmara Development Agency, 2015, 16);

"To be a MARKA-BRAND region in global competition and sustainable development, powered by its strategic position and cooperation networks, producing value with its multifaceted economic structure, shaping the future with its rich human potential, making a difference with its quality of life, focusing on people and knowledge, open to innovations."

# 1.1 The East Marmara Regional Innovation Strategies (2014-2018)

Global actors such as Europe, America, China, and India have pioneer positions in shaping the world economy. Competitive strategy of China and India basing on low-cost labor and view of America and Europe the strategies **focusing on informatics, energy efficiency and bio- and nano-technology** as the primary areas directly affect production strategies of developing countries.

**Innovation is deemed as the key factor of economic and social development by the international platform, particularly the United Nations, World Bank and European Union.** In line with all these inputs, providing smart specialization and development of pioneer sectors within a sustainable innovation system in the East Marmara Region appears to be a requirement. For this reason, **the East Marmara Region Innovation Strategy has been prepared** (The East Marmara Development Agency, 2014a, 6).

## Definitions of Innovation

The Oslo Manual, published by OECD and EUROstat, aims to support evidence-based policy making needs through technical guidance. According to Oslo Manual in 2005 (OECD, 2005);

"Innovation is the imxementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations."



## Innovation in TR42

Gebze Organized Industrial Zone which is the first Technology Development OIZ of Turkey operates in the region. 6 of 34 technoparks that are operational around Turkey and 2 of 20 technology centers are located in the region. 3 technoparks – TUBİTAK Marmara Technopark, Gebze OIZ Technopark and Kocaeli University Technopark – among the technoparks that are located in the region are in Kocaeli; and Sakarya University Technopark is located in Sakarya and Bolu University Technopark is located in Bolu. Moreover, two technology centers - Gebze Institute of Technology and KOSGEB Sakarya University Technology Center – are located in the region (See Figure 5) (The East Marmara Development Agency, 2014b, 81).

Figure 5. Innovation centers in the region (The East Marmara Development Agency, 2015, 232)

| Zone | University Name | Province | Date of Foundation |
|---|---|---|---|
| TÜBİTAK Marmara Research Center Technopark | TUBİTAK-TTGV | Kocaeli | 2001 |
| GOSB Technopark Technology Development Zone | Sabancı University | Kocaeli | 2002 |
| Kocaeli University Technology Development Zone | Kocaeli University | Kocaeli | 2003 |
| Sakarya University Technology Development Zone | Sakarya University | Sakarya | 2008 |
| Bolu Technology Development Zone | İzzet Baysal University | Bolu | 2009 |
| Düzce Technopark Technology Development Zone | Düzce University | Düzce | 2010 |
| Muallimköy Technology Development Zone (Inactive) | Gebze Technical University | Kocaeli | 2011 |

Table 1. Innovation centers in the region and their years of establishment (The East Marmara Development Agency, 2015, 232)

# 1.2 The East Marmara Regional Plan (2014-2023)

After determining the potential and risks of the region for the development plan, the approved Environmental Plans of Kocaeli, Sakarya, Düzce, Bolu, Yalova provinces were prepared. Development scenarios targeting 2023 were created by combining the regional environmental plan decisions and the 10th Development Plan (2014-2018) decisions. The main scenario for the TR42 region is divided into 3 main topics: livable region, competitive region and learning region. The lower regions, on the other hand, have a heterogeneous structure due to economic, human, environmental, spatial and human differences. In order to support the heterogeneous structure holistically, 3 different development scenarios have been determined (See Figure 6).

Figure 6. Conceptual Scheme of Global, Dynamic and Peripheral Sub-regions (The East Marmara Development Agency, 2015, 74)

### 1-Global Sub-Regions Development Scenario:

According to this scenario, the main problem for Gebze, Izmit and Adapazarı; quality of life lagging behind compared to the level of economic development. By increasing the quality of life, it is aimed to ensure high value-added innovative production together with the qualified population and workforce, and the workforce with increasing quality.

### 2-Dynamic Sub-Regions Development Scenario:

The main problem for Düzca, Bolu and Yalova, which is targeted according to this scenario, is to move the existing economic activities to a more competitive environment.

### 3-Environmental Sub-Regions Development Scenario:

According to this scenario, the target is to increase the existing economic and social activities in a sustainable way in terms of quality and quantity.


Figure 7. Prominent features of the East Marmara Regional Plan for 2014-2023 (The East Marmara Development Agency, 2015, 26)



# The East Marmara Region Environmental Datas

## Seismicity

Due to the 1999 earthquake, the ground condition should be well studied in the development of the region. Thus, the need to be prepared for an earthquake at any moment arises (See Figure 8).

Figure 8. Regional Earthquake Map (Republic of Turkey, Prime Ministry Disaster & Emergency Management Authority, 2010)

## Climate-Wind Potential

For an economical wind energy plant investment, wind speed should be at least 7 m/s and higher and capacity factor should be at 30% and higher. The administration identified a potential of 727 MW and the Yalova province stands out with a potential of 533 MW (See Figure 9).

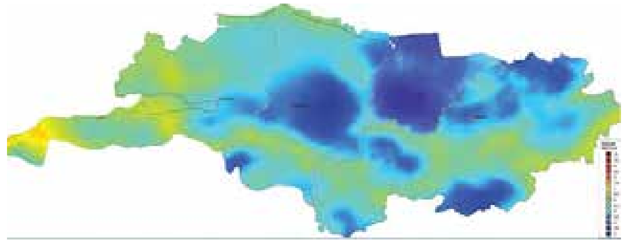


Figure 9. Regional Earthquake Map (Republic of Turkey, Prime Ministry Disaster & Emergency Management Authority, 2010)

## Climate-Solar Potential

Average solar energy of Turkey, 1.311 KWh/m2 per year, is a very important potential. Accordingly, average solar energy of East Marmara Region, 1.168 KWh/m2 per year, is below the national average but is a very high rate compared with Europe. In order to make investments in this field, the region needs to be promoted and a favorable investment environment should be available.

Figure 10. Regional Solar Energy Map (General Directorate of Energy Affairs, 2021b)

# Site study location and context

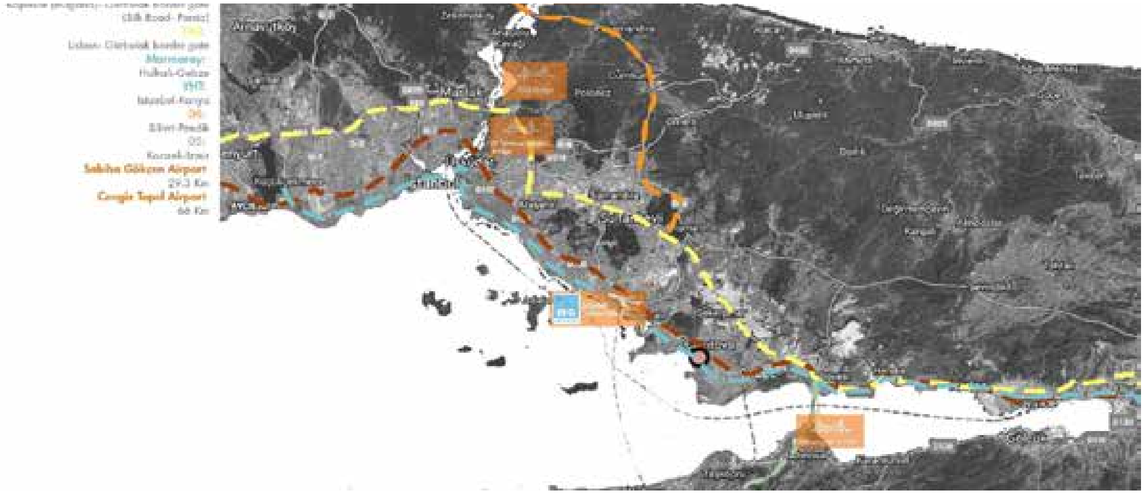


Figure 11. Connections

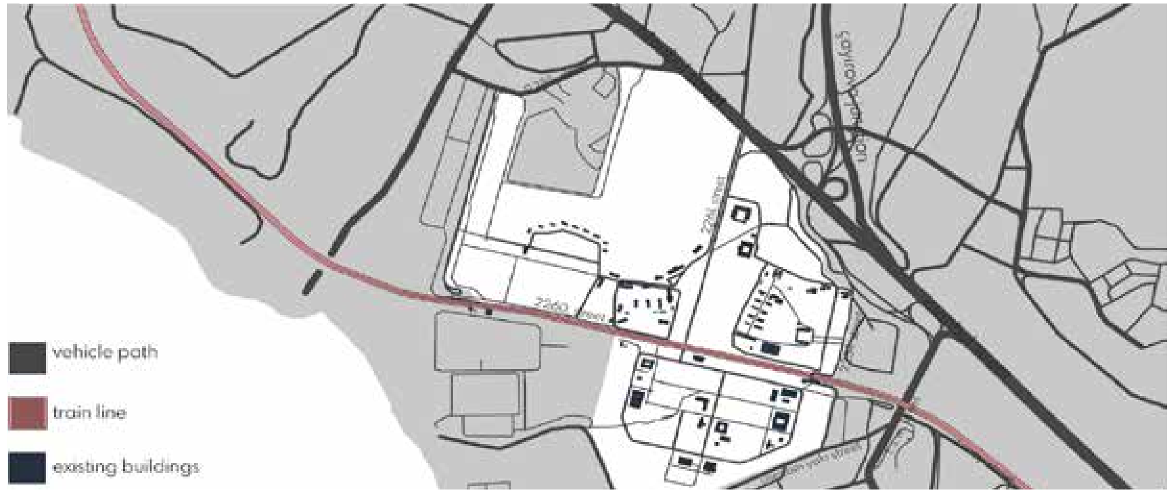



Figure 12. Traffic network



## Tourism

Kocaeli province hosts mainly the European tourists and majority of them are for business visits (The East Marmara Development Agency, 2015, 208). Tourism is seen as a sector open to development for the eastern Marmara region. However, in the current situation, it can be foreseen that congress and meeting tourism infrastructure can be established as well as potentials such as nature, thermal and agricultural tourism.

## Kocaeli Province

Kocaeli is bounded to the west by the Sea of Marmara and to the north by the Black Sea. The province is drained by the lower course of the Sakarya River. İzmit, lying on the Gulf of İzmit, is the capital city. İzmit serves as the main source of the agricultural (including sugar beets and tobacco), forest, and industrial (primarily cement, paper products, textiles, and petroleum) products of the province (Britannica, 2019).

## Kocaeli's Hierarchical Status in Reference Works

In order to turn the demographic opportunity into an advantage in the Eastern Marmara Region, to make the region a center of attraction for the population with a low level of education, and to overcome the risk of decreasing the population with higher education, the learning region model has been adopted, taking into account the innovative and competitive vision of the region. It is aimed to increase the quality of the labor force as well as employment with the increase of knowledge level in the region. In the learning region axis, three main tools are structured; development of abilities, increasing the contribution of abilities to employment and adoption of social development (The East Marmara Development Agency, 2014, 19).

# OUR EVALUATION

Gebze district, Gebze Technical University and its surroundings show that it has a potential to provide social integration with the transportation and proximity relationship established with the coast and the city. In addition, it is seen that the use of open space and green space of the area also contributes to environmental sustainability and supports the conceptual basis of the design project.

In this process, which started with the idea of designing an agricultural innovation institute, the concept of innovation is effective in shaping the design space organization. It is stated in the development plan that innovation also increases competitiveness.

In addition, when an institute design was requested on land located in Gebze Technical University, it was seen that there was a basis for recommending 21st century learning spaces that try to improve themselves in a learning region within the framework of the development plan.

The residential areas within the borders of Kocaeli and Gebze are defined as the global sub-region. The main problem in this region is the lagging behind in the quality of life compared to the level of economic development. The main goal is to identify the factors that increase the quality of life in this region. Thus, a qualified population, increase in workforce, awareness towards innovative production can be realized.

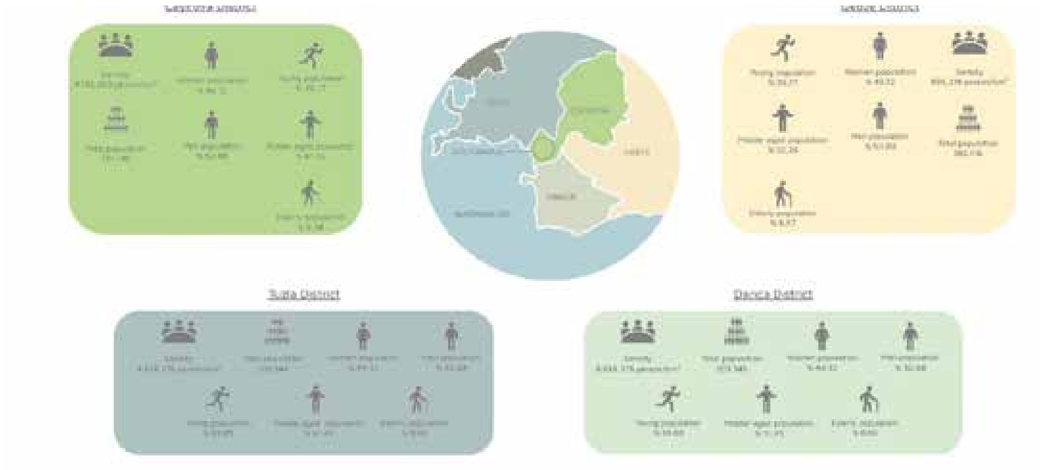


Figure 13. Demographics analysis

# 1.3 Brief History and Location of Gebze

## History

Gebze dates back to the XII century. There are traces of Greek origin Phrygians and Roman civilizations. Due to the location of the Kocaeli Peninsula, it has been home to many nations in most of history.

BC in Gebze After 281, famous kingdoms such as King Nicomede I and Carthaginian commander Hannibal settled here. As we approach today, after the war between the Ottomans and Byzantium in 1330, Gebze and its surroundings were included in the Ottoman administration. Orhan Gazi is the founder of today's Gebze. Orhan Gazi made great efforts for the development and survival of the region. During the Ottomans' efforts to become a state, Gebze was used as an army settlement. Gebze is a campus in the Ottoman Empire, sometimes included in Istanbul, sometimes in Kocaeli.

After the defeat of the Ottoman Empire in the First World War, Gbeze district was occupied by the British in 1920. On October 12, 1922, Gebze was liberated from enemy occupation. After the proclamation of the Republic, Gebze was connected to Izmit according to the new provincial law (Gebze District Governorship, 2019)

## Location

Gebze is the second largest district of Marmara Region and contains 15% of Turkish industry. As a result of its location on the important access roads, Gebze became the first stop of the migration through Anatolia to Istanbul for many years. As a result of searching for new settlements, most of the industrial sites localized on Gebze which is the closest one to Istanbul. Due to the land's low cost and easy to come by make Gebze a center of interest. Gebze Chamber of Commerce, 2021). In the Gebze district cluster (Gebze, Çayırova, Darıca, Dilovası and Körfez districts), the target for 2023 is to make sure that innovative industry continues its development in an environment friendly manner and the logistics industry is developed accordingly.

## 1.3.1 History of Gebze Technical University

Gebze Institute of Technology, founded on 3 July 1992, is one of the two high technology institutes in Turkey. Gebze Technical University (GTU) was established with the decree of the Grand National Assembly of Turkey on November 4, 2014, based on the foundations and experience of Gebze Institute of Technology (GIT), which was founded in 1992, inheriting and embracing GIT's 22-year heritage. As the institution's name was changed into "Gebze Technical University" in 2014, seven new institutes were established, and of them, the Institute of Nanotechnology and the Institute of Biotechnology started offering graduate education.

Gebze Technical University has gained a new status being designated as one of the 10 research universities of Turkey, with the announcement made by Dear Mr. President at the opening ceremony for 2017-2018 Academic Year (Gebze Technical University, 2016).Gebze has nine institutes working on Science and Social Sciences, Earth and Marine Sciences, Nanotechnology, Informatics Technologies, Energy Technologies, Transportation Technologies, Defense Technologies and Bio-technologies.

The Agricultural Innovation Institute building and campus that we have built, has the potential to be associated with common working areas and common issues with GTU's Biotechnology, Energy Technology, Nanotechnology and Information Technology Institutes.

## 1.3.2 Brief History of Agriculture and GTU

### Agriculture

Agriculture is defined as the activities of obtaining plants, animals and animal products through sowing, planting, care and cultivation in the field or their processing and evaluation by their producers (BTK, 2008, 5)The Agricultural Innovation Institute building and campus that we have built, has the potential to be associated with common working areas and common issues with GTU's Biotechnology, Energy Technology, Nanotechnology and Information Technology Institutes.

The main contributions of agriculture to the economy are (BTK, 2008, 6):

- Providing workforce to industry and service sector,
- In the food supply,
- Providing input to the industry sector,
- Earning foreign currency by exporting,
- **Preventing imports and thus foreign dependency and**
- **Contributing to real growth.**



## Collaboration between Ministry of Agriculture and Forestry and Gebze Technical University

The year 2020 has been determined as the "Year of Digitization in Agriculture". The developments in information and communication technologies, the increase in the use of artificial intelligence in agriculture, the integration of the internet of things, GPS, image processing technologies into agriculture, and the developments in smart agriculture applications that have entered our lives with industry 4.0 push countries to develop policies and take action in these areas. As a country with the largest agricultural production in Europe and the seventh largest in the world, Turkey has entered the process of forming a policy in this area, based on the requirements of the age.

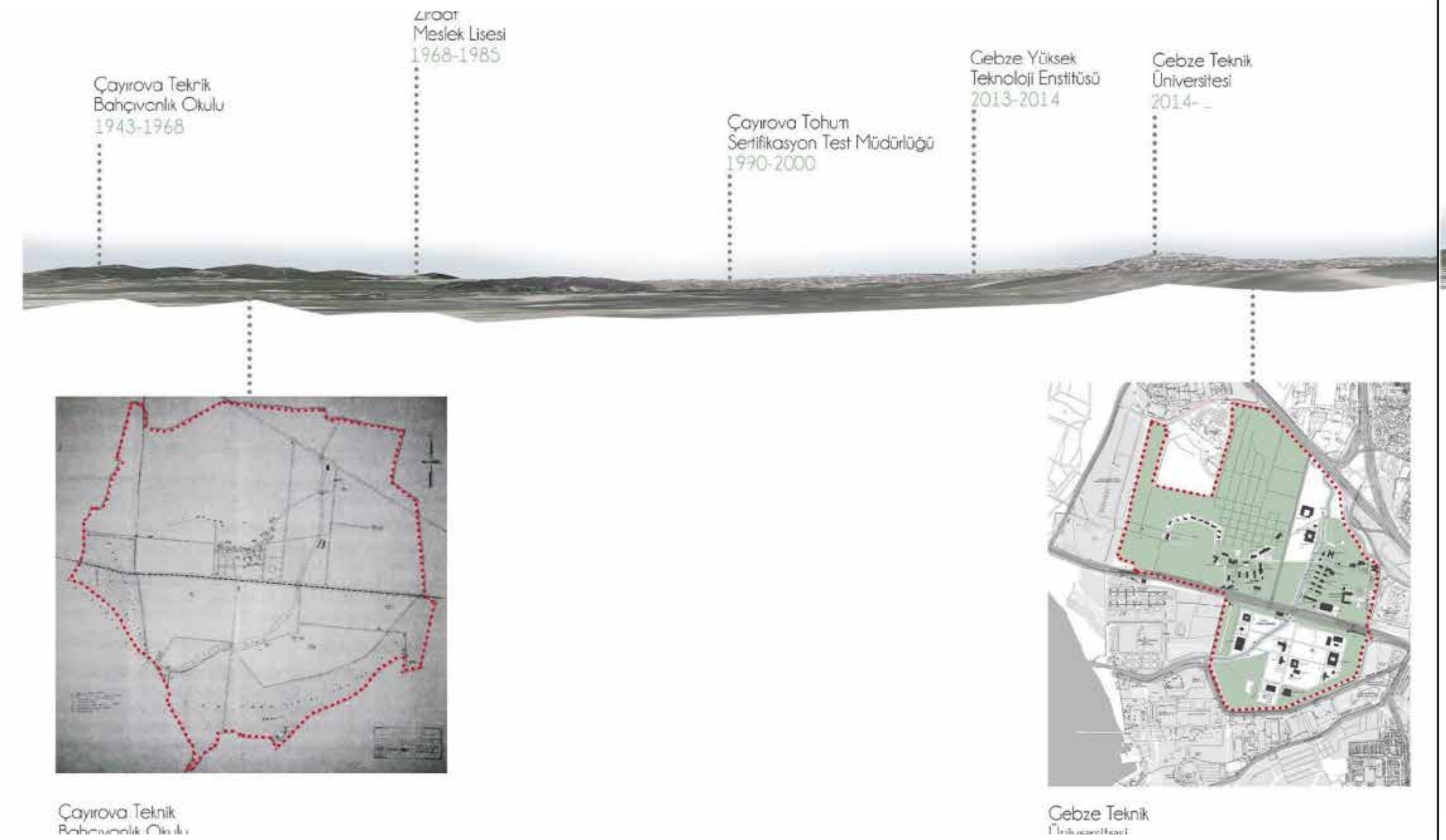
In this context, the cooperation protocol prepared with Gebze Technical University for the Development of Smart Agriculture Applications was signed on October 5, 2020 It is aimed that this campus will be a center that both practices and provides training by using smart farming techniques. (BTK, 2008).

# History of Agriculture in GTU

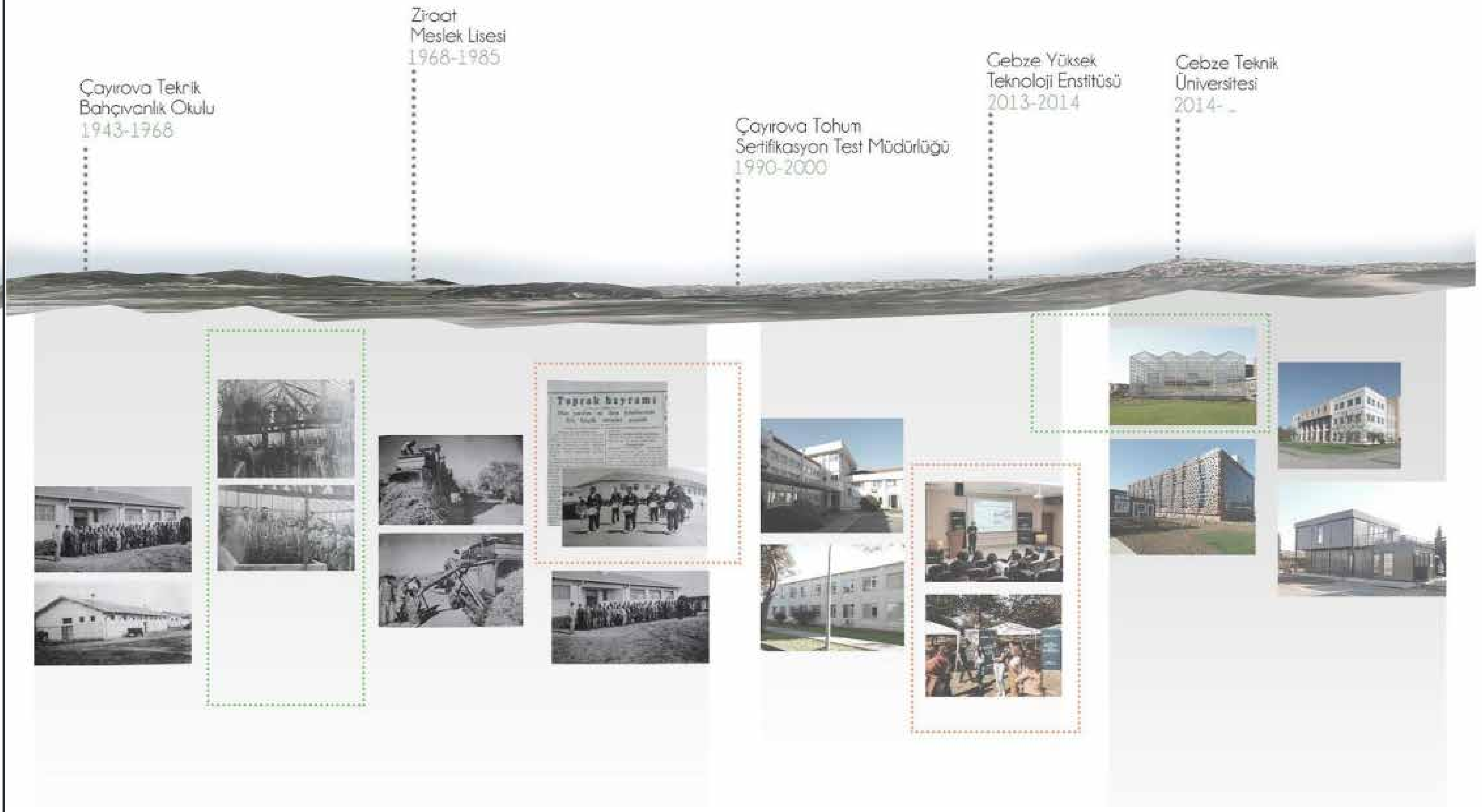
## Çayırova Technical Gardening School (Çayırova Teknik Bahçıvanlık Okulu)-Agricultural Vocational High School (Ziraat Meslek Lisesi)

Çayırova Technical Gardening School, within the body of the Ministry of Agriculture, Forestry and Rural Affairs, was established on July 24, 1943 with the Law on Technical Agriculture and Technical Gardening Schools. After 1968, it was converted into an Agricultural Vocational High School. The school provided education until 1985. The school trained technical gardeners and started the tradition of celebrating Earth (toprak) Day. The school was built on 4027 acres of land located between Tuzla and Gebze, and the practice agricultural areas were separated.(See Figure 14).

Figure 14. Timeline Photographies-Çayırova Teknik Bahçıvanlık Okulu first and last cadastral site plans (Şükür, 2020)   from past to present





## Existing Campus Plan and Maps.

'Campus Master Plan' has designed in 2015, considering the importance of the quality of campus life as a part of academic success. According to Salihoğlu, while considering the future of the campus, economic conditions and investment opportunities, it is important that the system to be created during the design process creates a «Living Environment».

According to Salihoğlu (2021), the campus was designed according to the following design principles;

- Pedestrian and bicycle priority access/convenience for circulation

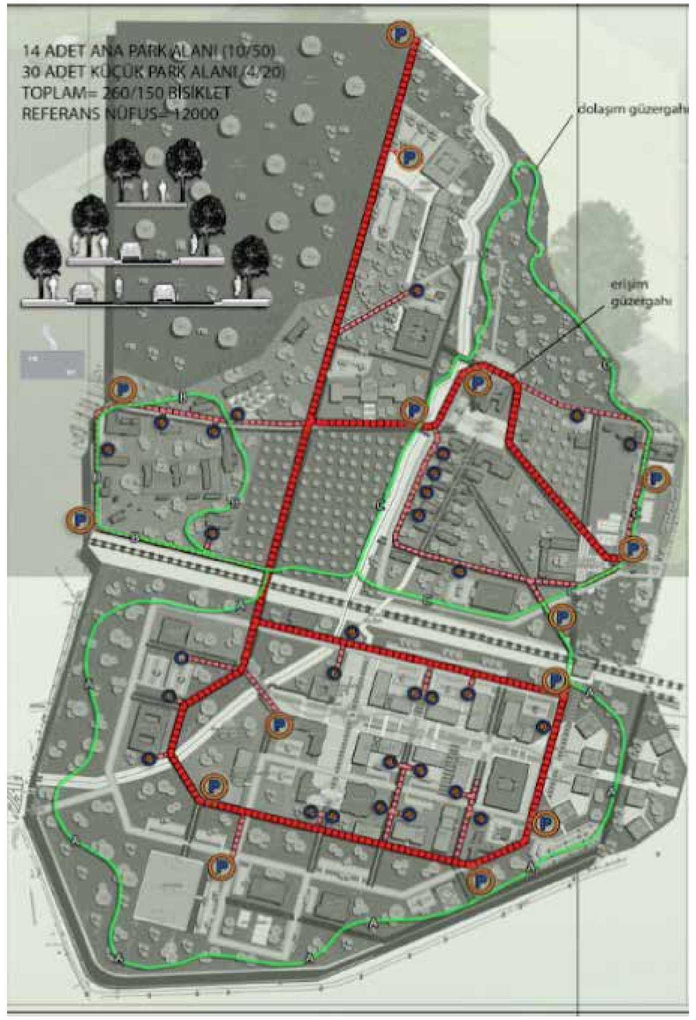
- Having a holistic spatial system that includes the entire campus

- Planning a dynamic living space where the campus identity is highlighted

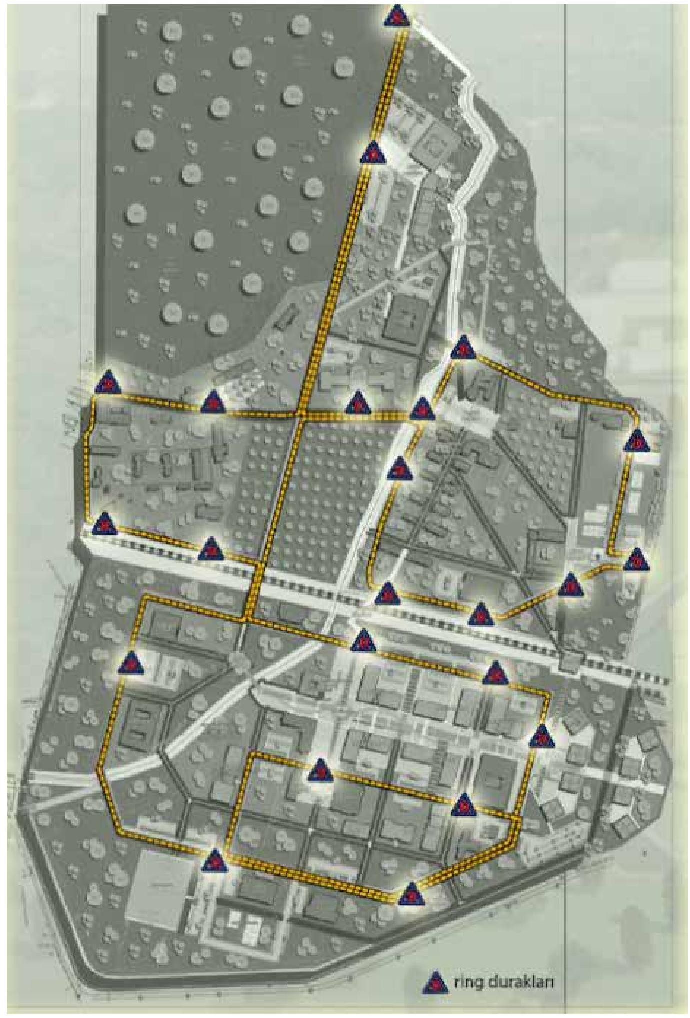
- Implementation of the 'sustainable campus' model, in which ecological values are transferred to campus life.



**Table 2.** Existing Master plan of GTU (Salihoğlu, T. et al, 2021)

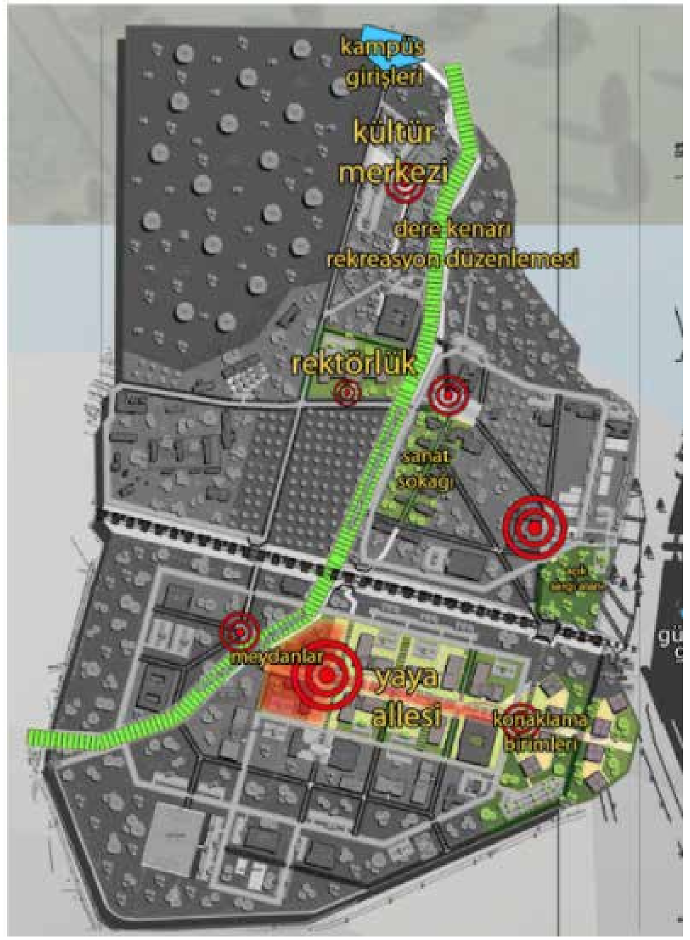



Bicycles Lines Decisions




Bus Stops Decisions

Key decisions that guide campus design




Priority project areas decisions


Key decisions in South Campus of GTU

## +2

# Innovation Campuses and Smart Agriculture

In 2015 With the United Nations Sustainable Development Goals, it aims to find solutions to the problems faced by people by 2030 by planning. In this context, targets have been determined under 17 headings. The following topics are included in the organization of campus built environments and the handling of higher education education models (See Table 4). The spatial organization of innovation campuses, new education and training models, and sustainable life proposals are created within the scope of sustainable development goals.

**Target 2.4.** By 2030, **ensure sustainable food production systems and implement resilient agricultural practices**

**Target 4.3.** By 2030, **ensure equal access for women and men to university education**

**Target 9.5.** By 2030, **enhance scientific research, upgrade the technological capabilities of industrial sectors, encourage innovation**

**Target 11.a. Support positive economic, social and environmental links between urban, per-urban and rural areas**

**Target 11.c Support least developed countries in building sustainable and resilient buildings utilizing local materials**



# Our Evaluation

For the design of the agricultural innovation campus and institute building, the design was developed within the framework of the sub-objectives in the sustainable development goals. In our design decisions, the ideas of using agricultural lands for production, using products in research and development, contributing to the circular economy of product waste, and using innovative agricultural technologies are in accordance with SDP 2 and SDP 9

At the same time, the design of educational spaces with the aim of teaching by experiencing agricultural production supports the purpose of SDP4.

Within the scope of SDP 11, building materials in the design of the institute building are planned to be recycled materials and materials suitable for recycling later. Supply from building material production facilities located in the immediate vicinity has been considered. Our priority is to support local production and use local building materials.

# 2.1 Definition of Innovation Campus

In the 21st century, innovation campuses are expected to have flexible spaces, technological opportunities, sustainable living spaces, sustainable environmental planning, and creative learning environments.Residential campuses promote strong social bonds, increase opportunities for peer-to-peer learning, and create a 24/7 campus experience.

Flexible Campus is based on the understanding and integration of environmental systems such as hydrology, habitat and topography, which interconnect the academic, residential, research, education, training function clusters with open, semi-open spaces.

Flexibility can enable different programming needs on a day-to-day basis (reorganization of classroom furniture and technology to support class activity), for special events during the semester (demonstrations, crits, and exams), or as part of campus-wide activities (student life forums, student organizations meetings) (Sheth, 2019).

Holistic and Sustainable Campus is inherently better connected to its environment, efficient in the use and replenishment of natural resources, comfortable to its occupants, and easy to maintain.

Buildings designed for change and adaptation enable refits instead of demolish-and-rebuilds. Over time, this approach significantly reduces costs, waste, and carbon footprint. Sustainable and flexible building design, combined with the thorough integration of optimized infrastructure systems and resilient landscape design, will help achieve greater levels of environmental stewardship, and are the keys to creating a zero net energy/carbon neutral campus (Sheth, 2019).

Technological Campus is benefitting from digital 5G-6G infrastructure system, cloud-based platforms, data visualization, of augmented and virtual reality (AR / VR) and wearables to create a virtual platform for teaching, learning, knowledge dissemination, operations, maintenance, and resource management.

“Learning by creating” is a revolutionary movement that creates great opportunities for universities to rethink models, new forms of multidisciplinary working.

# 2.2 From Agriculture 4.0 to Agriculture 5.0 and Smart Agriculture

## Agriculture 4.0

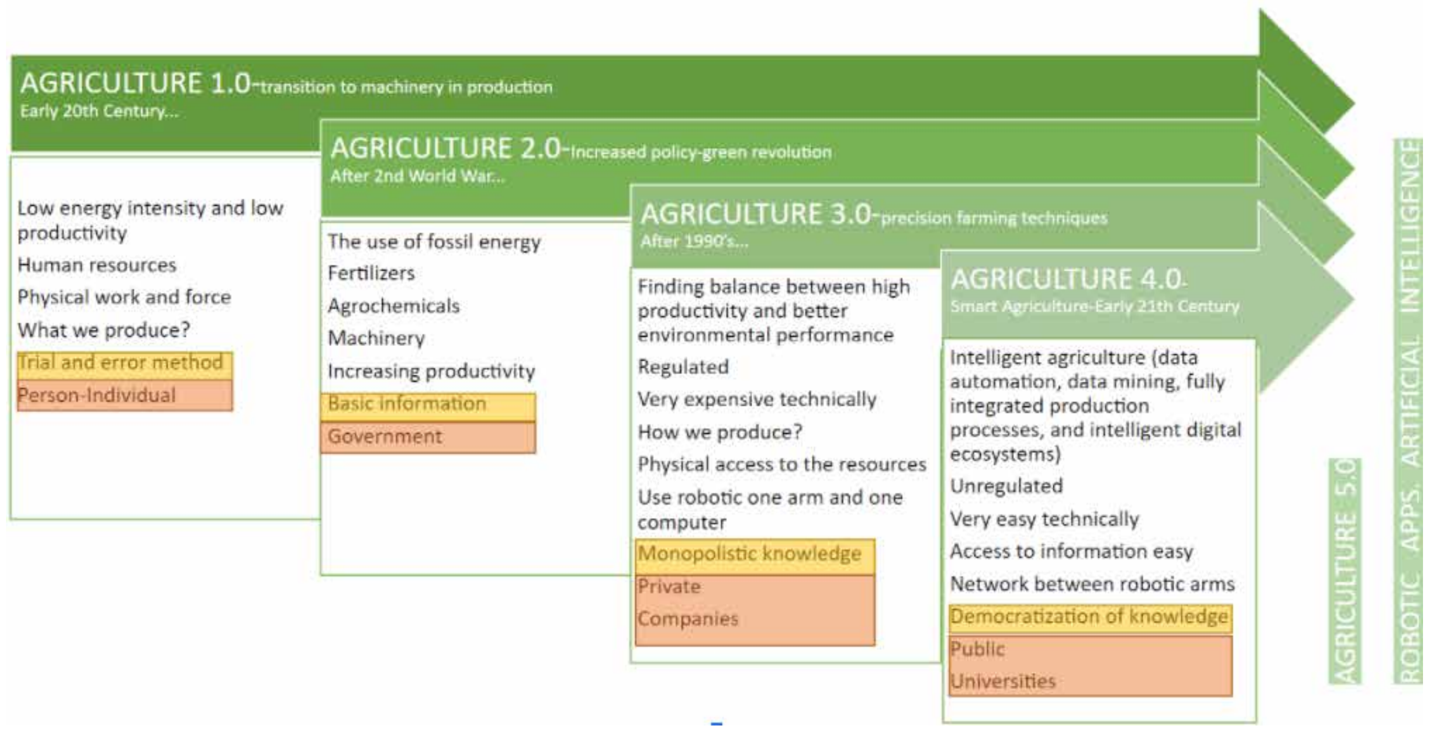



Figure 15. Agriculture innovations' bullet points from 1.0 to 4.0 (Rapela, 2019, #)



In Industry 4.0, technologies implemented in the agricultural sector have been a real success, and this novel idea has led to certain unimaginable improvements. Agriculture sustaining these changes and adapting according to Industry 4.0 technologies has given rise to the concept of Agriculture 4.0. Work was done in the context of designing, developing, and implementing technologies like artificial intelligence (AI), the Internet of Things (IoT), machine learning, deep learning, artificial neural networks, blockchain, big data, drones, robotics, and solar energy was termed Agricultural 4.0.

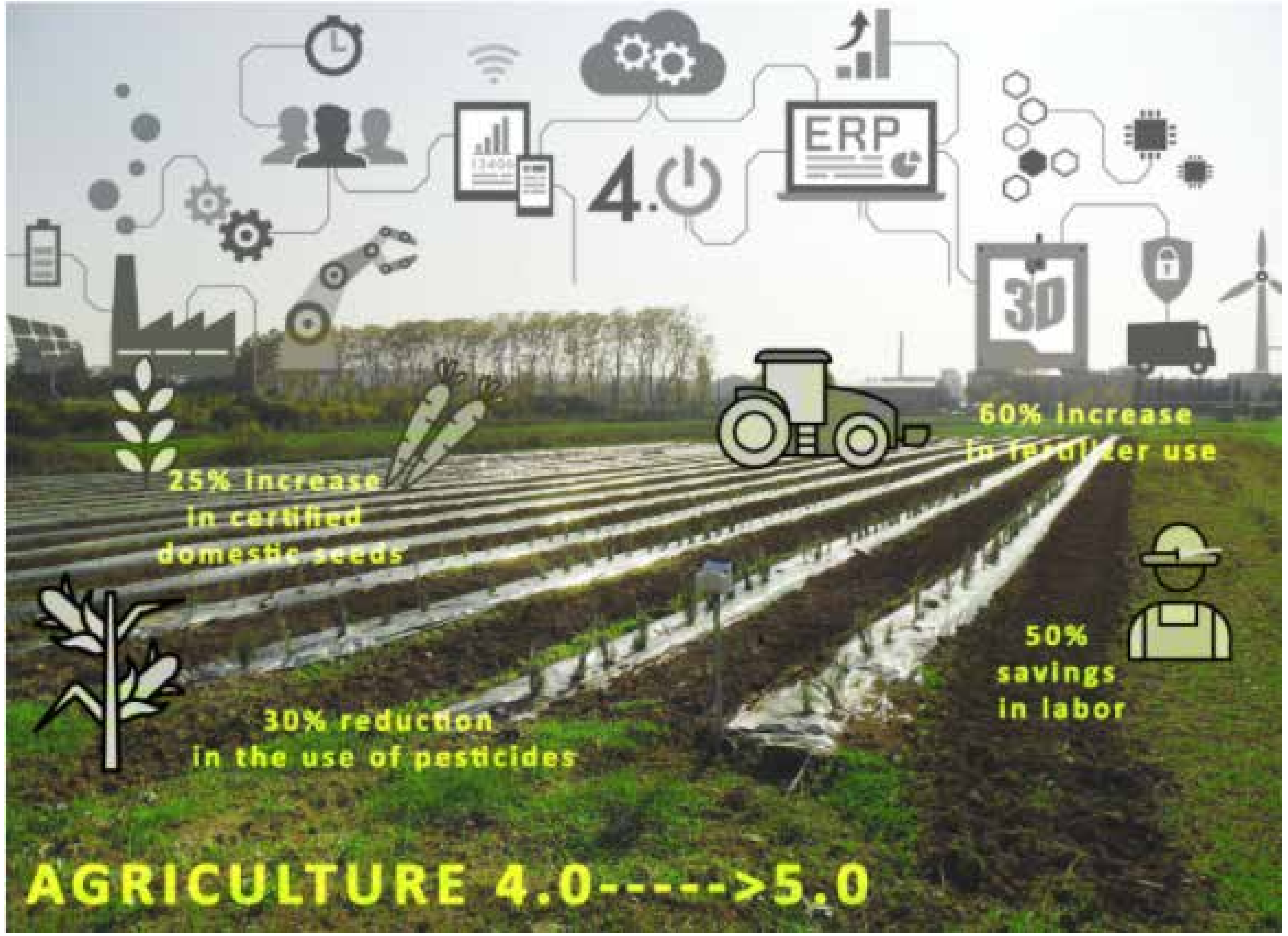



Figure 16. Objectives of passing agriculture from 4.0 to 5.0 (YouTube-'Akıllı Tarım Uygulamaları Ve Gebze Teknik Üniversitesi İşBirliği Protokolünü Gerçekleştiriyoruz', 2020)

## Smart Agriculture

Smart agriculture is defined as a set of technologies that have helped agriculture into the computerized information-based world and is designed to help producers get controlling over the management of agriculture operations (Ahmad & Nabi, 2021, 3).

Smart Agriculture has three main components;

Information:Information is necessary for parameters such as crop characteristics, soil properties the incidence of pests weather/ climatic conditions, plant growth response, harvest and postharvest handling, marketing and market intelligence, and socioeconomic conditions of farmers It can be used to create information-rich maps of the farms/villages/ regions (Mahdi & Ahmad, 2019, 20).

Technology: Emerging technologies work hand-in-hand with precision farming in order to keep farmers updated and to provide them with all of the associated benefits. The technologies have proven to increase production, productivity, and profitability to a compelling magnitude. (Mahdi & Ahmad, 2019, 20-21).

Management: Management combines information obtained with available technology into a comprehensive administration system. The user must possess sufficient knowledge to apply the aforementioned information and technology to be able to procure maximum benefits. The 5 R's are supported by precise and competitive management.

### Smart Agriculture Tools and Technologies

-Global Positioning System (GPS)

-Geographic Information System (GIS)

-Wireless Sensor Networks

-Agricultural Drones

-Robotics

-Satellites

-Irrigation System

-Softwares

-Yield Monitoring

-Online Platforms

-Remote Sensing



# 2.3 Bio-based Agriculture

Biotechnology offers technological solutions for many of the health and resource-based problems facing the world. The application of biotechnology to primary production, health and industry could result in an emerging "bioeconomy" where biotechnology contributes to a significant share of economic output. The bioeconomy in 2030 is likely to involve three elements: advanced knowledge of genes and complex cell processes, renewable biomass, and the integration of biotechnology applications across sectors (OECD, 2019, 19). Renewable biomass is related to bio-based agriculture (See Figure 17)

> "Greater use of renewable resources is no longer just an option, it is a necessity. We must drive the transition from a fossil-based to a bio-based society, with research and innovation"

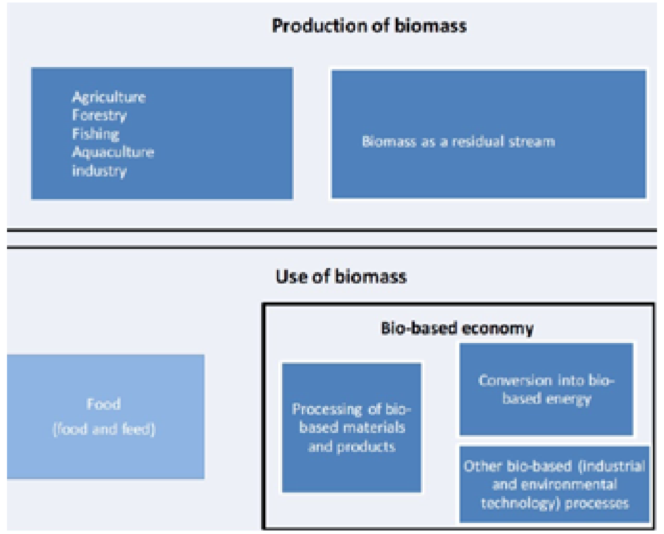



Figure 17. Relationship between renewable biomass and bioeconomy (OECD, 2019, 19)



## Definition Bio-Based Technology and Building Products

Bio-based economy uses renewable bio-resources, biological tools, eco-efficient processes that contribute to GHG emission reductions while improving the quality of the environment and standard of living (OECD-Organisation for Economic Co-operation and Development, 2001). The Triple Helix model combines local, university, society with the idea of bio-based agriculture (See Figure 18).

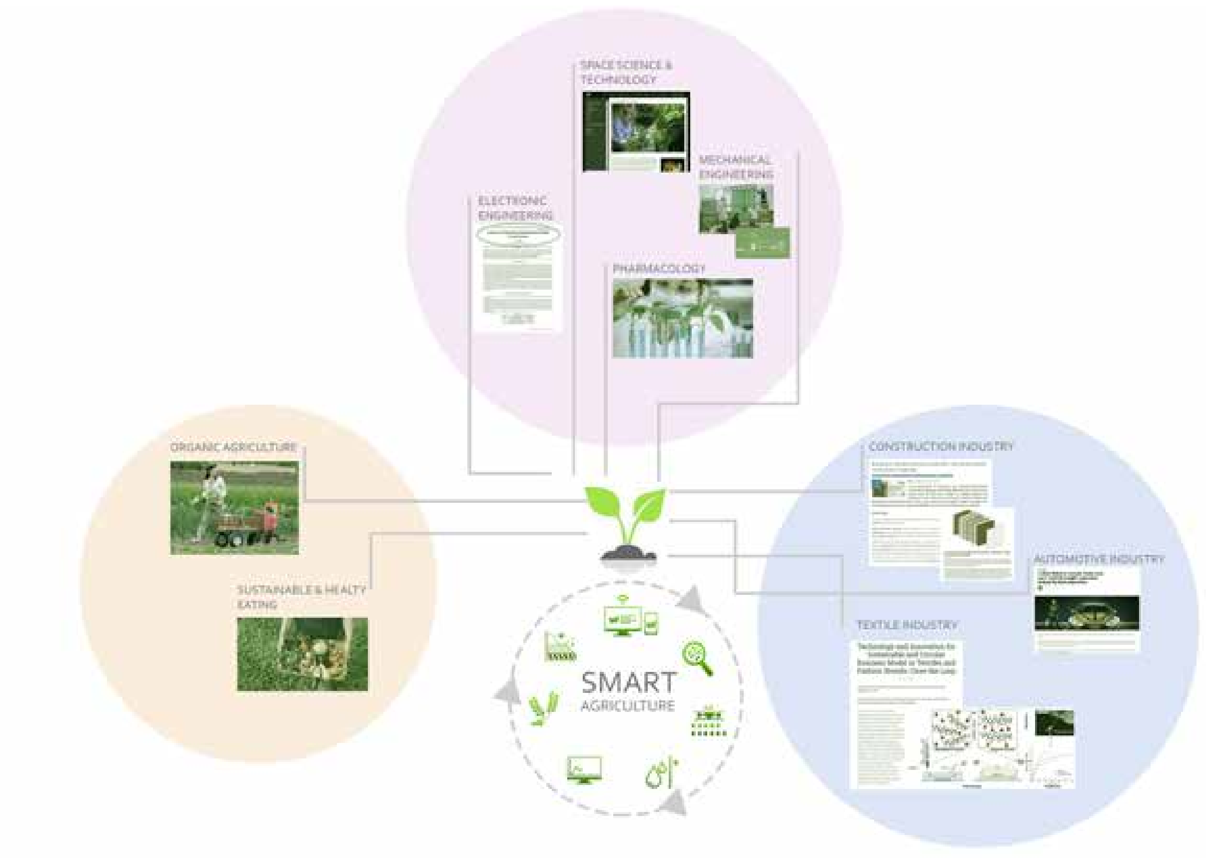



Figure 18. Concept of combining with Bio Based Technologies and Triple Helix Method

The Biobased Industries will optimize land use and food security through a sustainable, resource efficient and waste-free utilization of Europe's renewable raw materials for industrial processing into biobased products. Figure 19 shows bio-based industries and their relationships with each other.


**Figure 19.** Integrated bio-based value chains cycle

## Potential of Biobased Technology and Building Products

The nova-Institute's market report was commissioned by BIC. The new data for 2018 demonstrates that the bio-based industries made a contribution of 780 billion EUR, to the European economy, a notable increase of 30 billion EUR (+ 4%) compared to 2017. This represents a more than 20% increase compared to 2008. Figure 20 for the bio-based chemical industry (including plastics) alone reveal a turnover of around 54 billion EUR with the bio-based share relatively stable at around 15%, up from 7.5% in 2008.

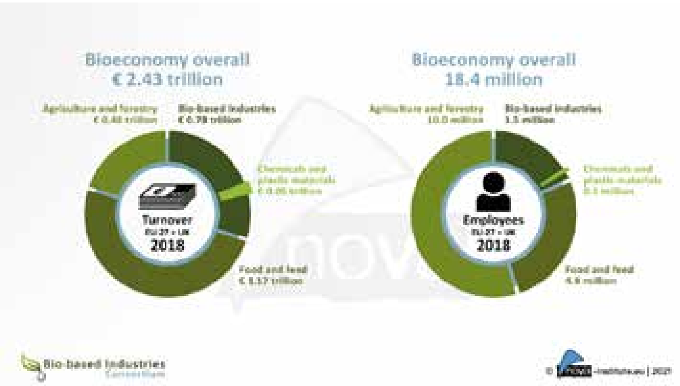



**Figure 20.** European 2017's Bioeconomy (Biobased Industries Consortium, 2021, 5)



## Biobased Technology in Turkey

In Turkey Vision 2023 Strategy Paper; statement, " Biotechnology identified as 21.century technology, not only limited to improving the quality of life of our people, but also gaining economic and technological superiority ", is located. According to a study including 48 countries by Scientific American; Turkey, in terms of generation capacity in biotechnology innovation, is 34th (first three rows are USA, Denmark and Sweden).

Biotechnological methods can be counted as plant tissue culture techniques, molecular breeding methods and genetic transformation methods in Turkey. There is still not a widespread use of agricultural biotechnology in Turkey. The first plant tissue culture laboratory was established in 1974 but has not been sufficient to meet demand (DPT, 2004).
Bio-based building materials made with plant aggregates have a lot of potential in the market for construction materials worldwide. The bio-based building materials that are made with plant aggregate, are able to effectively insulate a building. However, bio-based building materials exhibit low mechanical strengths.

## Gebze's Bio-Based Agriculture Potentials

At Gebze technical university, 20 kinds of farmers are working on ornamental and medicinal aromatic plants such as basil (reyhan) varieties, rosemary (biberiye), echinacea (ekinezya), English grass, arugula (roka), yellow rose (sarı gül), pepper and tomato (Gebze Technical University, 2021a). In addition, sunflowers were grown and harvested with smart agricultural practices (Gebze Technical University, 2021b).

## +3

## 21st Century Learning Environment

"Too much remote work creates its own set of problemsi such as diminished knowledge transfer, decreased engagement cultural disconnect, and a slew of new distractions" (Redman et al., 2014, 1-17)

# 3.1 Education Approaches in 21.Century

Digital learning environments expand students' reach far beyond the classroom and the campus, enabling them to make interdisciplinary connections that better prepare them for the workforce and for life. Campus-level moves are in constant dialogue with broader cultural and economic changes, creating exciting opportunities to transform how teaching, learning, and research take place (Sheth, 2019).

Intercultural and interpersonal skills will form the crux of the future workplace, and developing a pedagogical environment that encourages students to collaboratively address real-world challenges will be critical to being successful in this century. To address these shifts, universities are increasingly encouraging holistic and open-ended approaches to developing individuals, focused on the "four C's": critical thinking, communication, collaboration, and creativity. These elements are vital in forming students into lifelong learners who can adapt and engage in self-directed learning to continuously refresh their skills (Sheth, 2019).

Discussions about 21st century learning spaces come to the present with studies examining the concepts of human, place and technology. The intersections of these three concepts also lead to new concepts such as Connected Learning, Social Networking and Ambient Displays.

Today, these concepts are asked for innovation campuses, research, development, work, production and learning spaces. Campuses are changing their physical spaces in this direction. Essential questions should be asked for the transformation of innovation campus spaces.

How to use the space to best communicate the social rules and welcome newcomers?

How to make social networking easier for different personalities and working styles of individuals?

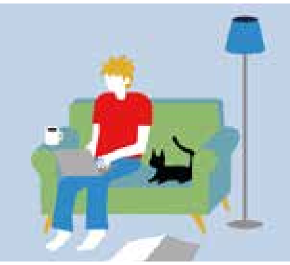
How to create a platform to share knowledge between coworking members?

How to turn knowledge available outside the coworking space?



# 3.2 Generation's Educational Needs and 21. Century New Learning Spaces

In practice, 21st century learning spaces are often combined with other workplace concepts and design ideas. The most important ones are described below (Meel, 2019, 15-18).



**Remote Working:** Remote working is about working from places other than the office. Concept builds upon the same idea of giving people more freedom to choose when and where to work.

**Smart innovative offices:** To an increasing extent, office buildings are equippedith various kinds of sensors that measure how the building is being used.

**Collaborative Spaces:** Offices are designed as attractive meeting spaces and located circulation routes as open spaces that increase people crossing paths.

**Healthy offices:** The central idea is that buildings should be designed in such a way that they have a positive impact on people's mental and physical well-being. Much of this relates to indoor climate: acoustics, daylight access, air quality and thermal comfort.

**Co-working:** Co-working is a membership-based office concept in which members—typically freelancers and small businesses—get access to workspaces, office facilities and services in return for a monthly fee.

**Agile working:** Flexibility of work processes can be explained as a highly interactive and iterative way of working, in which teams work in small 'sprints' with lots of feedback loops.

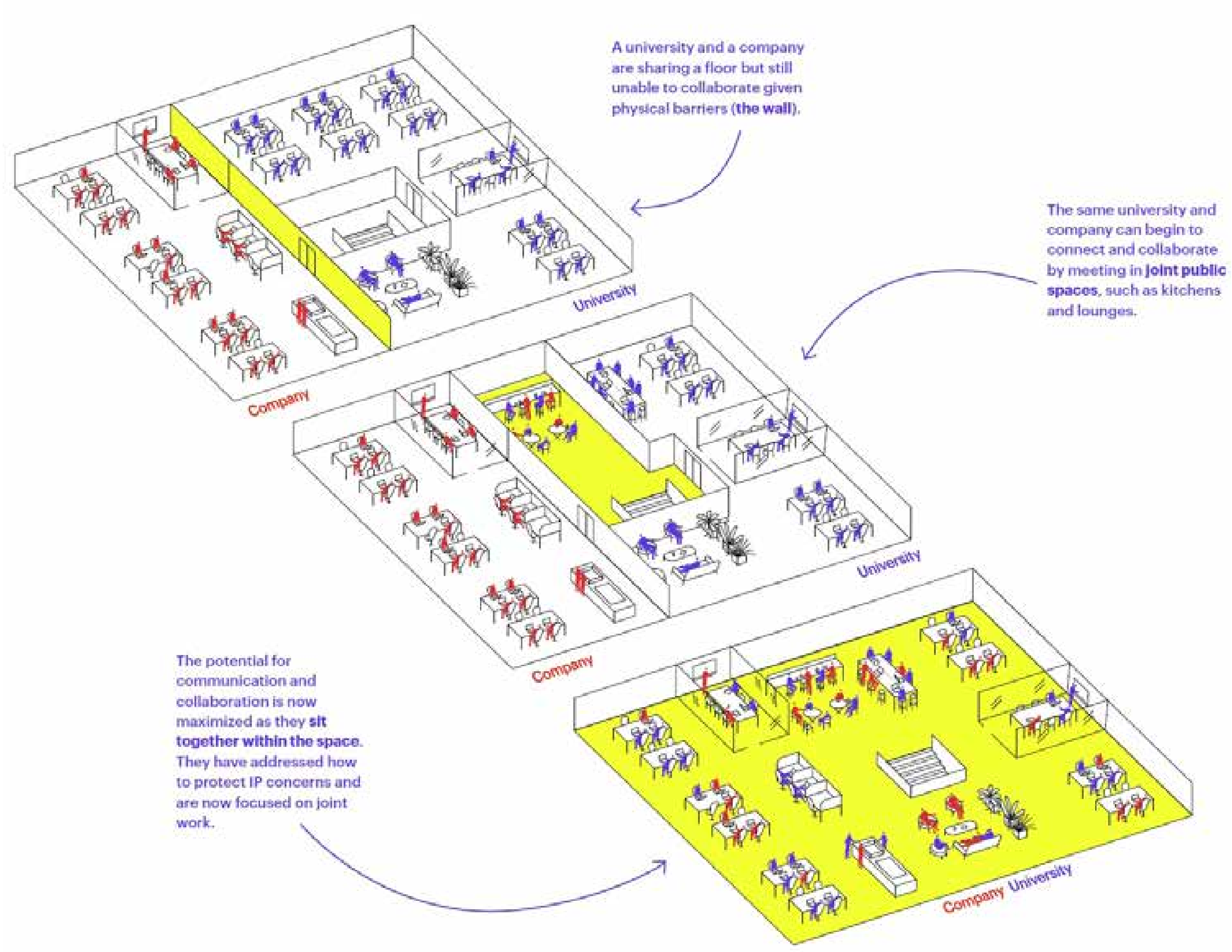



Figure 21. Diagram of processing transformation to collaboration spaces on plan level as horizontal (Wagner & Watch, 2017, 22)



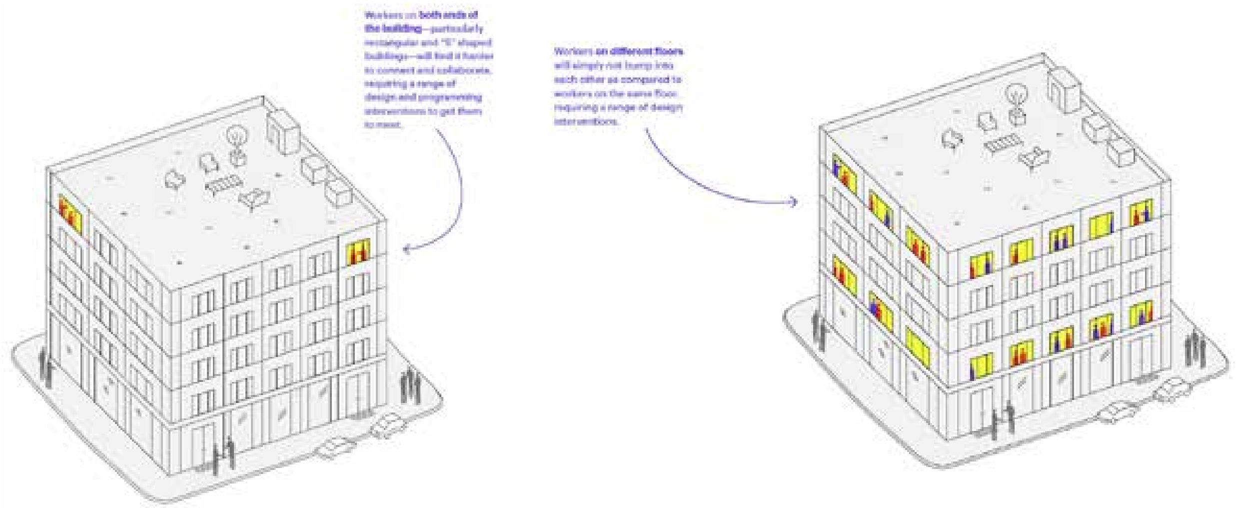


Figure 22. Diagram of processing transformation to collaboration spaces on floor level as vertical (Wagner & Watch, 2017, 30-31)

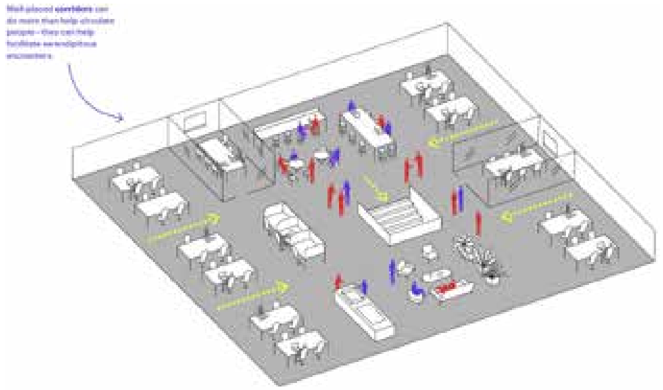


Figure 23. Diagram of corridors in collaboration spaces on floor level (Wagner & Watch, 2017, 33)

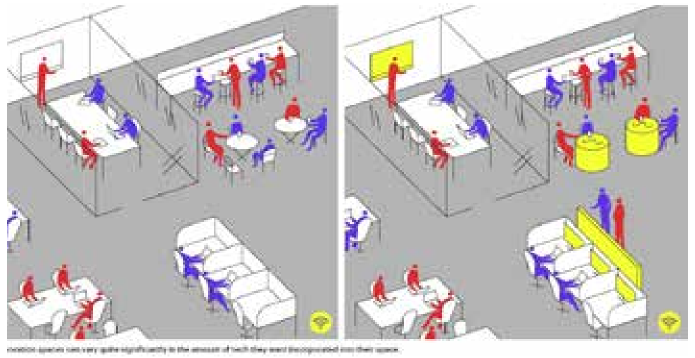


Figure 24. Diagram of varying teaching equipments in collaboration spaces (Wagner & Watch, 2017, 45)

## Activity Zones

It is also worth mentioning the concept of activity zones.  Activity zoning is about the clustering of activities with similar characteristics so as to avoid friction due to incompatible activities. It is desirable that the innovation institute offices together with the 21st learning spaces are combined with a single architectural program. However, these places should be separated according to different features such as social, interactive and quiet.

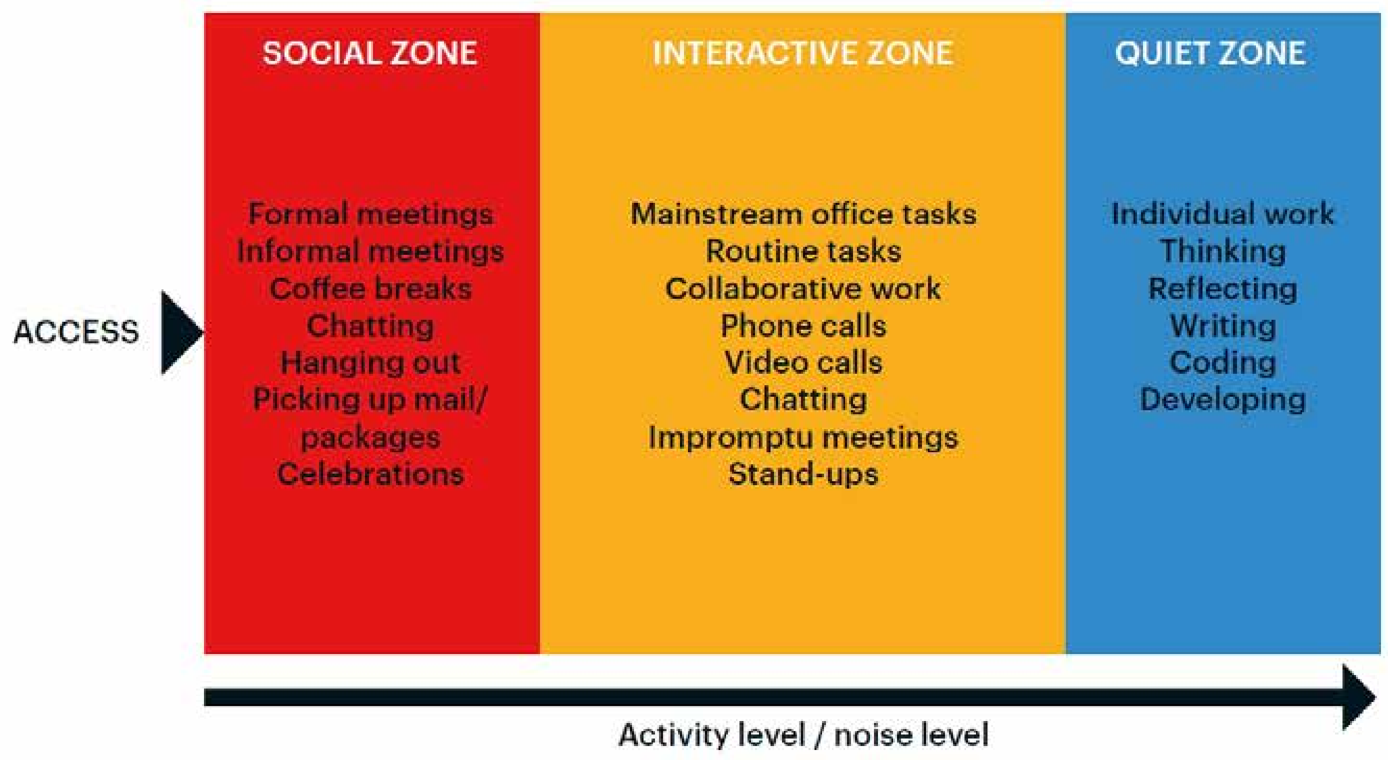



Figure 25. Activity zones types ( (Meel, 2019, 60)

# +4 Project Site Environment Analysis

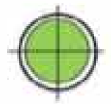
The current analysis of the project campus area, borders, transportation, city-university distance, green space, flora and fauna, the function of the existing campus structures have been examined.

Accordingly, the borders of Gebze Technical University are very close to the organized industrial zone, silicon valley, district center and the coast. In addition, the transportation network is very dense both by road and train. The maritime transportation point is close to GTU, but at a developable distance.

# University Campus

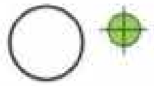
## Campus and City relationships

### Equals



City is the same as the campus. it includes those areas that were newly built as towns or cities. They were built and planned from scratch to accommodate clusters of technology. They are located only in Asia.

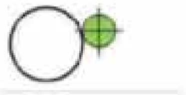
### Disjoints



City shares nothing with the campus. it includes those areas located outside the city limits but not distinguihed as independent cities.


Kansai Science City

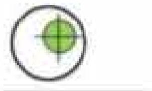
### Touches



City touches the campus. It includes those areas bordering on the city. In most cases they and the city are tnagent. TOuches and the city are usually tangent, but in some cases they are separated by a river, highway or some other feature.


Drienerlo Campus University of Twente & The Innovation Campus Kennispark Twente

### Contains



City contains the campus. it includes those areas that are inside the urban fabric, but they are perceived of as distinct campus with borders such as roads, fences, water front or natural features.


Brandenburg Technical University Campus

### Overlaps

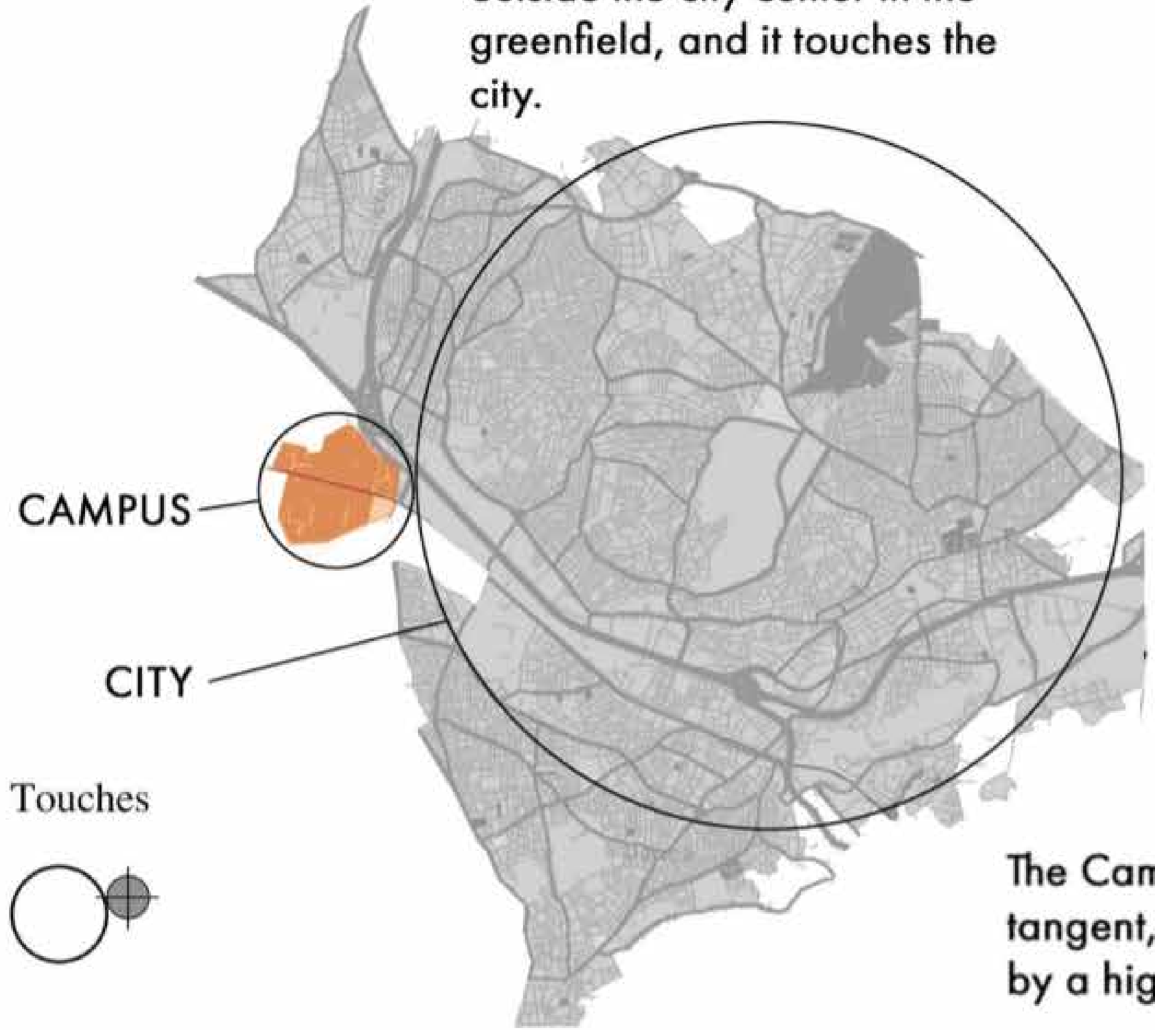
City and campuses have multiple points in common, it includes those areas integrated into the urban fabric and in many cases the boundaries between the sites and the rest of the city aren't clearly defined or perceived.


TU Delft District & Technopolis and Innovation Campus Delft

## University Campus

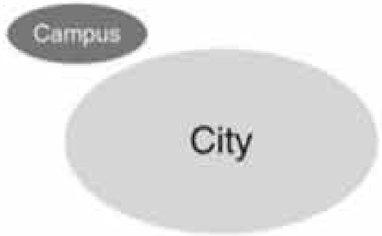
### GTU and City's relation

The Campus is situated outside the city center in the greenfield, and it touches the city.





The Campus and the City are tangent, and also separated by a highway.




Greenfield, outside the city

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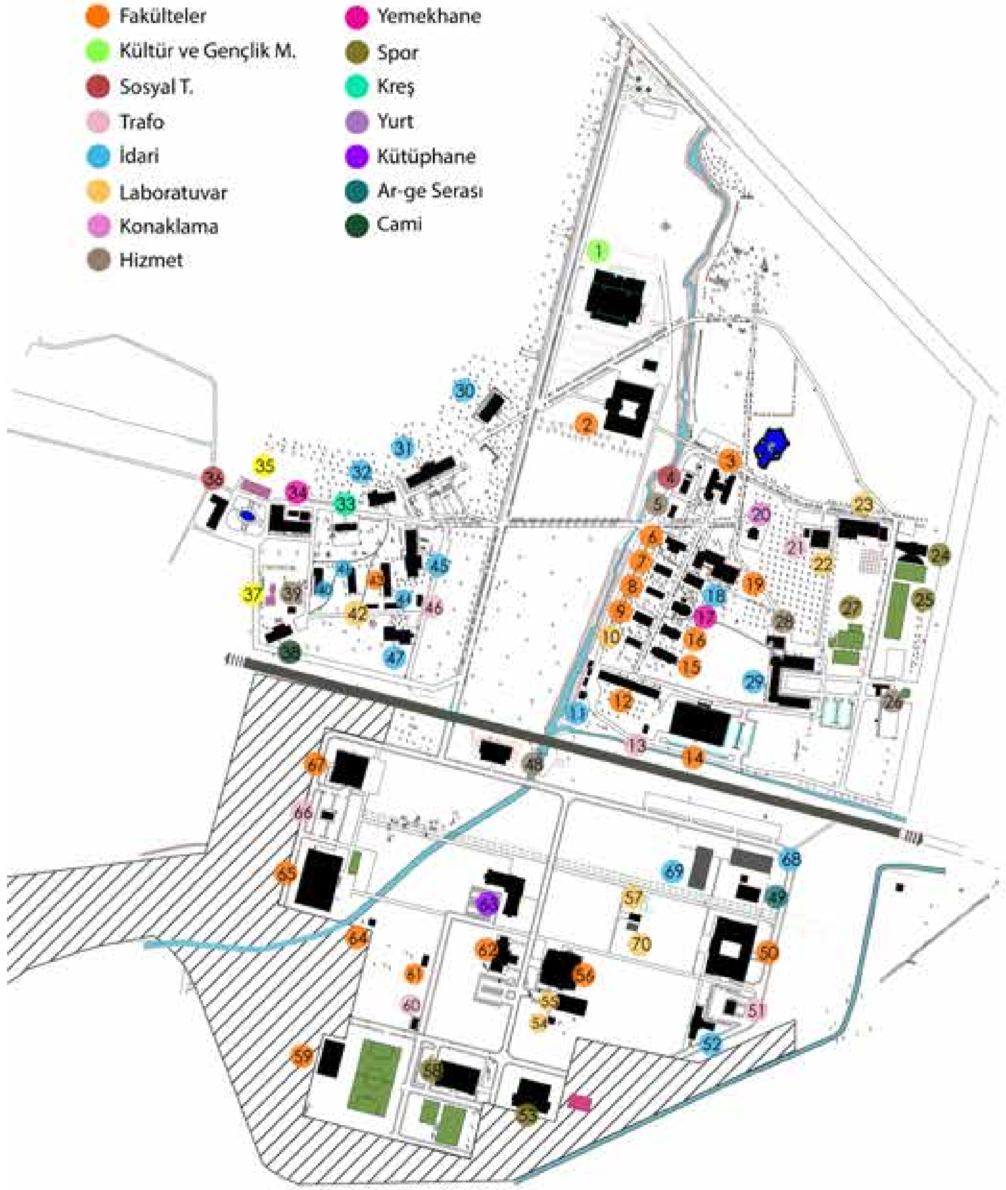
ARCHITECTURE NON-THESIS MASTER'S PROGRAM (MTZ) • ARCHITECTURAL DESIGN I • MTZ501E

# GTU

## Campus Plan




1 Kültür M.
2 Mühendislik Dek. -Malzeme Müh.
3 Yabancı D.Bölümü
4 Kafeterya
5 Kırtasiye
6 Şehircilik B.P.Bölümü
7 Mimarlık Fak. Derslik
8 Mimarlık Ek Bina
9 Fizik Bölümü
10 Cad-cam Lab.
11 Ulaşım Koordi.
12 Ek Dershaneler Binası
13 Trafo
14 İşletme Fak.
15 Harita Müh. Bölümü
16 Fizik Bölümü
17 Öğrenci Yemekhanesi
18 Fizik Öğr. Üyeleri Ofisi
19 Mimarlık Bölüm Binası
20 Rektörlük Konutu

21 Trafo
22 Nano Teknoloji
23 Fizik Lab.
24 GTU Spor Kompleksi
25 Halı Saha ve Kort
26 Ana Giriş&Güvenlik
27 Kort ve Sahalar
28 Isı Merkezi
29
30 4.Enstitü Binası
31 Rektörlük İdari Bina
32 Yapı İşleri Başk.
33 Kreş
34 Personel Yemekhanesi
35 Tohum Sertifikasyon Test M.
36 Misafirhane
37 Tohum Sertifikasyon Test M.
38 Cami
39 Şadırvan
40 Enerji Sis.Enstitüsü

41 Savunma Tek. Enstitüsü
42 Fizik Lab.
43 Yabancı D. Ek Derslik
44 TTO Ek Bina
45 Öğrenci İşleri Binası
46 Trafo
47 Teknoloji Transfer Ofisi
48 Su Deposu
49 Sera
50 Temel B. Fakültesi
51 Trafo
52 Yer ve Deniz Bil. Enst.
53 Kapalı Yüzme Havuzu
54 Dikey Tarım Lab.
55 GTÜ-MAR
56 Moleküler biyoloji ve Genetik bölümü
57 Sumer
58 Kapalı Spor Salonu
59 Elektronik Müh.
60 Trafo

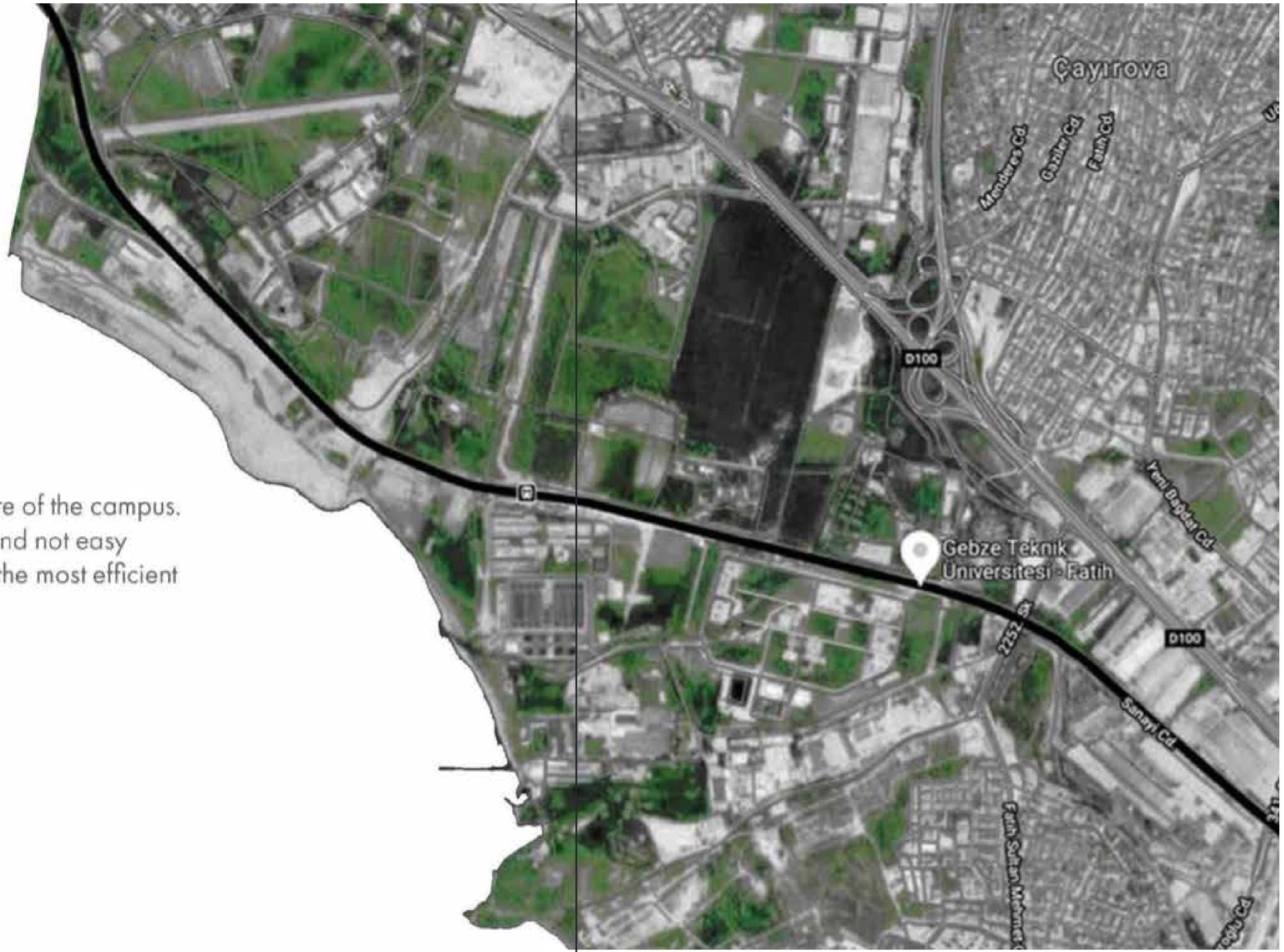
61 İnş. Müh. Atölye
62 Kimya Müh.
63 Kütüphane
64 Bisiklet Atölyesi
65 Elektronik Müh.
66 Trafo
67 Bilgisayar Müh.
68 Enstitü Binaları
69 Enstitü Binaları
70 Sumer Ek Bina
71 Yurt
72 Yurt
73 Yurt
74 Yurt
75
76
77
78
79 Enstitü Binaları
80 GTU Merkezi Derslik

81 GTU Merkezi Derslik
82
83 GTU GençlikMerkezi
84 Havacılık ve Uzay Bil. Fak.
85
86
87
88 Merkezi Lab. Binası

Mevcut Binalar
Tohum Sertifikasyon Test Müd.
Spor Sahaları
Yapılmakta Olan Binalar
Planlanan Binalar

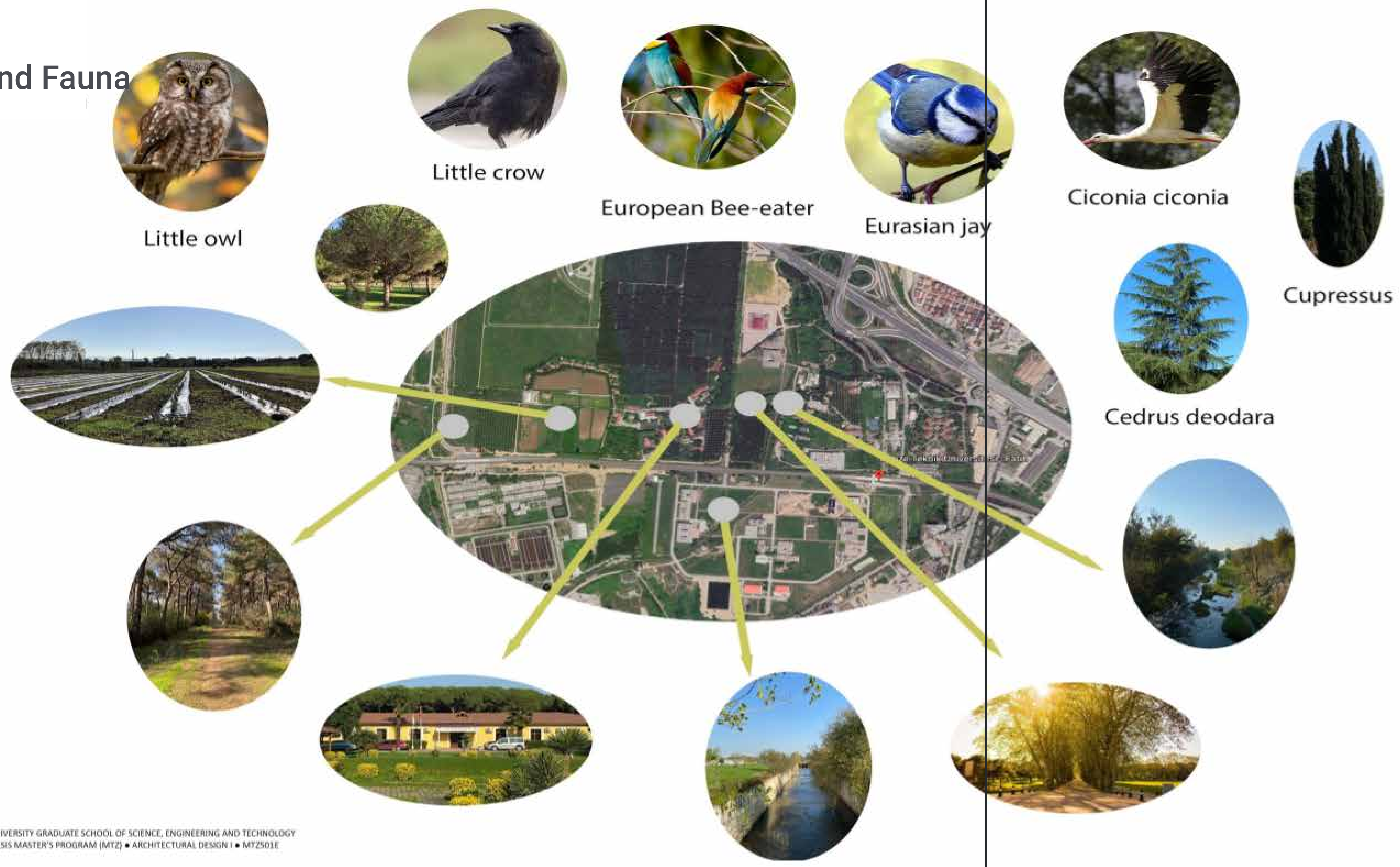
## GTU
### Green texture

There is non-continuity in the green texture of the campus. Most of the green areas are undefined and not easy accessible, therefore they aren't used in the most efficient way.



## GTU

### Flora and Fauna

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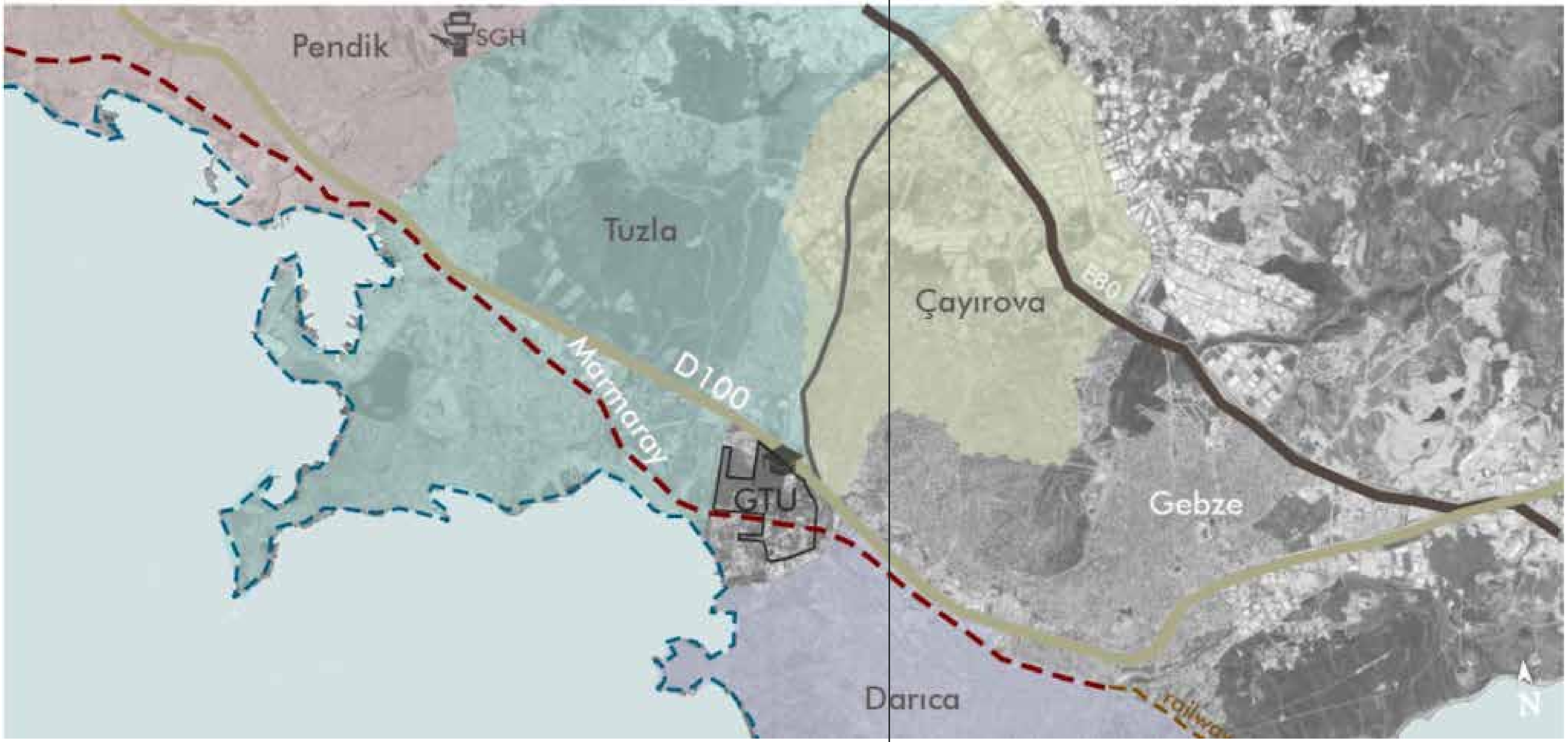
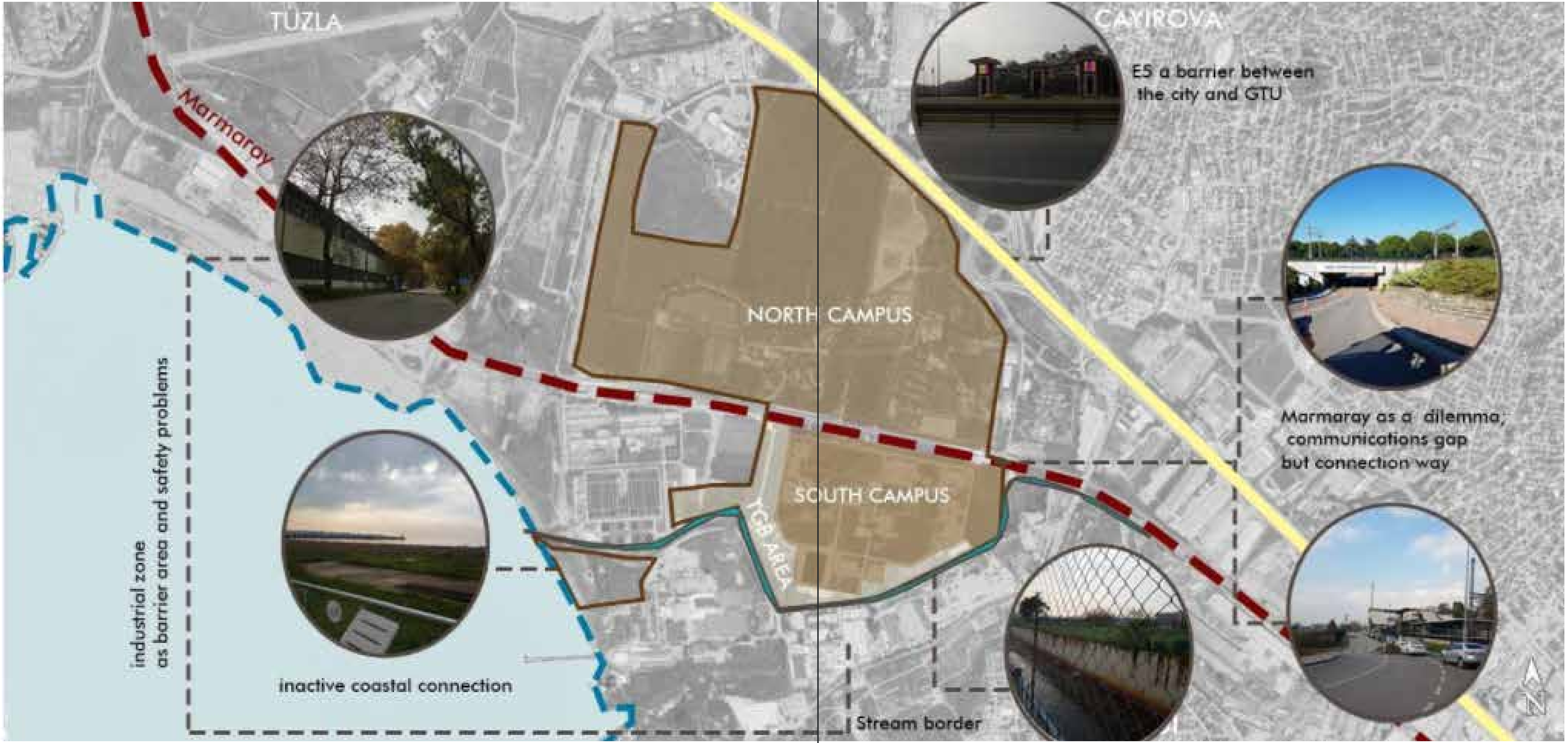
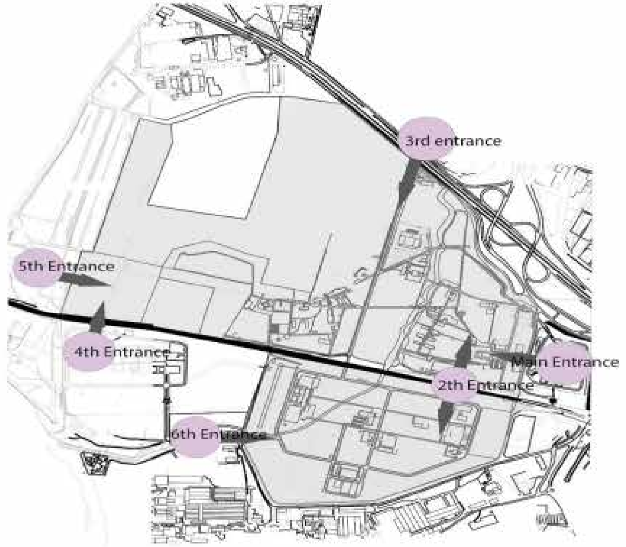
# 4.1 Drawing Campus Site Borders




TUZLA
CAYIROVA
Marmaray
E5 a barrier between
the city and GTU
NORTH CAMPUS
SOUTH CAMPUS
TGB AREA
Marmaray as a dilemma,
communications gap
but connection way
industrial zone
as barrier area and safety problems
inactive coastal connection
Stream border

## Entrances




**Main Entrance**
pedestrain and bicycle crossing.

**Second Entrance**
(Access to both North and South campus)
People who come with marmara train can use this entrances.

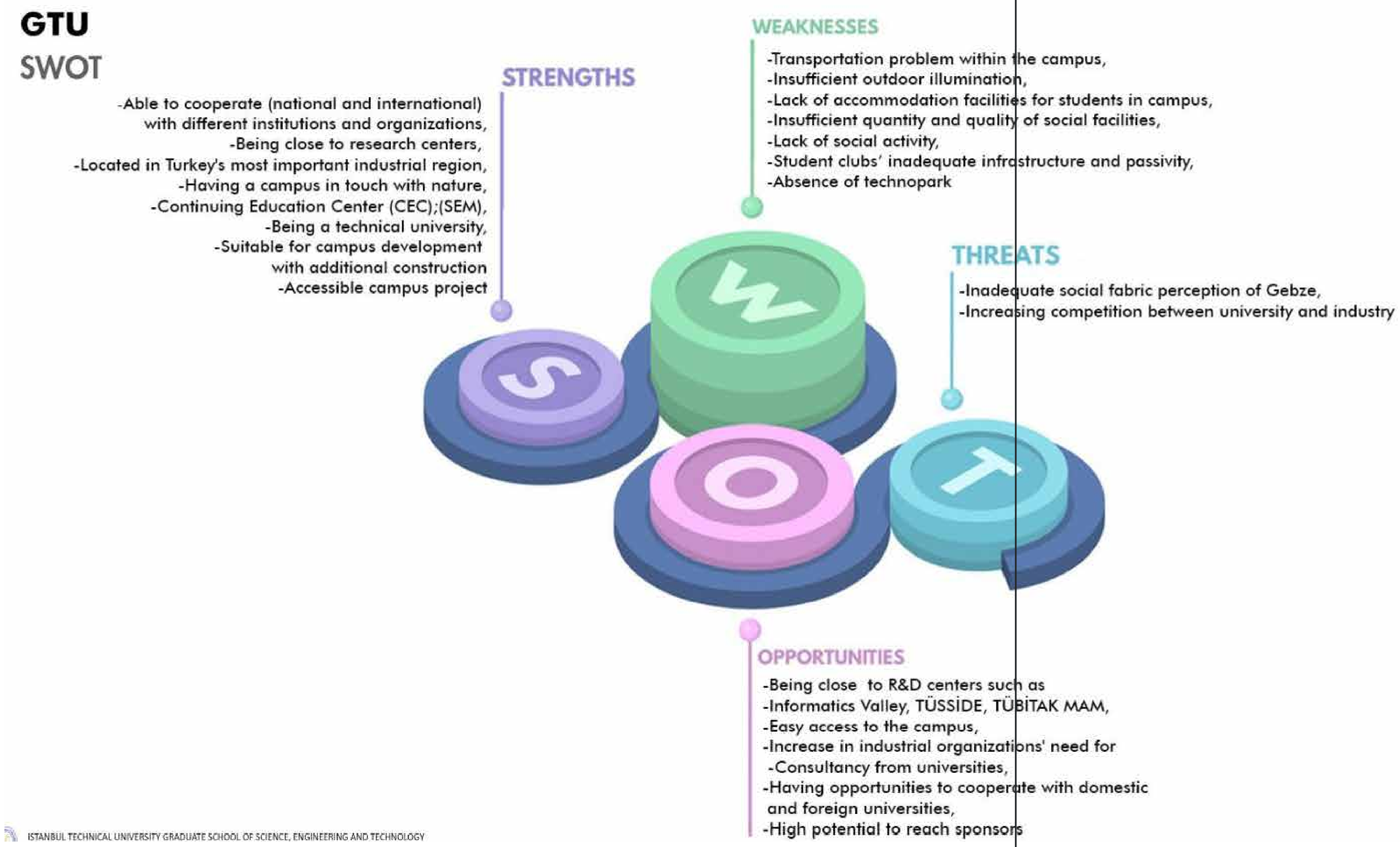
**Third Entrance**
Car access /people who come from gebze and Istanbul city

**Fourth Entrance**
Out of use

**Fifth Entrance**
Out of use

**Sixth Entrance**

# 4.2 SWOT Analysis and Results



# +5

## Project 1

GTU is a pioneer in industry, economy and agriculture. According to this the campus development has axes open to development in the north-south, east-west directions.GTU's close access to the shore is used for the development of Agricultural Tourism. Proposed axis benefit the revitalization of the south campus.

The innovative institute building has been developed within the framework of communication, cooperation and creativity in 21st century learning spaces. Based on Agriculture 5.0 that corresponds to the technological period of the industrial age different methods such as vertical agriculture and bio-based production are applied together with smart agriculture applications.

# 5.1 GTU Master Plan-Biobased Innovation Campus

## 5.1.1 General Approach to the Campus

### Problems and Solutions for GTU

**Problem:** Being closed to outside

**Solution:** Revealing the potentials of the university

**Problem:** Not being noticed due to being close to Istanbul

**Solution:** Highlighting campuses agricultural memory and making suggestions for innovative design based on the agricultural economy

**Problem:** Not emphasizing the agricultural background

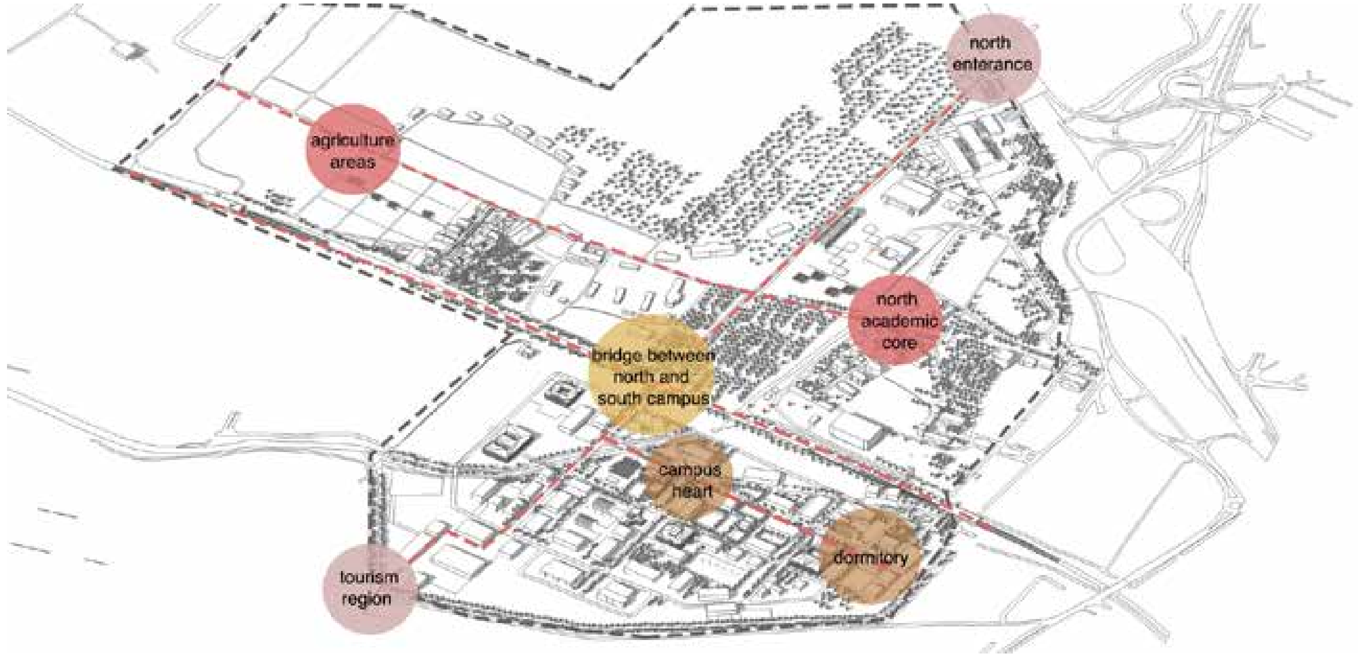
**Solution:** To offer the use of historical buildings by refunctioning

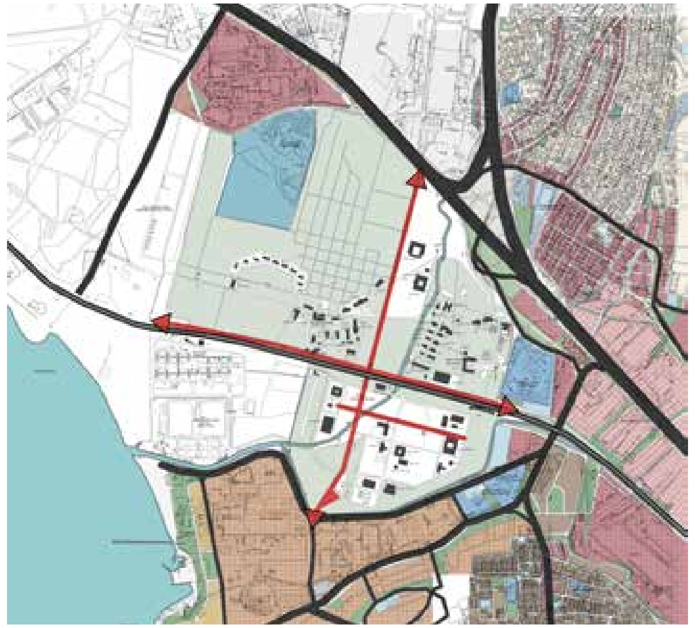
**Problem:** Not emphasizing the agricultural background

**Solution:** To offer the use of historical buildings by refunctioning



### Relationship with the Surrounding



The masterplan design revealed the short and long term potentials of the university. In the short term, it is aimed to strengthen the connection of the campus area with its historical past, while in the long term, it is aimed to revive the agricultural tourism of the campus, which is a bridge between the coast and the city. In the environmental plan, there are implementation decisions for the use of the coastline for tourism in the long term.

The Marmaray line has been decided as the main axis, which will strengthen the transportation network for agricultural tourism, and the northern protocol road line will strengthen the connection between the city and the coast. Secondary axis is one axis that will revitalize the innovation center in the north and another axis that will enliven the dormitories and student centers in the south.

Rather than designing a new campus area, the design concept aims to renew the existing campus plan, improve the current situation, and increase the variety of use of the spaces by giving them new functions. Campus renewal is designed to consider the use of resources from environmental, regulatory, operational, economic, historical and cultural perspectives that support the mission of learning, research and outreach. The following topics are focused on;

Learning-oriented approach; The design was carried out so that 21st century learning spaces are critical thinking, communication, collaboration, and creativity spaces.

Research-oriented approach; With the aim of gaining experience within the scope of innovation and agriculture 5.0 concepts, it is thought to design greenhouses and traditional agricultural areas as places where applications are made.

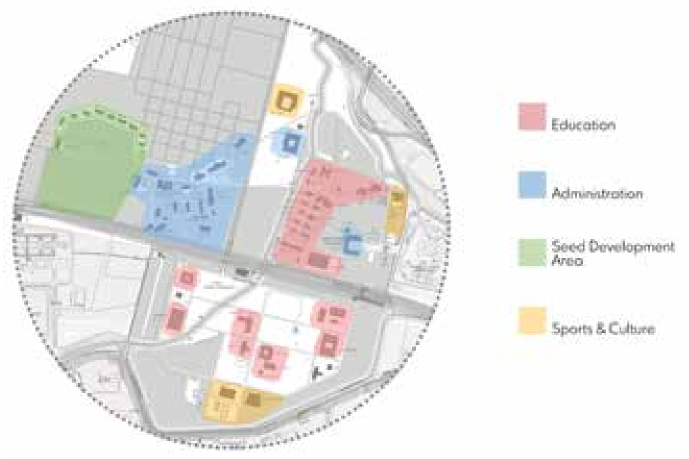
Social life-oriented approach; It is in a way that allows easy access between the student's accommodation (night life) and open spaces (day life). Common use areas that will enable the student to use open space have been proposed.

Environmental oriented approach; Paying attention to the sustainability issue, importance was given to the orientation of the space and the use of shading elements in order to use the sun and wind potential. In addition, the number of rainy days in a year has been suggested to be suitable for the storage of rainwater.

Historical and cultural oriented approach; Çayırova Horticultural School buildings and the height relationship they establish with their surroundings, and the similar design attitude are aimed to be captured in the innovation center and new buildings. A design was made using local materials, lost in nature.

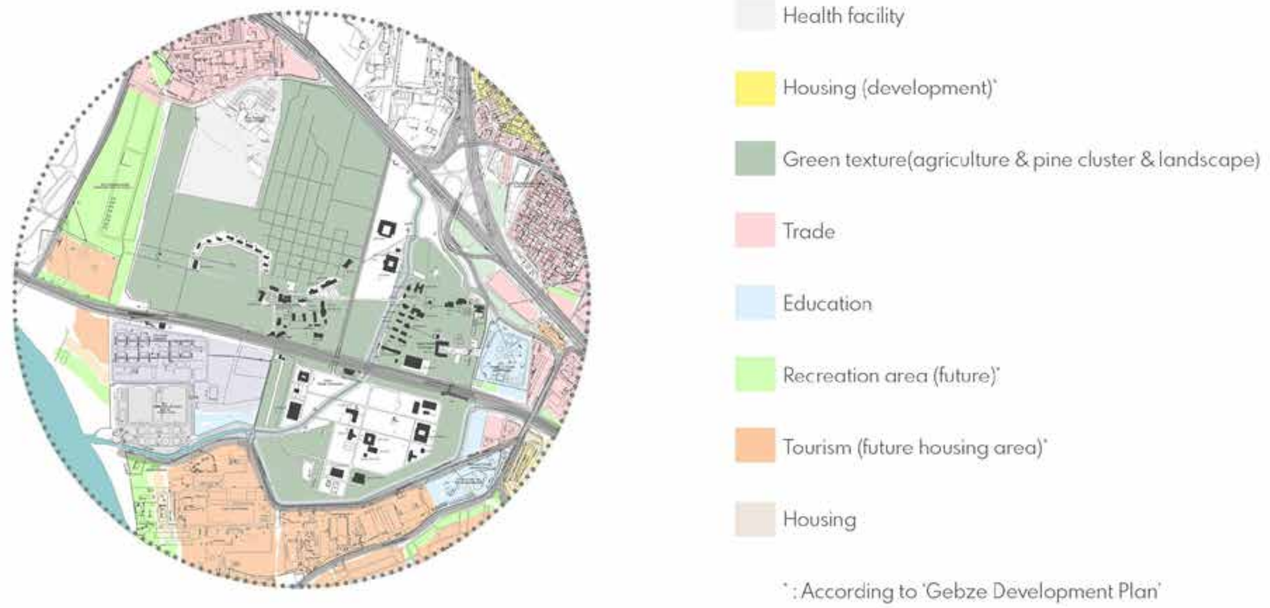
Economical oriented approach; It has been proposed to contribute to food production in the near region by increasing agricultural areas. It is planned to transform the organic wastes generated after the agricultural harvest into new building materials in the agricultural innovation center within the scope of bio-based research topics. This contributes to the circular economy.

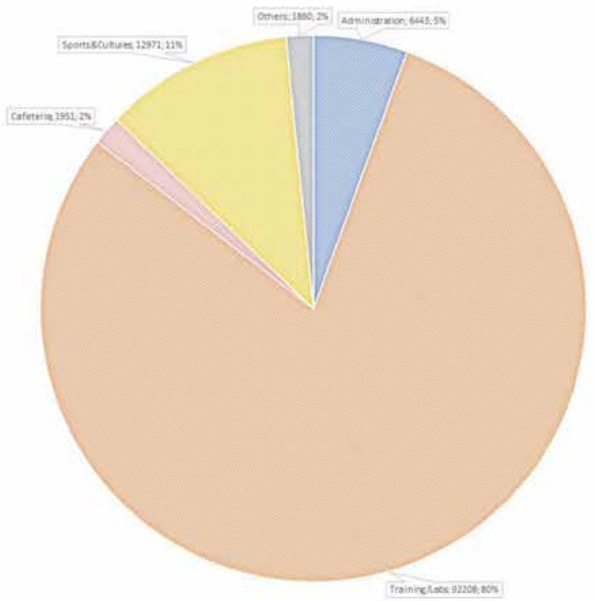
Business-oriented approach; The main axes dividing the campus land in the middle were not seen as a negative design data. On the contrary, these main axes have been beneficial in recommending transportation, food and beverage, social life, accommodation and academic units on and off campus. Secondary axles, on the other hand, support the operation program related to the main axles.



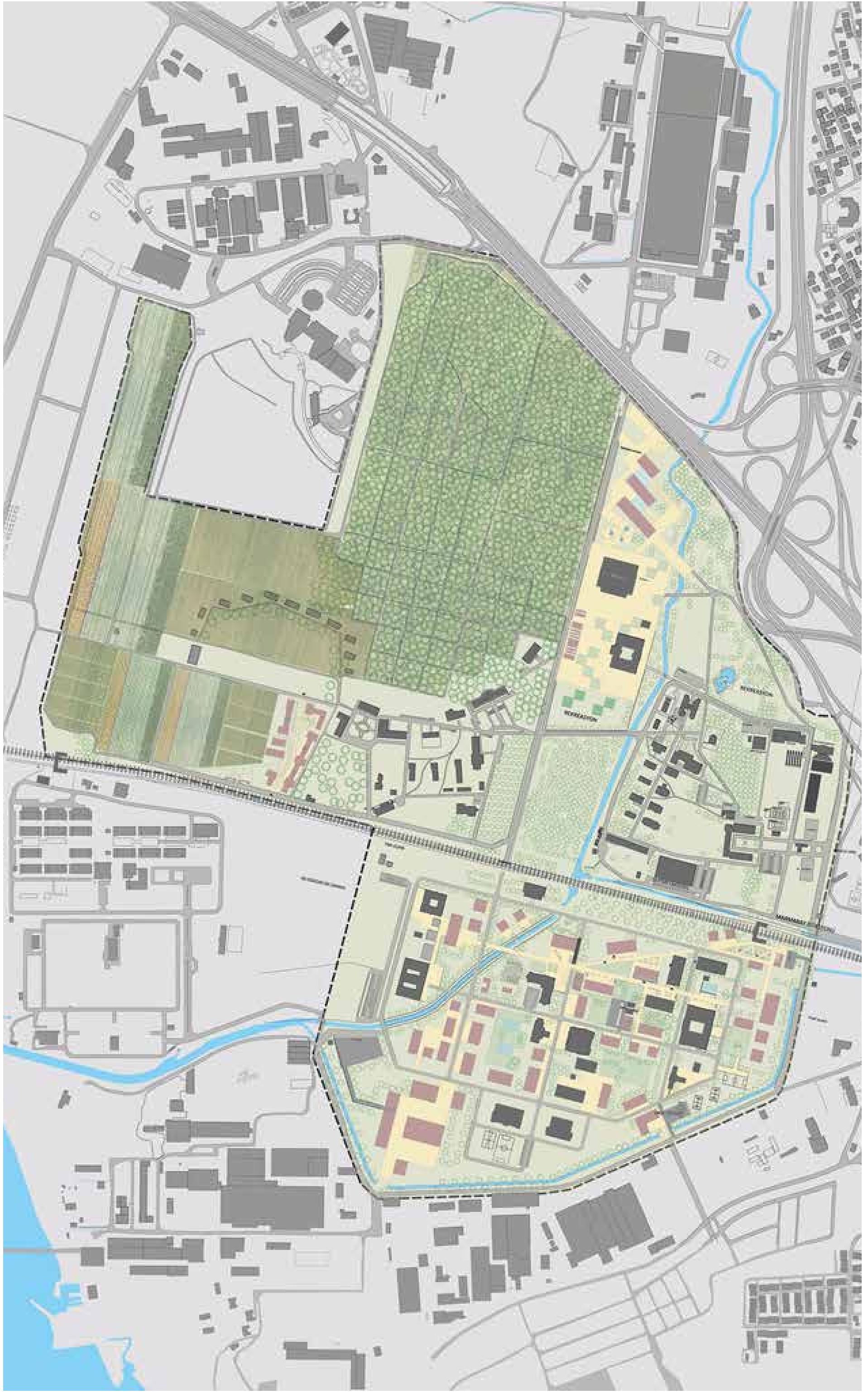



## Campus Area




The entrance to the north campus consists of wooded and even forested areas at a height of approximately 20 meters from the establishment of Çayırova Horticultural School to the present day in the northwest direction. For this reason, the north campus has a greener and more natural environment than the south campus.



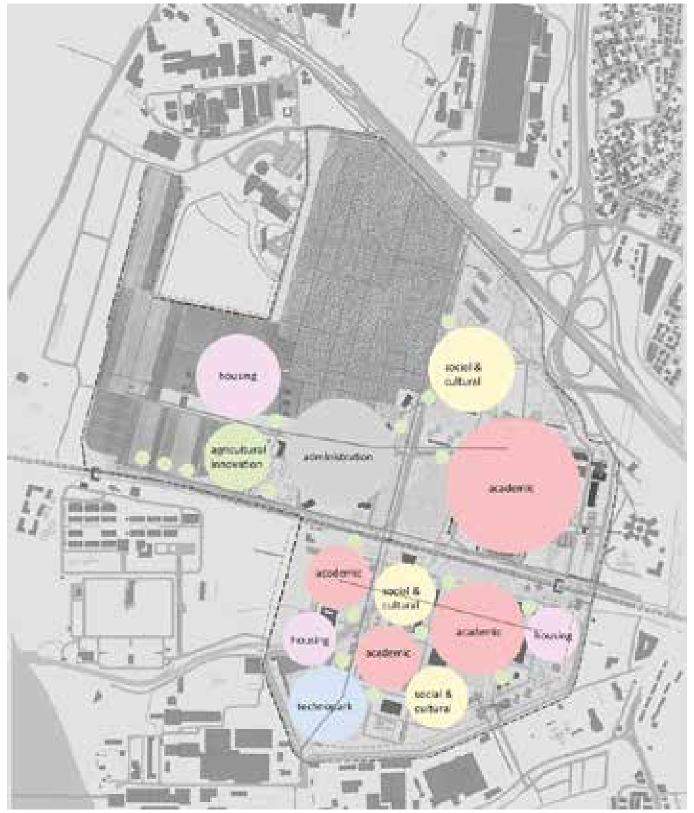
## Campus Master Plan

In order to establish open innovation, it is necessary to have a campus architecture, establish smart and healthy cities, and establish regional innovation systems. Gebze Technical University is an important campus in terms of being close to the informatics valley, signing an agreement with the Ministry of Agriculture regarding innovations in the field of agriculture, and the campus being suitable for agricultural production and research.

Considering the strengths of the campus, it is a suitable area for the design of the Agricultural Innovation Center that the campus has an agricultural-based history, strong vegetation, landscape, sufficient wetland and streams. The innovation priority subject to agriculture has reached the level of 5.0 in the world. Accordingly, the aim of Innovation 5.0 is to create knowledge-based economies in cooperation with the public and universities and to carry out sustainable production, research and development studies.

The campus masterplan has been planned in a way to contribute to GTU development. In the coming years, the campus will have a dynamic transition axis that is worth seeing with the development of coastal areas and port transportation in agricultural tourism along with agricultural innovation. Accordingly, it is thought that the development of agricultural innovation will develop according to bio-based products. The agricultural innovation center was designed as a bio-based product research center.






## Functions and Zones

-Agritourism Zone (Experimentation/ demonstration farm)

-Future Agriculture Development Zone

-Energy Production Zone

-Waste Management Zone (5R-Refuse-Reduce-Reuse-Repurpose-Recycle

-Housing Zone (Single, Couple, Rent room, Free room, Academic lojman)

-Agri Park Zone

-Bio based industry Zone

-Technology Development Zone

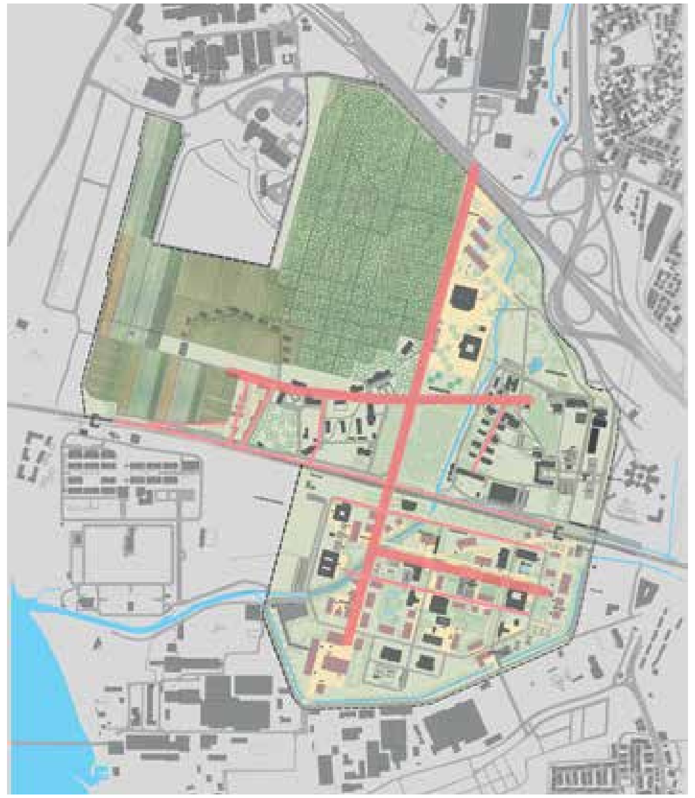
-Sports Zone

-Academic Zone

-Forest Zone

-Community Gardening Zone

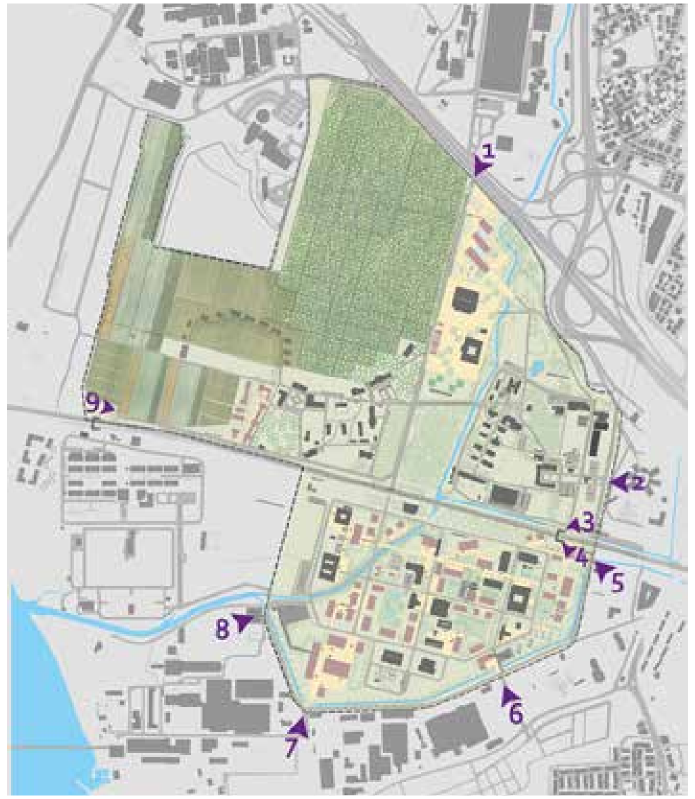
-Hobby Gardening



## Axes

As the campus highway, the main axis in the north-south direction is the axis of the campus that has been used since the historical settlement decisions. The main axis in the east-west direction is the main axis accepted because the Marmaray line separates the campus.

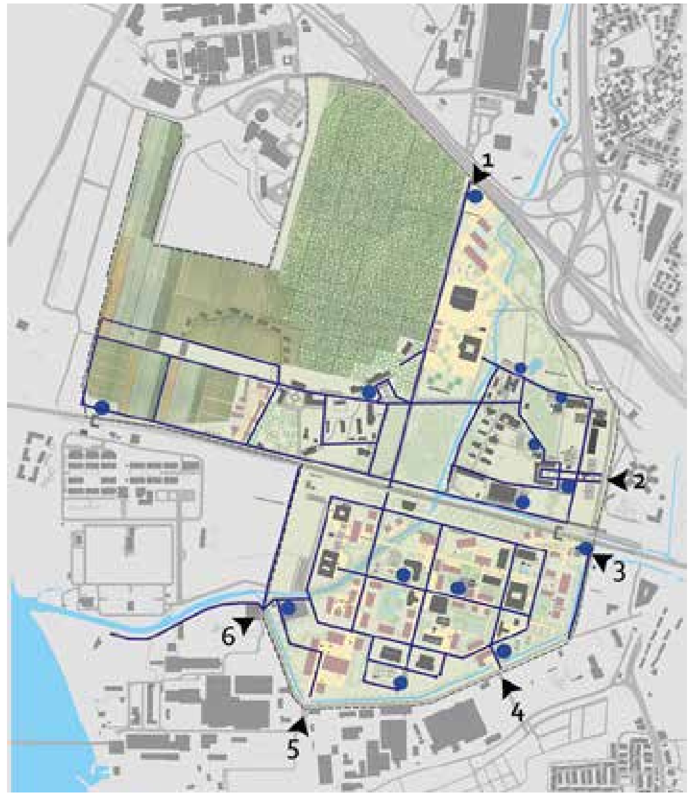
Our suggestion is to identify secondary east-west axes within the north campus and south campus that will distribute the transportation and function density from these main axes.




## Entrances for Pedestrians

9 controlled entrances are recommended; existing protocol road+north axis entrance, existing main gate and student entrance, the entrance from Fatih Marmaray Station where passengers can disperse to the north and south, entrance from the currently unused road connecting to Fatih station from the south campus, new entrance for sports facilities, new technopark entrance, existing coastal access road entrance, the entrance of Çayırova Marmaray stop, which opens towards the north.






## Entrances for Motor Vehicles

There are 6 entrances for motor vehicles. Blue circles are car parking spots.

Entrances and car park points have been determined for motor vehicles to enter the campus in case of emergencies and protocol visits. However, in other cases, the entry of motor vehicles into the campus area is not considered appropriate for pedestrian-oriented, wellness and healthy campus planning.

## Bicyle Road and Parking Area

Our main goal is to offer a clean, noise-free area without vehicles entering the campus. Therefore, motor vehicle and bicycle rental and delivery points have been proposed. Electricity of motor vehicles will contribute to the reduction of CO2 emissions.

It is suggested that bicycle paths should be in such a way that all roads of the campus such as soil, asphalt and forest areas can be reached.

21.century sustainable campus is a place where environmentally friendly innovation practices and education combine with creativity, co-working, collaboration, critical thinking, and communication.

## 5.1.2 Campus Program

### Agricultural Campus Deparments program

Agribusiness

Agricultural Communication

Agricultural Engineering

Agricultural Systems Management

Biochemistry

Biological Engineering

Crop Science

Environmental-Natural Resources Engineering

Sustainable Food Science

Sustainable Farm Management

Plant Genetics, Biotechnology

Products Sales and Marketing

Soil and Water Sciences

Rainwater Storing-Harvesting Area

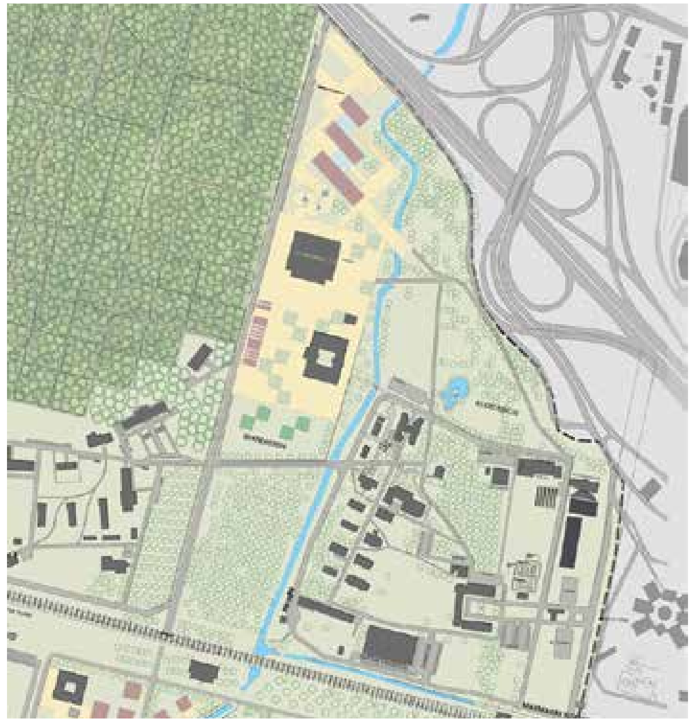
Compost Production/Food Fertilizer

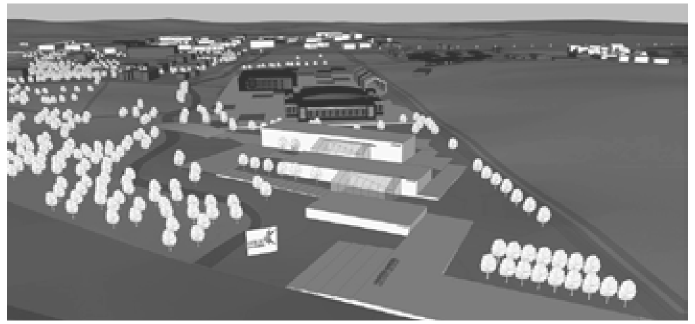
Seed Control and Production System

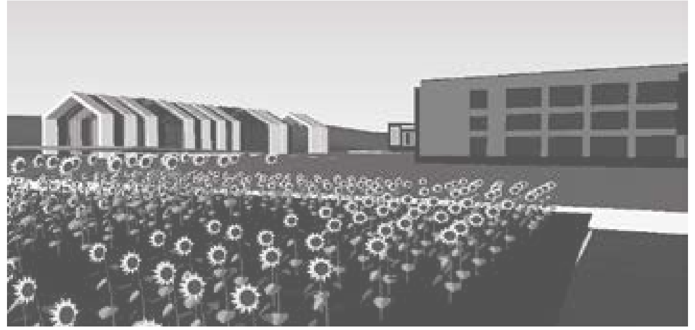
## North Campus

North campus is part of historical buildings and forest area. North campus entrance is named as protocol road. Since it is close to the administration buildings, transportation and service are made from this axis. Since it is possible to enter from the intercity highway, it is a point that the people of Gebze can easily reach.For the people of Gebze, agricultural training, agricultural technologies and tools fair, cafes can be held in the buildings proposed in this area.

The climate of Gebze is suitable for holding outdoor workshops. The north campus is a forested area for healthy living activities such as walking, jogging and cycling on the right and left parts of the protocol road. Trees up to 20 meters high contribute to the visual and auditory comfort of the Gebze Technical University area, as well as to the air quality.







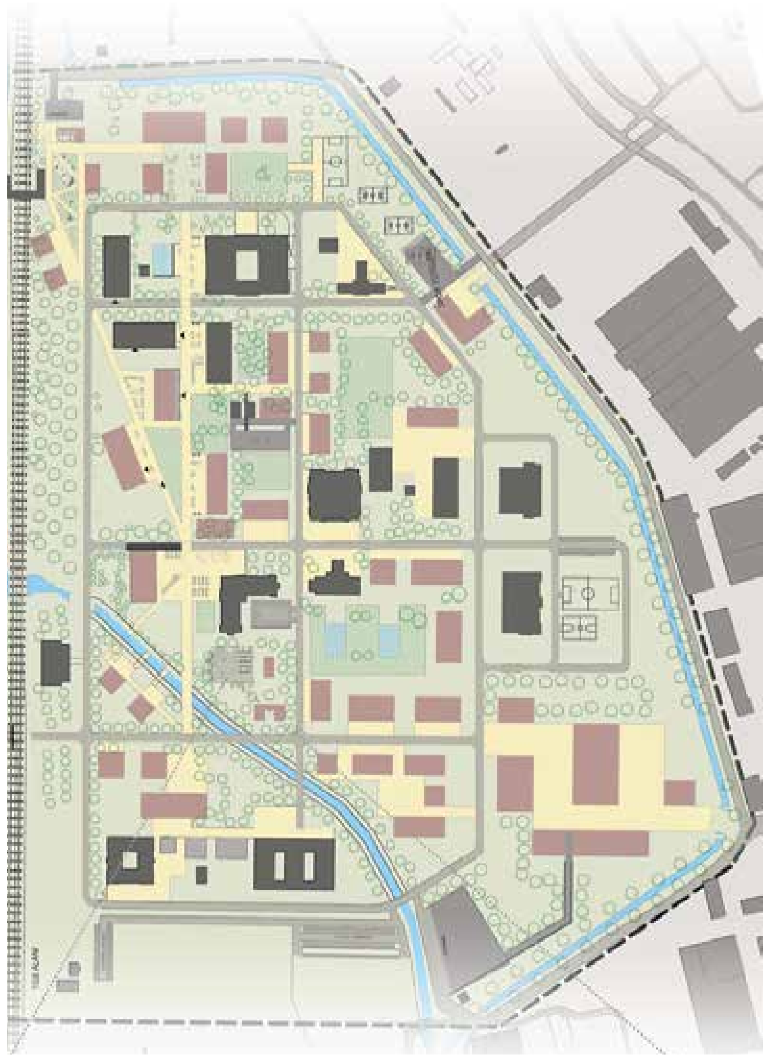


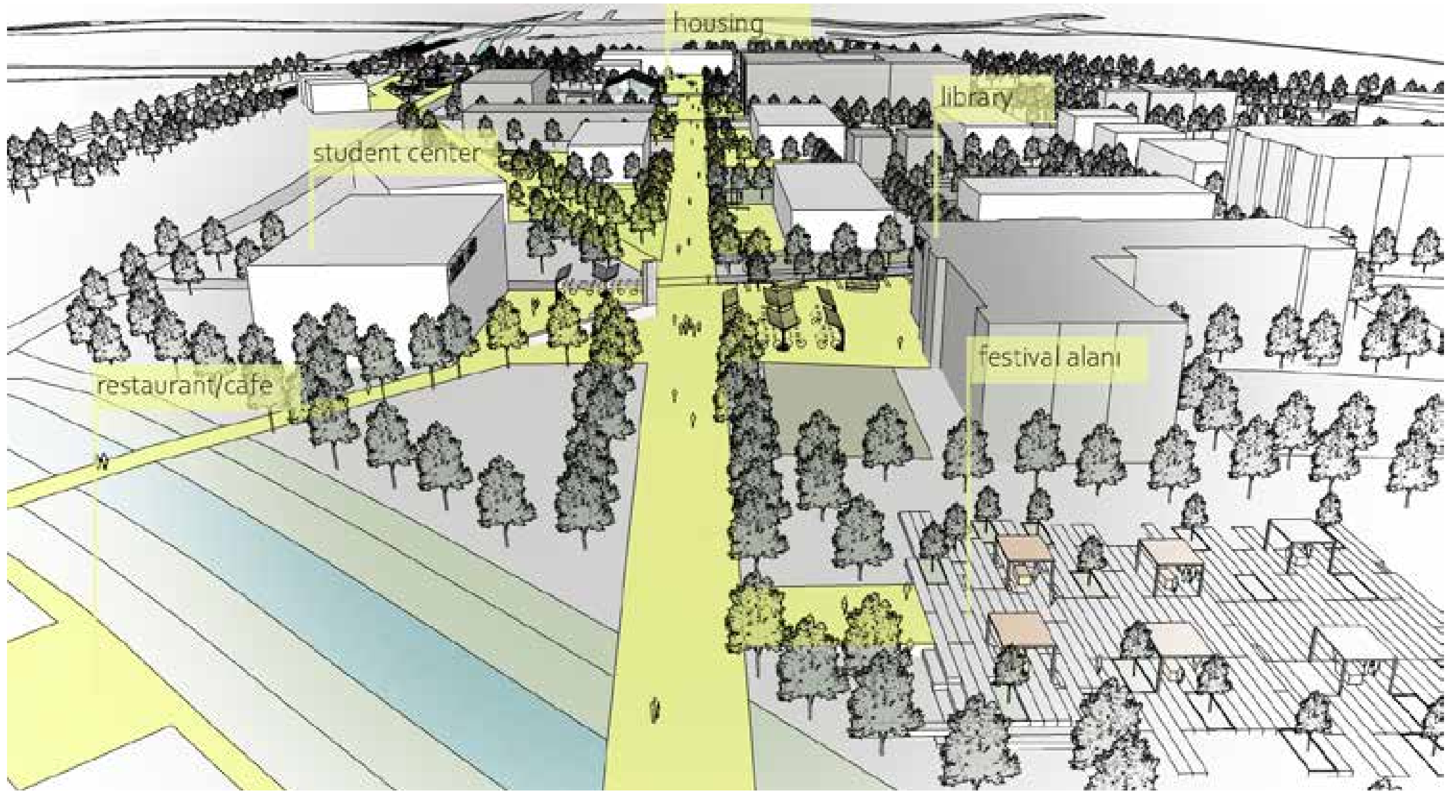
## South Campus

South campus has a grid structure. While the buildings on the north campus show a more organic layout due to its old layout, the south campus has a more grid form due to its planning after 2015. For this reason, transportation is made with 90-degree roads.

The square meters and heights of the buildings in the current south campus are quite large and tall. The open space relations of the buildings with each other are interrupted by 90 degree vehicle roads.

For this reason, social, academic and accommodation zones have been proposed between the buildings in the east-west direction on the south campus plan, where only pedestrian and bicycle paths can be connected.

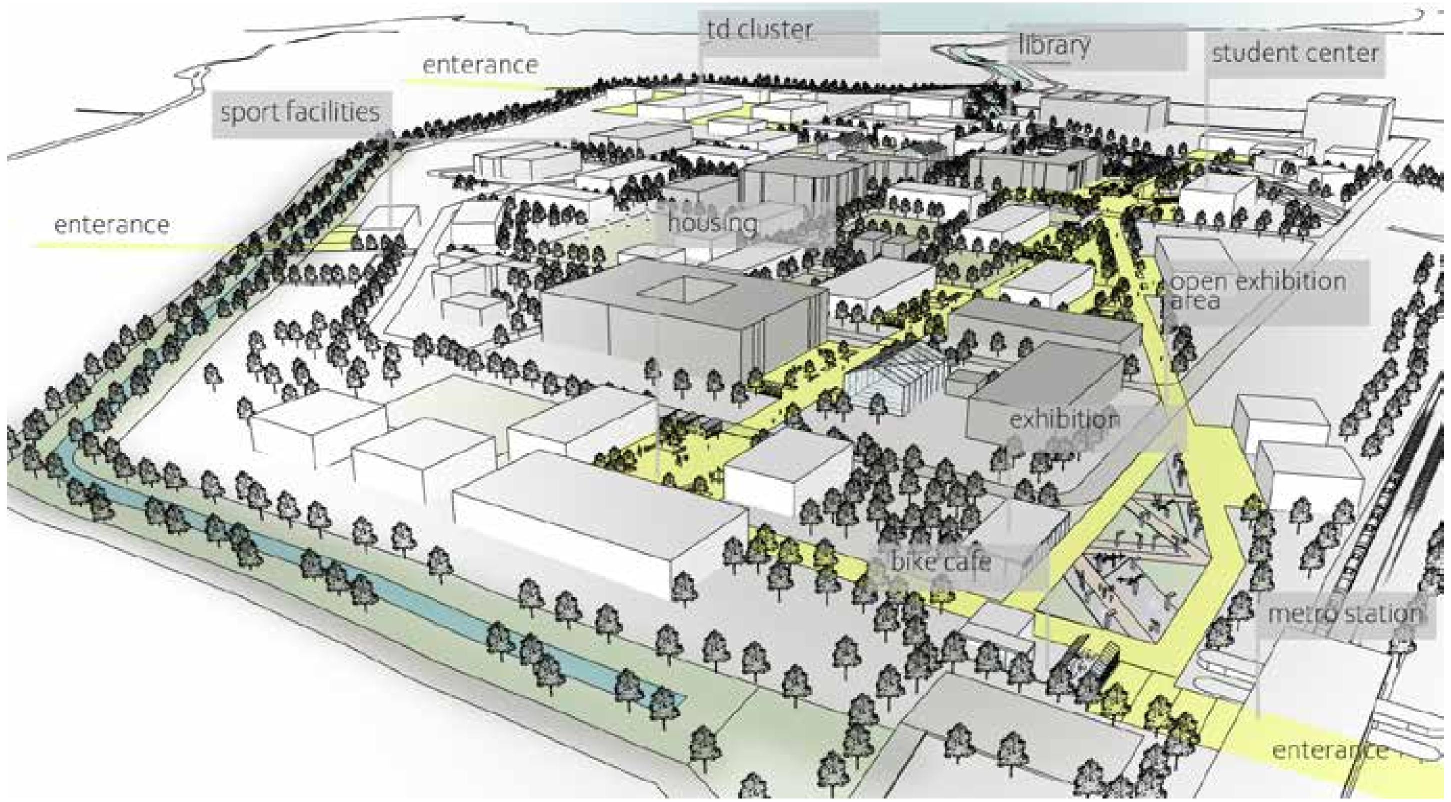





## South Campus

The secondary axis proposed to the south campus is the proposed axis to revitalize the south part of the campus. This axis provides a visual connection by combining the life in the south campus with housing, academic and social zones at street level. Within the scope of 21st century learning spaces, it allows use in open spaces in a way that provides critical thinking, communication, collaboration, and creativity. In addition, the distances of the buildings on the axis are suitable for the concepts of pedestrian-oriented access, disabled access, healthy campus, wellness campus.






## South Campus

The Marmaray line provides easy access to the students throughout the campus. The part of the south campus with the Marmaray station was requested to be an open-air reception area. For this reason, function suggestions such as a bicycle cafe, exhibition, open exhibition, greenhouse, green area have been made. After these functions, the student who comes with his suitcase in hand can go to the dormitory buildings.

In the current campus plan, the technology development zone area is defined in the southernmost part of the south campus. We completed this area with a building group that meets the end of the axis starting from the north. These building groups will also be a welcoming area that will connect the agro-tourism and coastal development areas  to the campus, which are expected to be developed.

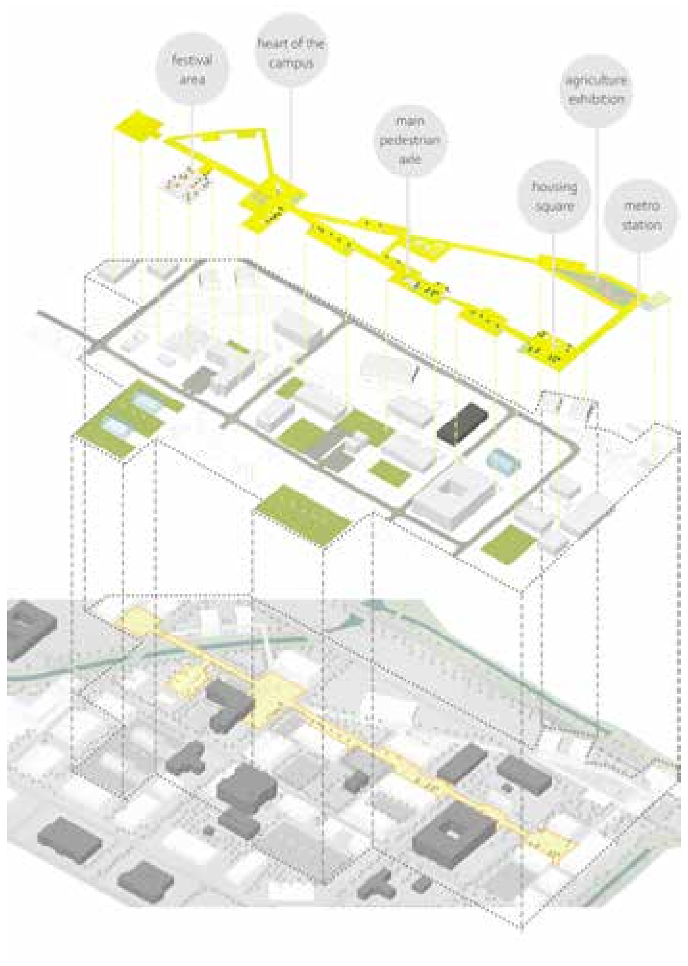
## South Campus

To support a collaborative, communicative and creative education and experience environment of 21st century learning spaces, greenhouses as indoor spaces and soil agricultural areas as open spaces are proposed in the common open areas of the existing buildings on the south campus facing each other.

Greenhouses are places where production can be made with vertical farming method and innovative techniques. Open areas, on the other hand, are places where cultivation is done in the soil but production can be made with smart farming methods.

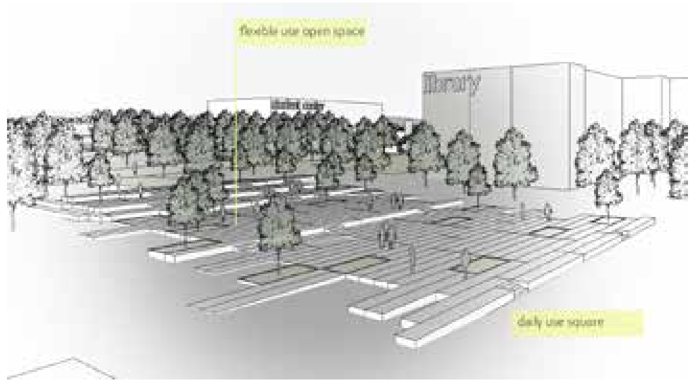
It is aimed that students studying in different faculties experience greenhouse and soil farming practices together and have knowledge about agriculture.

Vertical farming practice requires the use of current innovative technological tools. These are tools such as smart meters, screens, computers, artificial lighting for monitoring greenhouse areas, being compatible with the outdoor climate, genetic analysis in laboratory spaces, and collecting data.



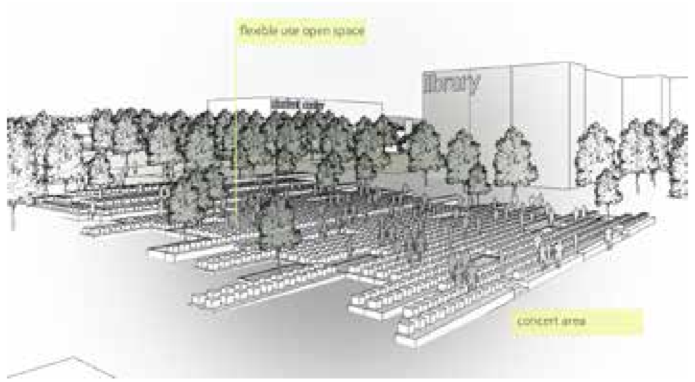



## 5.1.3 Campus Landscape Approach



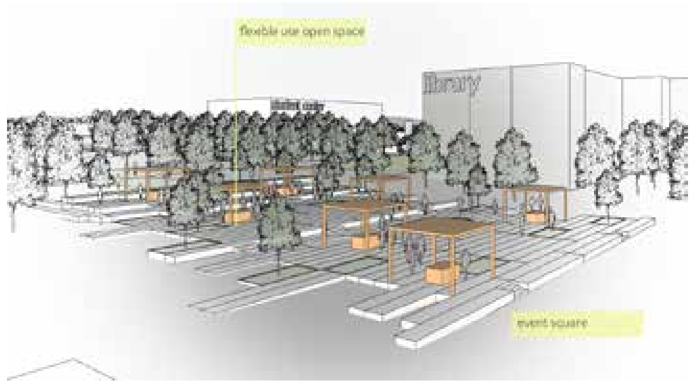

### Daily Use Square

It is suitable for use during the day, between classes, after classes. Seating areas can be arranged according to the number of student groups.




### Concert Area

It is an area that can be used for rearrangement such as night concerts, theater performances and stand-ups in accordance with the event calendar on the campus.

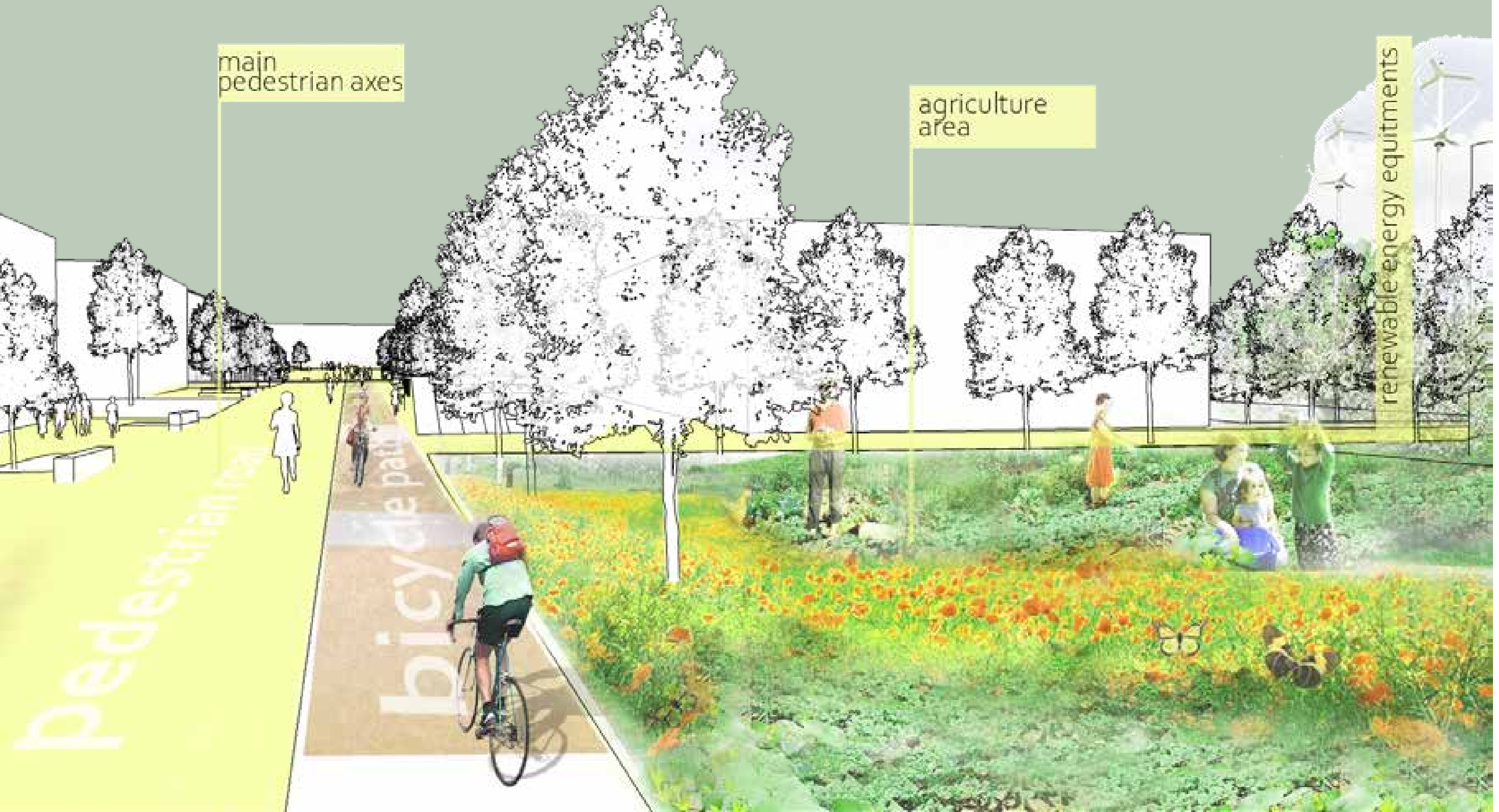



### Event Square

It is an area that can be transformed into a covered seating arrangement for daytime activities of student groups. It can be used for daytime chatting, working, and picnic activities.

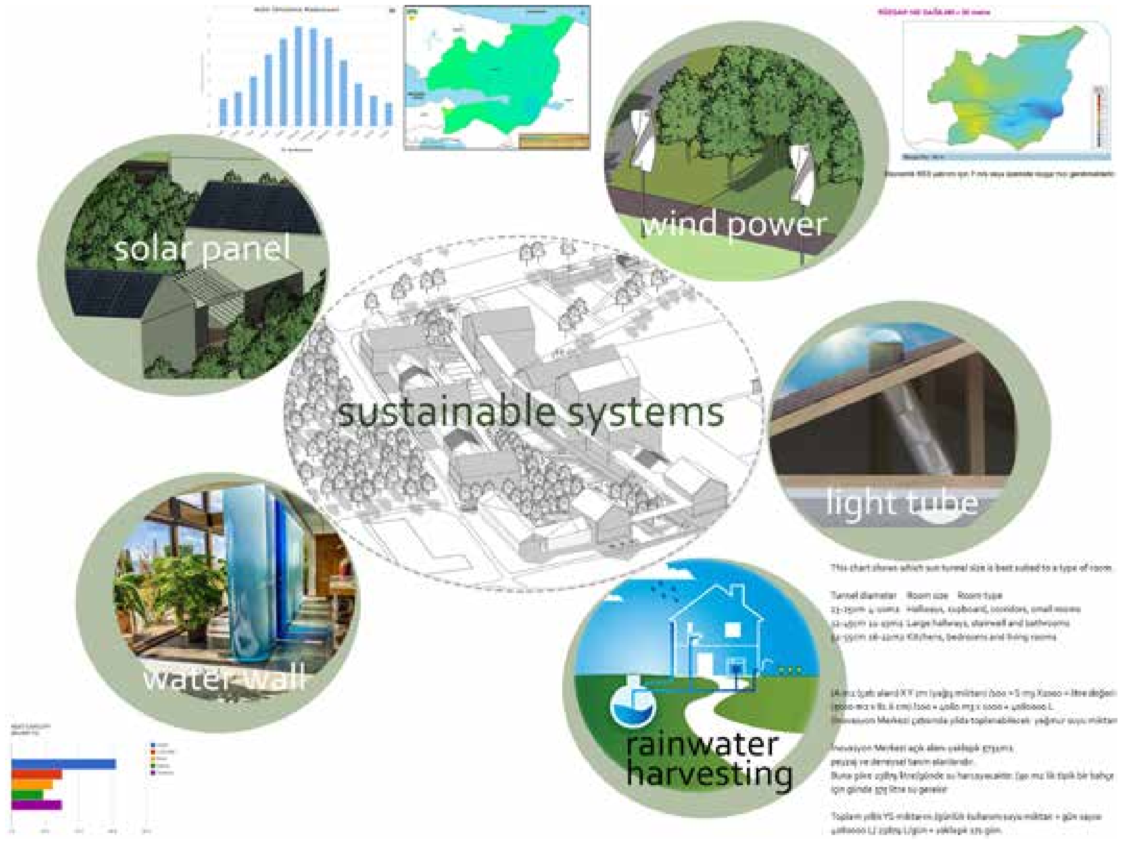
Campus WHERE we…

live, work, study, think, organize, communicate




## 5.1.4 Green Design and Sustainable Strategies

1-Kocaeli province has a low solar radiation potential compared to Turkey in general but quite high compared to Europe. For this reason, it was thought that the use of building-integrated roof PV would be appropriate. 2-Kocaeli has a lower potential than Turkey in terms of wind energy potential. Since Gebze Technical University is on the coast of the Marmara Sea and there are no high buildings around the university, it is an area that can take the wind open. For this reason, it was thought that it would be appropriate to use vertical wind energy for environmental lighting. 3-According to the rain water harvest calculation we have made for Kocaeli province, it has an efficient precipitation regime for 171 days. For this reason, it is possible to store rain water flowing from roofs and use it in agricultural areas.4- In order for the innovation center to benefit from daylight, it is recommended to use light tubes that can transfer natural lighting into the interior for a long time. 5-The heat storage capacity of water is almost 2.5 times that of a reinforced concrete material. For this reason, by creating water walls on the south-facing surfaces of the innovation center, the heat storage capacity of the water can be utilized, the heat can be stored indoors and the heating loads can be reduced.



# 5.2 BIO-BASED AGRICULTURAL INNOVATION INSTITUTE

# Scenario

Due Campus decisions and the decisions of the internal and external functions of the institute building are student and academician oriented. However, the collaborative environments of 21st century spaces allow users to diversify. Accordingly, businessmen, producers, agricultural workers, farmers, and civilians are some of them.

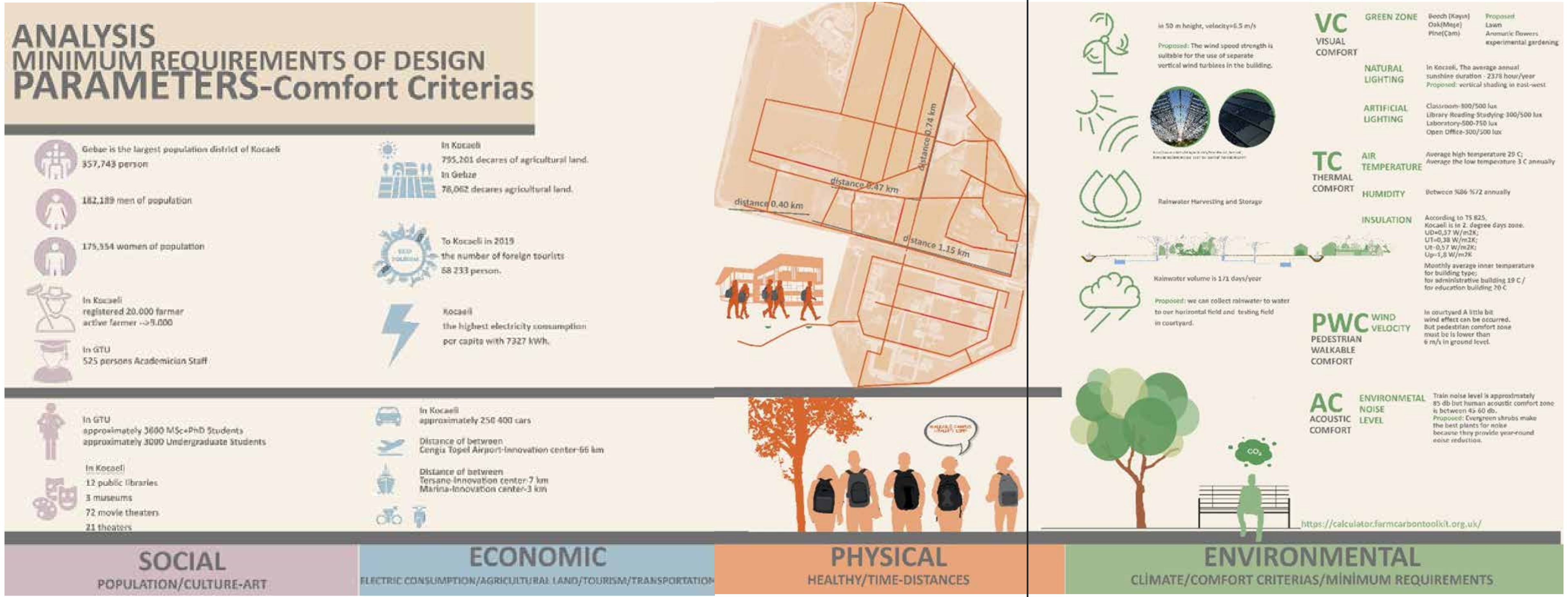
Space usage is suggested according to each user profile. In the innovation campus, offices and collaboration spaces have been proposed to enable businessmen and manufacturers to work with academicians on research and development.

Innovation-based production and the use of technology are the basis of the studies. Thus, the campus and the innovation institute will evolve towards the future circular economy with collaborative, social spaces of the 21st century.

# 5.2 Bio-based Agricultural Innovation Institute

## 5.2.1 Architectural Design Brief

### Innovation Institute Design Parameters




Social-economic-physical-environmental data that will affect design decisions have been researched. According to the social data, since it is seen that 9000 active registered farmers and 10% of the agricultural lands in Kocaeli cannot be used, the need for an agricultural innovation center building has been seen.

According to the economic data, the issue of agricultural tourism is important in the long run, as there is a tourist potential of close to 70,000.According to physical distance and environmental data, campus can be defined as 'wellness, healthy life and walkable campus'.

According to environmental data and calculations; stormwater potential to irrigate indoor use and experimental gardens (171 days/year rain volume/Humidity 86%-72%); the solar potential allows efficient use of PV on the south-facing parts of the roofs. (When we look at the solar potential, the average annual sunshine duration is 2378 hours/year. June is 900 Wh/m2).

The existing wood texture of the campus is a good pitch for the Marmaray train sound (train sounds 85 db) (Beech, Oak, Pine).




## Innovation Institute Master Plan and Entrances

The design idea is based on the creation of production-based spaces where the social network between people is strengthened. While the introverted courtyard provides human-density moving audio-visual tactile experience; extroverted spaces support production-productivity. Buildings, on the other hand, establish a link between the interior and the exterior for the search for education-innovative ideas.

Building functions establish a close relationship with outdoor functions. At the northern entrance, there are car and agricultural vehicles park, camping area and warehouses, restored rentable buildings and open space workshop spaces, while the buildings designed are administration, library and cafe buildings. To the south, there is the festival area and the organic market, while the associated bio-based food laboratory and restaurant buildings are located.

The height of the building is maximum 2 floors and it harmonizes with the surrounding historical texture, building and forest area. The campus is intended to give the impression of a town in itself. Building entrances are shown with red arrows, campus primary entrances with orange arrows, and campus secondary entrances with yellow arrows.

As a concept, we wanted to approach the agricultural innovation center with a modern village concept. We preferred low-rise buildings in parallel with the floor heights of the south campus. By using hipped roofs, we achieved both a different space experience inside and the modern village effect we wanted outdoors. We used agriculture as a landscape element and made it livable. With the special agricultural area behind the center, we have created an area where everyone can observe plant growth and be intertwined with agriculture. We also defined a restaurant where these grown products are used naturally at the entrance. At the same time, in order to increase the interest in agriculture, we also made suggestions such as using technology to collect points for the workshops that students attend or for activities related to agriculture.

# Design Strategies of GTU Agriculture Innovation Center

## CONCEPT STRATEGIES

- A-SUSTAINABLE VILLAGE → Low-rise and hipped roof buildings provide compatibility with the surroundings
- B-CAMPUS IN CAMPUS → The designed courtyard and settled modules creates an campus feeling
- C-COMPATIBILITY WITH CAMPUS HISTORY → Compatible with the architectural form and campus's ancient history
- D-AGRICULTURE BAZAAR → Sales of agriculture innovation center's produced crops
- E-NATURAL RESTAURANT → Consumption of produced organic foods
- F-BRIDGE for CITY AND THE UNIVERSITY → Strengthening relationship with local community, employees and university

## PROGRAM STRATEGIES

- BIOBASED → Advanced transportation fuels, Chemicals, Renewable materials, Food ingredients and feed and Energy

## CONSTRUCTION STRATEGIES

- A-DEMOUNTABILITY → Design of assembly: All steel connections is bolted and timber connections are screwed.
- B-MODULARITY → There is 3 modules. 5x10, 5x15 for the main buildings, 3x6 for the containers
- C-ADAPTABILITY → Demountable wall panels

## MATERIAL STRATEGIES

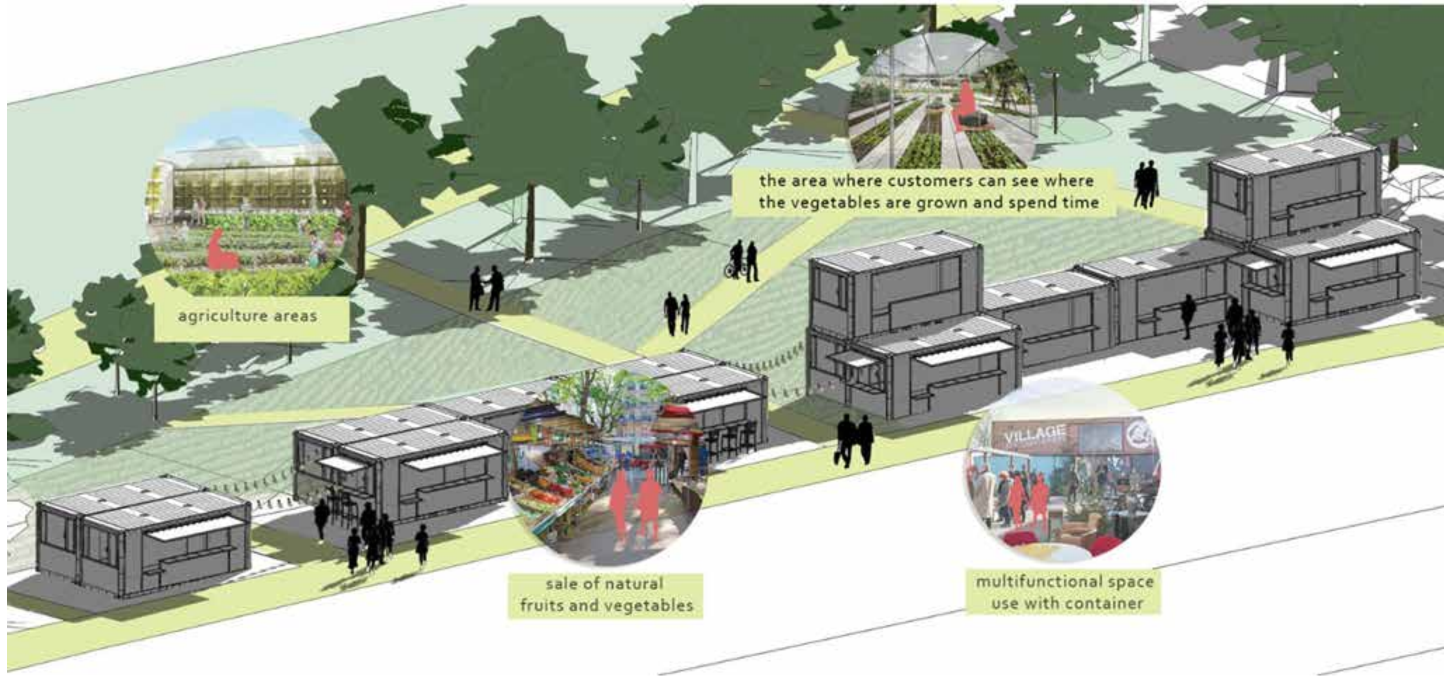
- A-LOCAL MATERIALS
  - 1-SURROUNDING FIRMS → Glass from Şişecam, Ceramic flooring from Tekser and Steel,paint from GOSB
  - 2-NATURAL STONES OF GEBZE → Gebze Granite: roads and stairs; Gebze Kurtçalı Limestone: entrance hall and walls; Gebze Marl Limestone: cement; Gebze Stone: interior spaces

Our design strategies are gathered under 8 headings: concept, program, construction, material, interior, sustainability, landscape and technology. It is reflected that all of the design ideas included in the concept strategy to the project. Our program strategy is created on bio-based innovation.

All of our buildings have been created to reduce their carbon footprint with a 5x5 axle system, steel carriers and connections, most of which can be disassembled compared to the 3x6 system in the market area. Local industrial production materials were examined, it was predicted that glass and steel materials could be used, and it was predicted that the brick material used in building facades would be supplied from Tekirdağ province, the second place that produces the most bricks in Turkey.



# Concept Strategy / Agriculture Bazaar




A fruit and vegetable market close to Marmara was designed both in order to use the gebze technical university as a state and to develop a relationship between the local people and the university. Behind it, a space was created where people could see and collect the product they bought, and spend time at the same time. Containers were preferred for the design of the market in order to transform it according to the needs.

## Program Strategy / Biobased

### Regarding GTU Strategy Document for 2017

There are;

511 persons Academician Staff-for now 525 persons Academician Staff. 297 persons Officer-for now 300 persons Officer

Approximately 2500 Undergraduate Students-for now approximately 3000 Undergraduate Students.Approximately 3500 MSc+PhD Students-for now approximately 3600 MSc+PhD Students

101 - Existing Labs Count

Between 2017-2018, There had been 1728 undergraduate engineering students in all engineering faculty and 2514 MSc+PhD Students in Institute of Natural and Applied Sciences. We assume for now approximately 2000 undergraduate students in Engineering Faculty and 2550 MSc+PhD Students in Institute of Natural and Applied Sciences.

If we assume that the laboratories will be used mostly by engineering students,we can make spatial planning for a total of 4550 students. But Due to our building's inner space are flexible, transformative, instead of creating square meters depending on the number of people, we envisioned a sufficient number of spaces that can be used in accordance with the management of the enterprise.



| AREA | SQUARE METER /PER STUDENT OR USER |
|---|---|
| Laboratory (Engineering, Science)<br>Preparation+Store | 4-6 m2<br>1 m2 |
| Laboratory (Construction materials+Electrical machine or Heavy Engines, machine tools<br>Preparation+Store | 6-9 m2<br><br>1 m2 |
| Meeting Room | 1.5-2 m2 |
| Creativity zone/ Teaming area/workshop room | 3-6 m2 |
| Offices<br>academicians<br>companies<br>administrative | 2.5 m2<br>2.5 m2<br>5 m2 |
| Small classroom | 2 m2 |
| Large classroom | 2.5 m2 |
| Learning-in-round Classroom | 3 m2 |
| Breakout space | 1 m2 per user |
| Supporting units | Up to 10% of the departments area without circulation |
| Common use areas | Up to 20% of the departments area without circulation |
| Circulation | Up to 10% of the total area |

We have 5 deparments for Biobased Agricultural Innovation Institute

## 1.Advanced transportation fuels

-Biochemistry Lab. (Bio fuels are cellulosic ethanol and biodiesel)(30 student+2 lecturer)32 x 6 = 192 m2

Preparation+Store 32 x 1 = 32 m2

-Breakout Space 32 x 1 = 32 m2

Department 1 total M2 = 256 m2 +Circulation %10 (25 m2) = 281 m2

## 2.Chemicals

-Nano-Technology Labs (for 30 student+2 lecturer) 32 x 6 = 192 m2

Preparation+Store 32 x 1 = 32 m2

-Perfumes, Fragrances, and Aromatics Lab. (for 30 student+2 lecturer) 32 x 6 = 192 m2

Preparation+Store 32 x 1 = 32 m2

-Breakout Space 64 x 1 = 64 m2

Department 2 total M2 = 512 m2+Circulation %10 (51 m2) = 563 m2

## 3.Food ingredients and feed (Nutrition and Health/Agro Food Robotics)

-Vertical Agriculture Lab. (for 30 student+2 lecturer) 32 x 6 = 192 m2

Preparation+Store 32 x 1 = 32 m2

-Horizontal Agriculture Lab. (for 30 student+2 lecturer) 32 x 6 = 192 m2

Preparation+Store 32 x 1 = 32 m2

-Machine Learning with Robot Atelier/Lab (for 30 student+2 lecturer) 32 x 8 = 256 m2

Preparation+Store 32 x 1 = 32 m2

-Breakout Space 96 x 1 = 96 m2

Department 4 total M2 = 832 m2+Circulation %10 (83 m2) = 915 m2

## 4.Energy

-Biogas(metan) Lab and storage space (for 30 student+2 lecturer) 32 x 8 = 256 m2

Preparation+Store 32 x 1 = 32 m2

-Biomass Lab. (for 30 student+2 lecturer) 32 x 8 = 256 m2

Preparation+Store 32 x 1 = 32 m2

-Breakout Space 96 x 1 = 96 m2

Department 5 total M2 = 960 m2+Circulation %10 (96 m2) = 1056 m2

## 5.Materials (Renewable Materials/ Construction Materials)

-Radiocarbon Analysis Lab. (for 30 student+2 lecturer) 32 x 8 = 256 m2

Preparation+Store 32 x 1 = 32 m2

-Recycle Lab (for 30 student+2 lecturer) 32 x 8 = 256 m2

Preparation+Store 32 x 1 = 32 m2

-Breakout Space 64 x 1 = 64 m2

Department 3 total M2 = 640 m2+Circulation %10 (64 m2) = 704 m2

## 6.Common Use (Education Spaces)

-Typical Research Labs x 4 (for 25 student+2 lecturer) 27 x 4 x 5 m2= 540 m2

Preparation+Store 27 x 4 x 1 m2 = 108 m2

-Small classroom x4 (for 25 student+1 lecturer) 26 x 4 x 2 m2 = 208 m2

-Large classroom x2 (for 50 student+2 lecturer) 52 x 2 x 2.5 m2 = 260 m2

-Learning-in-round Classroom x4 (for 20 student+1 lecturer) 21 x 4 x 3 m2 =252 m2

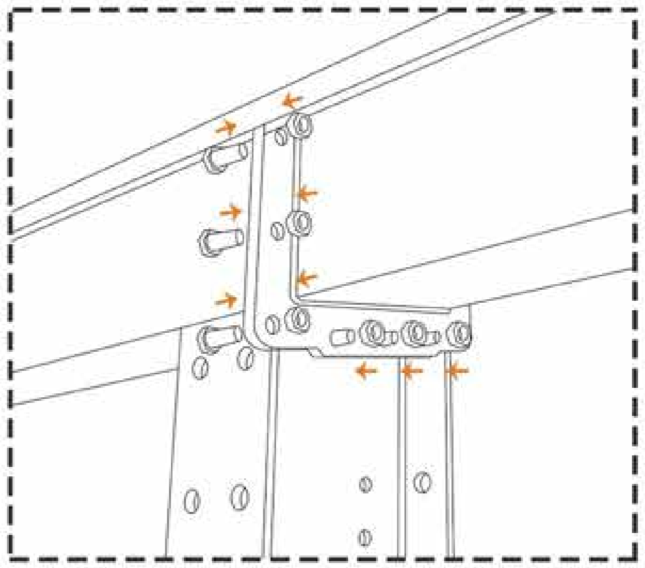
-Creativity zone/ Teaming area/workshop room x4 (for 50 student+2 lecturer) 52 x 4 x 4 m2= 832 m2

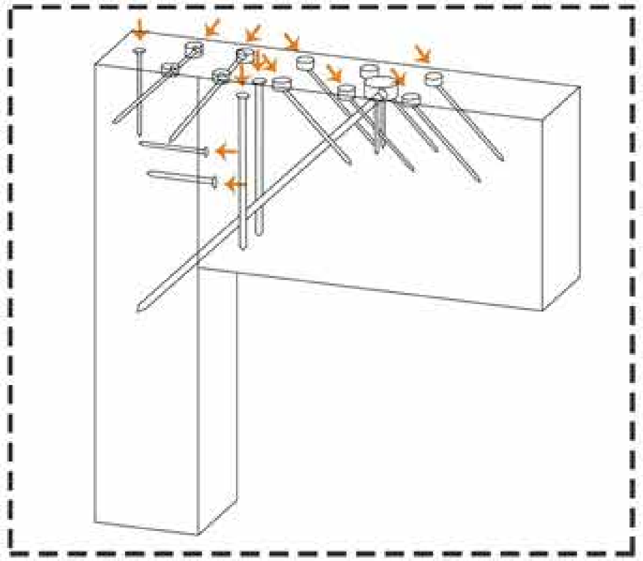
-Meeting Room x2 (for 25 student+1 lecturer) 26 x 2 x 2 m2= 104 m2

For the design of the innovation center building, first of all, an architectural requirement program study was carried out. As the top program title, innovative and bio-based energy-food-fuel production-chemistry and materials were chosen within the scope of smart agriculture 5.0. According to these titles, space samples were researched. The total usage area foreseen for the architectural needs program is approximately 10,000 square meters. According to the final project total spatial areas: 7316 square meters.

# Construction Strategy / Demountability

## Design of Assembly





All steel connections are bolted and all timber connections are screwed. Benefits of the demountability are:

-The system from dry joints

-Building as a recyclable product

-Sustainable

-Having zero waste

-Super low carbon building

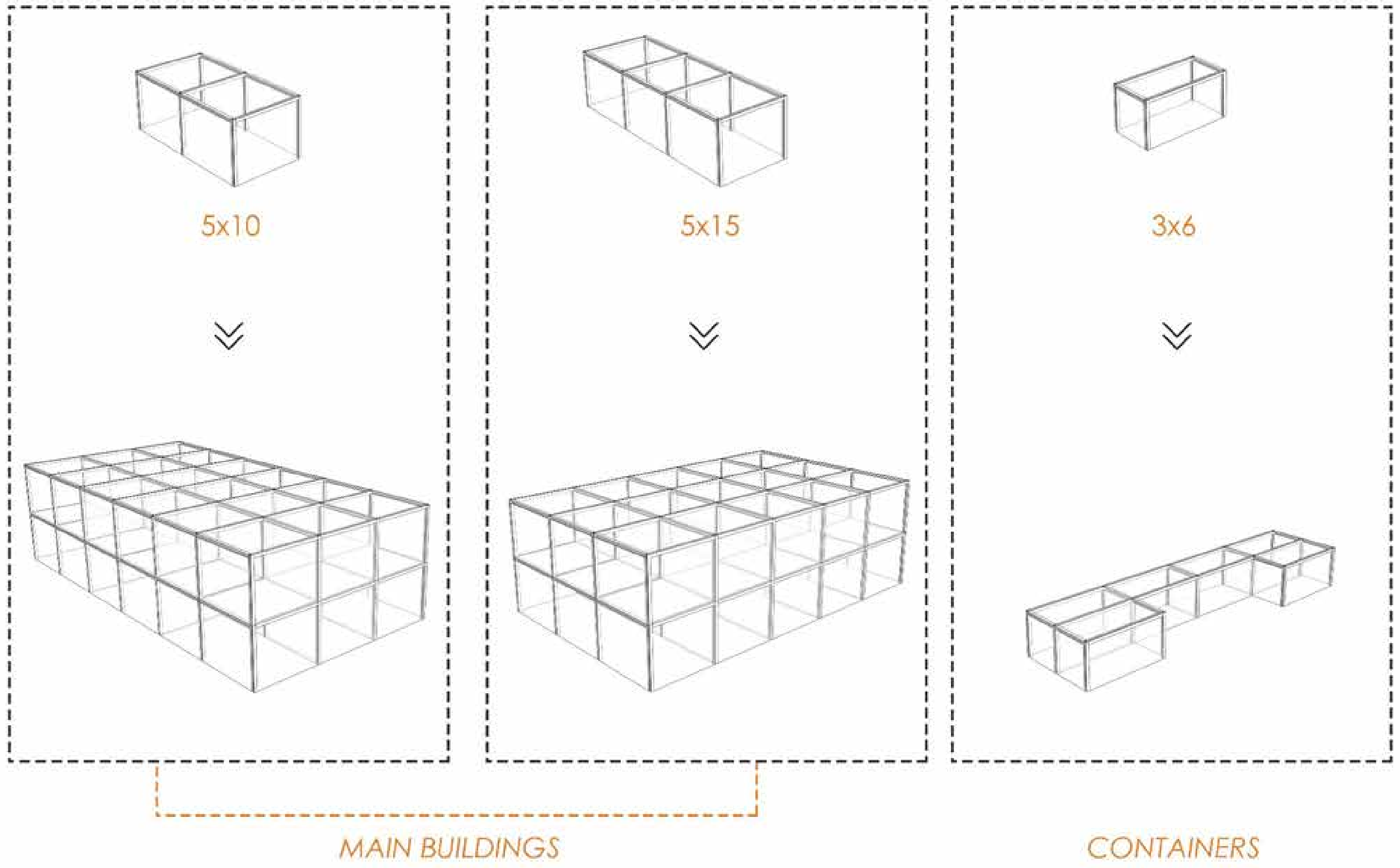
-Fast constructible

-Super lightweight

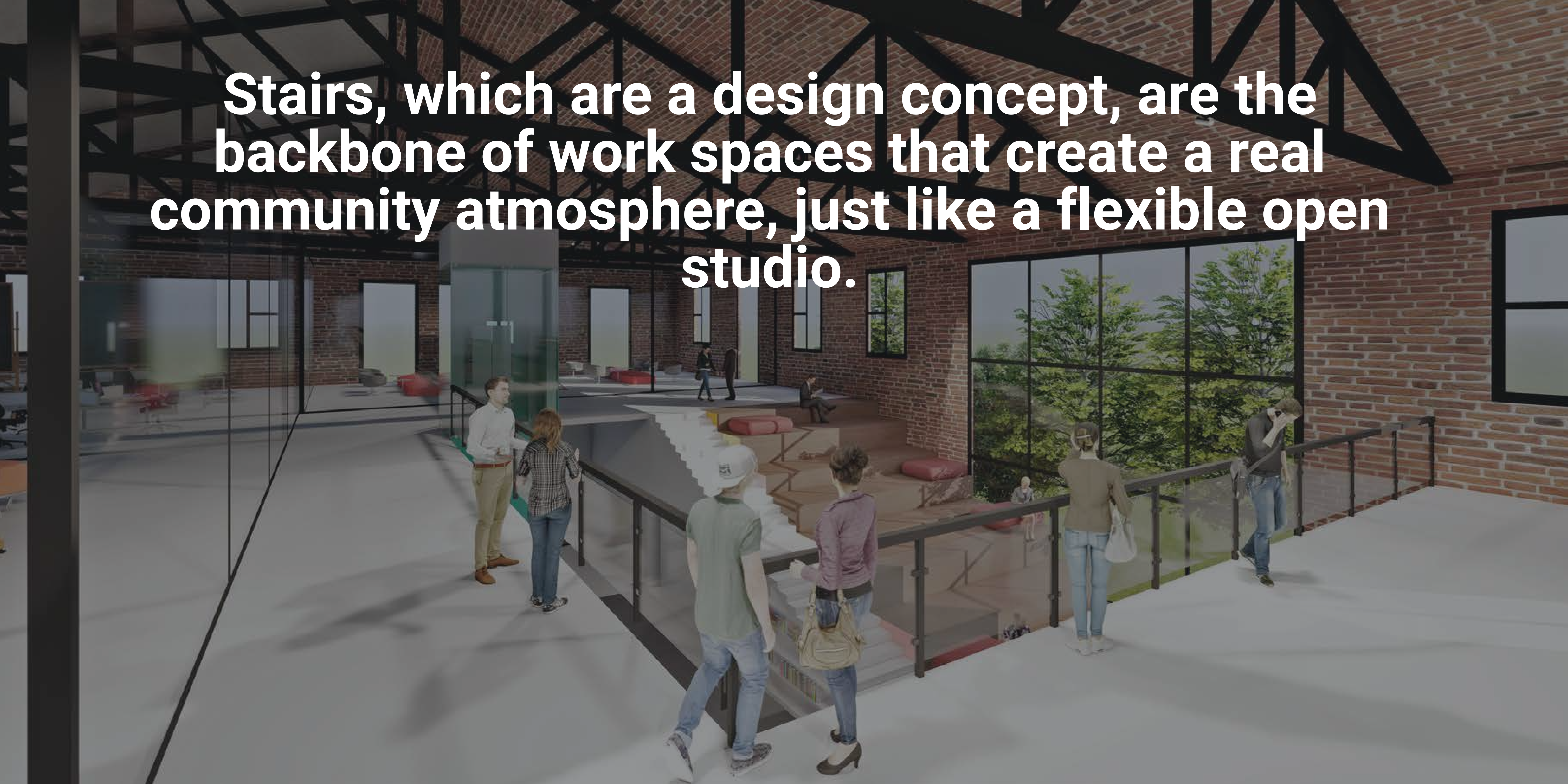
-Flexible in space arrangement



# Construction Strategy / Modularity




Modularity offers mass production and a more economical solution at the manufacturing stage. 'Module' is the largest portable unit of the structure. Three types of modules have been identified for this project. The building groups were chosen as 5x10-5x15 and 3x6 modules. 5x10-5x15 modules constitute the main decision of the carrier system layout of the innovation institute buildings. The 3x6 module is the simplest known container size and was used for shops in the festival areas. The modular operation provides the opportunity to use the same divider elements repeatedly in the desired direction to provide flexibility in interior spaces.



Stairs, which are a design concept, are the backbone of work spaces that create a real community atmosphere, just like a flexible open studio.

## INTERIOR SPACE STRATEGIES

- A-FLEXIBILITY → Varied seating arrangements and diverse space articulations
- B-CREATIVITY SPACES → Supporting creativity and co-working with the interior elements
- C-PLANTS and VEGETATIONS → Utilization from the positive pschological effects of the green
- D-SOCIAL SPACES → Breakout areas to improve productivity
- E-CLIMATE CONTROL → Proper natural-artificial lighting and acoustic adjustments

## SUSTAINABLE STRATEGIES

- A-RAINWATER HARVESTING → Water purification trees for the workshop areas
- B-SOLAR ENERGY → Building Integrated PV-Transparent PV Panel
- C-WIND ENERGY → Building Independent Turbine-Vertical Wind Turbine

## LANDSPACE STRATEGIES

- A-AGRICULTURE AS LANDSCAPE → Visible agricultural areas in courtyard as a part of the landscape design
- B-WORKSHOPS → Learning and gaining experience about the agriculture and sustainability, for both citizens and students
- C-AGRICULTURE FESTIVAL ZONE → Area for the agricultural events and courses
- D-EXTERIOR OPEN CLASSROOMS → Brainstorming and collaboration spaces for students
- E-FOREST CLASSROOMS → Creating creativity zones in nature

## TECHNOLOGICAL STRATEGIES

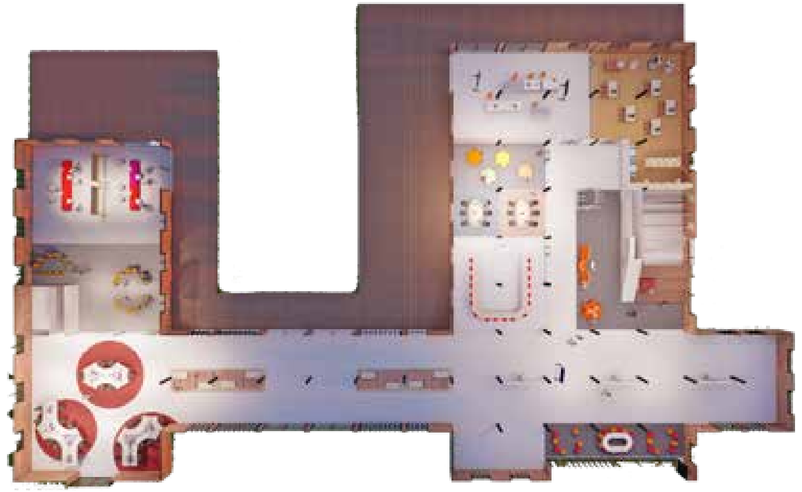
- A-SMART AGRICULTURE → Following the latest technological innovations in agriculture
- B-SMART MOBILITY IN CAMPUS → Bike renting, electric scooter
- C-STUDENT MOBILE APPLICATIONS → Creating apps that students gain some points in agricultural-sustainable events

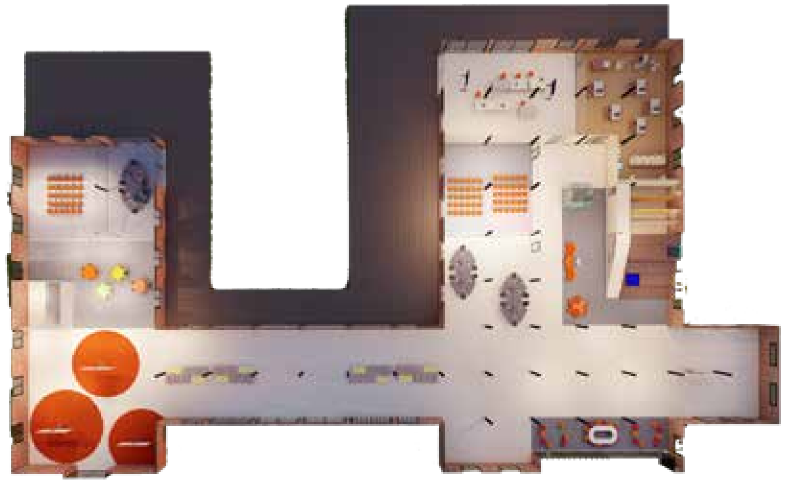
Socialability, creativity and flexibility concepts were studied in indoor strategies. The productive results in sustainability were seen in the potentials of rain and sun. Almost all of our landscape strategies were developed and added from the very beginning of the design.

In terms of technology strategy campus operation, smart campus and smart agriculture are recommended, while credit collection screens are suggested for each agricultural activities and environmental practices for students.



# Interior Space Strategy / Flexibility





Flexibility in Vertical Partitions: movable and reshaping space for aesthetic, functional and economic uses that responds to peoples' needs.

Flexibility in Horizontal Planes and Levels: Institute buildings can be used vertical partitions and horizontal planes (levels) flexibilities together and can be changed the vertical partition to horizontal one, to reach maximum flexibility at minimum space and materials.

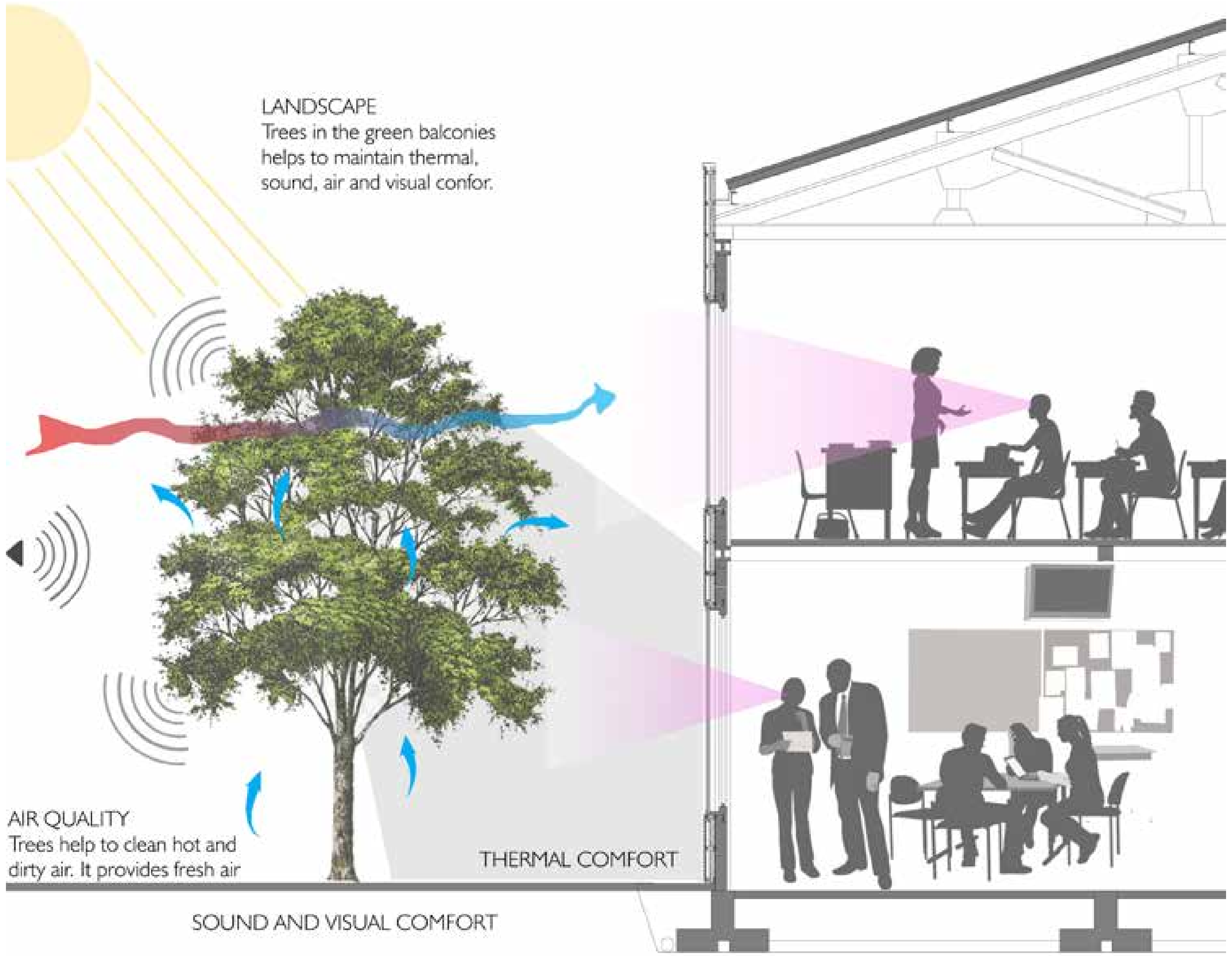
Flexibility in Furniture: The furniture can add another type of flexibility which gained from repeating the furniture piece with changing the arrangement or adding other pieces without decreasing the aesthetic and functional efficiency of space.

The diversity of furniture colors is given importance in spaces that support creativity. Idea generation boards are located on the wall in front of each study group. Transparent dividing structural elements are preferred to provide dynamic mobility between groups.



The interior heights are not covered by a particularly limited slab of flooring. The roof is carried with steel trusses. The spaces between the trusses give the space a higher and more spacious feel. Interior decoration elements such as carpet and lighting used on the floor in the project provides the differentiation of group working areas.

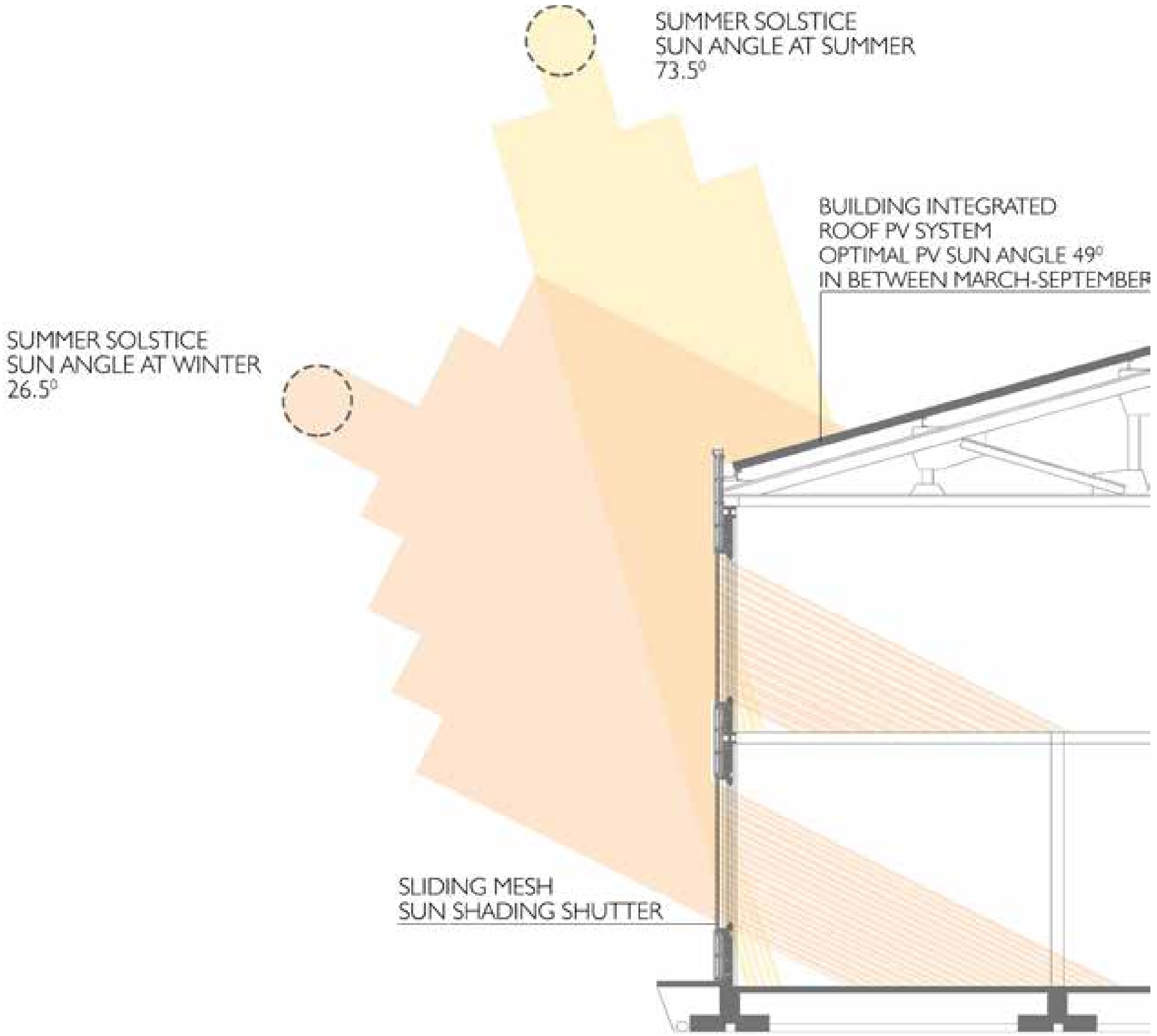
## Interior Space Strategy / Climate Control




During break times from work, there are common areas that support communication, production and creativity.



## Sustainable Strategy / Solar Energy




Solar energy angles move between 26.5 degrees in winter and 73.5 degrees in summer for Kocaeli. Accordingly, the most optimal integrated building roof pv system angle for Kocaeli is 49 degrees.

**Flexibility** helps finding new architectural solutions to get the maximum benefits and functional use of small areas. Flexibility is one of the physical properties of materials and geometrical forms used in interior design, that property depends on the physical shape in addition to its **compositional** and other structural properties, so that repetition, balance and similarity can be used for making flexible space. It means that we can use geometrical properties in order to gain a flexible space that can be **transformable** and **multi-uses** in the same plot area.

## Sustainable Strategy / Bioswale

Bioswales incorporate into the green infrastructure and help enhance biodiversity and quality of life. Bioswale is planned to be built on the edge of pedestrian walkways in the innovation campus courtyard area. It is desired to collect rainwater along the inclined pedestrian path. Bioswale is a natural drainage system.




## Sustainable Strategy / Rainwater Harvesting

The annual average precipitation in Turkey is 643 mm (kg/m2). In Kocaeli, while the annual average number of rainy days is 131 days, the annual average precipitation is 816 mm. For Rainwater Harvest Calculation, it is appropriate to use rainwater for irrigation of vertical farming and experimental farming from the roofs of the Innovation Center, which has a roof area of approximately 5000 m2.

(A m2 (roof area) X Y cm (amount of rainfall) /100 = S m3 X1000 = liter value

(5000 m2 x 81.6 cm) /100 = 4080 m3 x 1000 = 4080000 L (The amount of rain water that can be collected annually on the roof of the Innovation Center)

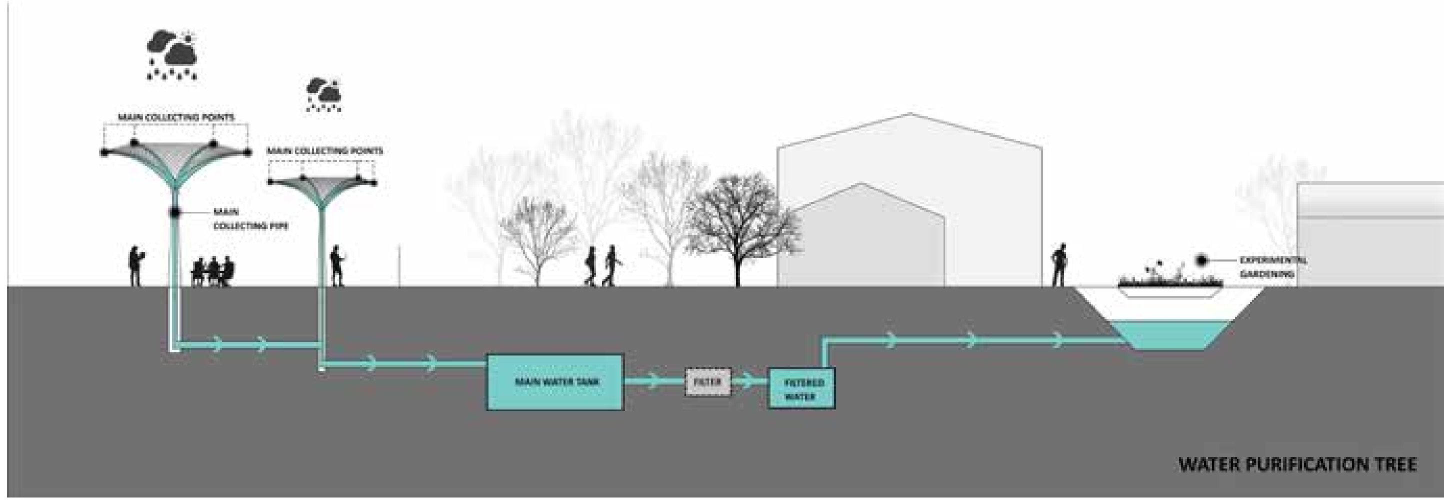
A typical 90 m2 garden requires 375 liters of water per day (Kendiway, 2018, 112-113)

The Innovation Center open area is approximately 5731m2 of landscape and experimental agricultural areas. Accordingly, it will consume 23879 liters/day of water.

Total annual YS amount / daily usage water amount = number of days

408,000 L/ 23879 L/day = approximately 171 days. The number of days that can be used for garden irrigation at a considerable level has been determined.

**Rainwater collection system, on the other hand, allows the rain water, which seeps into the middle of the canopy-shaped top covers, to accumulate in durable tanks under the soil with a water collection channel. Due to the lack of slope throughout the land, the collected water can be used when necessary with the help of a pump.**



## Landscape Strategy/Workshop

The canopy, which is used to collect rain water, also provides shading for the workshop areas. There are open space workshop spaces that support research, production and experiential learning methods of the Agricultural Innovation Institute. These spaces are sequentially in and around the pedestrian axis determined within the agricultural areas. Shaded open spaces provided with canopies have seating areas suitable for group work.



## Landscape Strategy / Agriculture Festival Zone

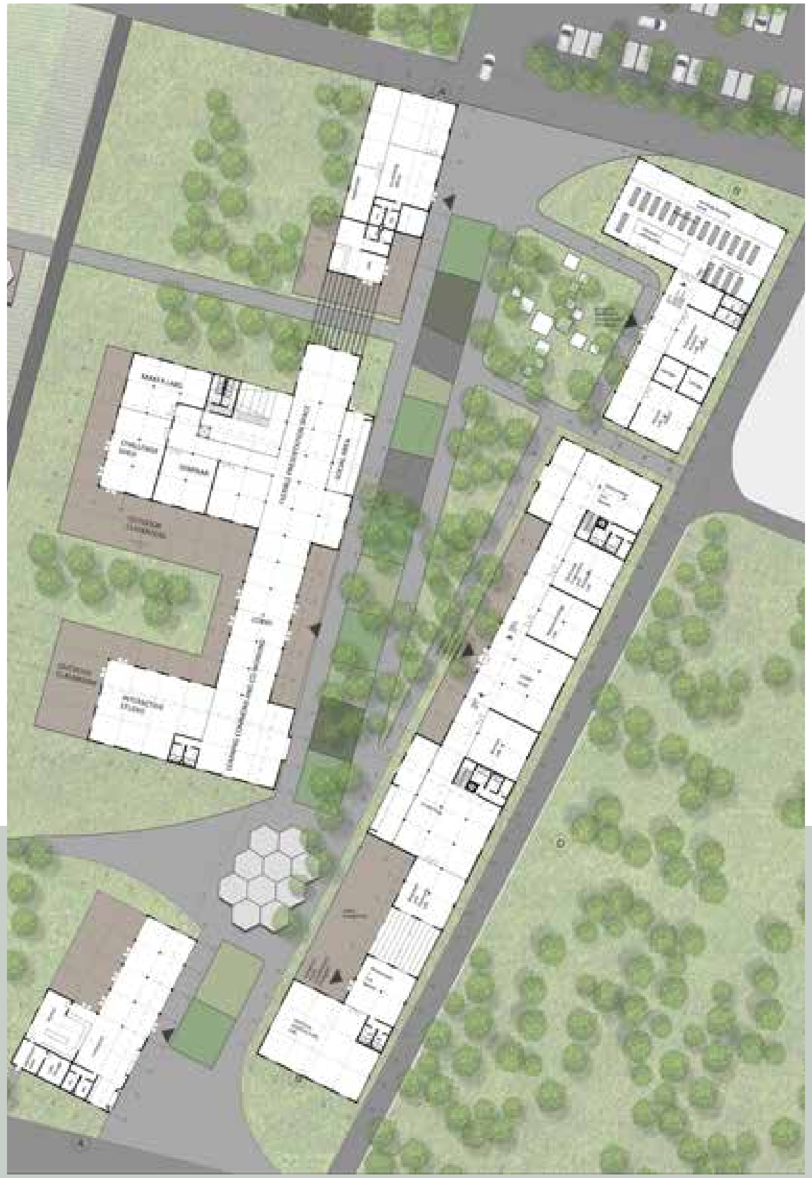
Festival zone is the area designed around the pedestrian path recommended for people coming to the Agricultural Innovation Institute from the Çayırova stop of the Marmaray train line. In this area, outdoor spaces related to the agriculture week, harvest time, open field workshops have been suggested. In the 3x6 module, there are places where fast, healthy foods are cooked, served or sold in container shops.

## The Art and Sensibility of Sustainability’

This design aims to ensure sustainable campus life in a healthy and wellness environment that allows socializing. The experimental agriculture proposed in the courtyard provides an opportunity for 21st century learning spaces to be inference-oriented rather than knowledge-oriented.

# 5.2.2 Technical Drawings

## Plans-Ground Floor

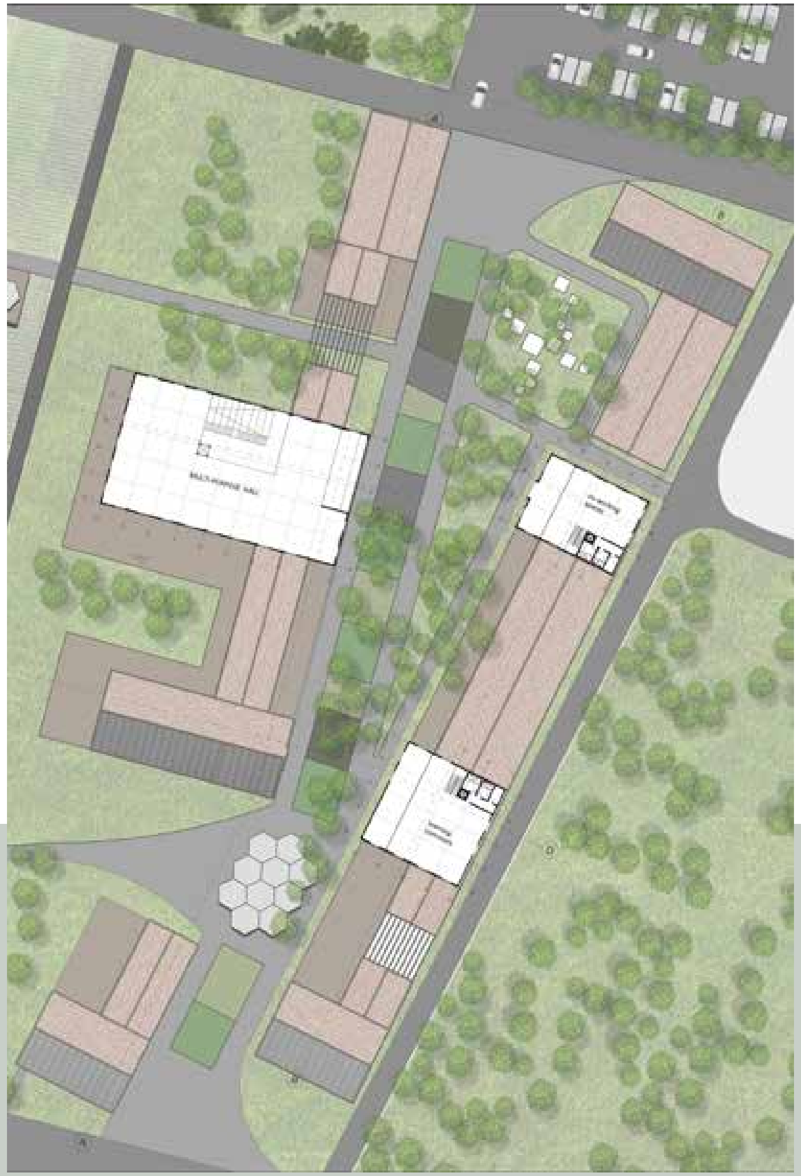


The agricultural library and administration office buildings are located in the north as a door opening to the courtyard, while the location of the administration building is appropriate in terms of operation and control of the area, the location of the library is appropriate in terms of outside access and serving the student density in the north.

The two buildings located in the south of the plan are the reciprocal building groups that support restaurant and food researches at the entrance from the south.



## Plans-First Floor



The buildings located in the west and middle areas has two floors and it include open space classrooms, interactive studios, Maker labs, large volume production areas, shared learning spaces, multi-purpose hall, and are the buildings that establish the strongest link between the courtyard and agricultural areas.

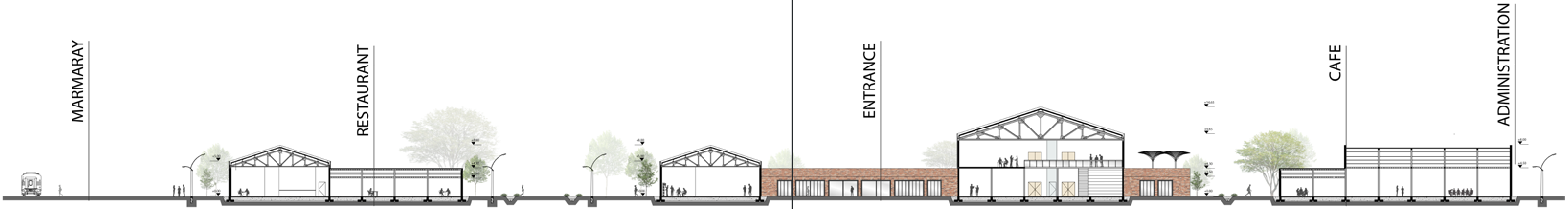
In the same way, he located building in the eastern and central areas has two floors and it consist of building labs, open space criticism-critical spaces and open study spaces are located.

In the eastern part of the design area, from north to south, are the library and bio-based departments. While the buildings in this section have classrooms for education, laboratories for research, and quiet areas for reading, the buildings on the west have more socializing spaces.

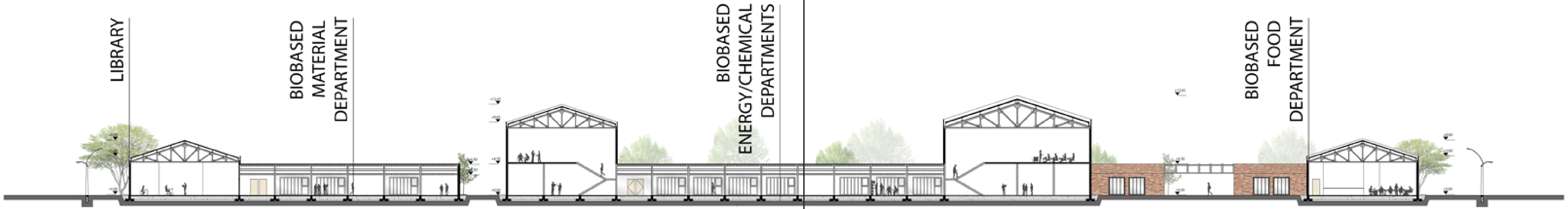
It is aimed to increase the use of the main axis of the open spaces in the north-south direction and the courtyard of the innovation institute. The same design decision was not applied for the library building. By defining its own front garden, the library mass has been drawn backwards from the main axis. Thus, quieter spaces were created.

## Sections and Elevations

In the sections, the height of the building is 2 floors and there is also a carrier truss system. The lattice beams are made according to the calculation of 1/7 of the span passed and 1/10 of the height in the gap. Accordingly, the trusses rise by 3.5 and 5 m.




A-A Section



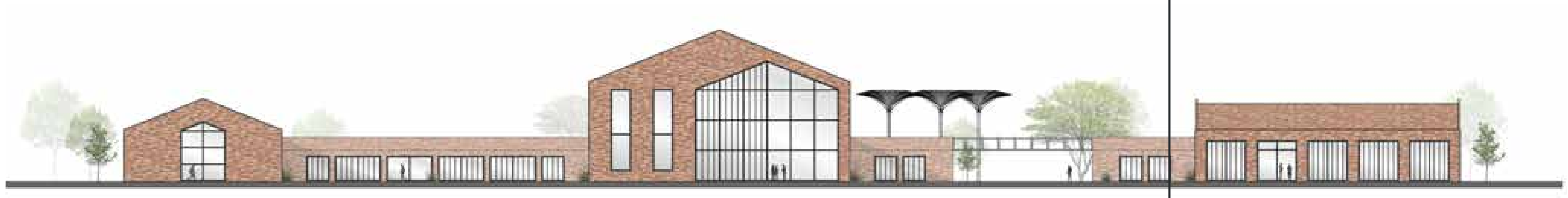

B-B Section

The innovation center main building has a central staircase. This staircase traditionally connects the ground floor to the first floor, and also allows watching the stage performances to be held in the common area. This space can be a large-surfaced staircase where group work can sit, relax and work during the day.



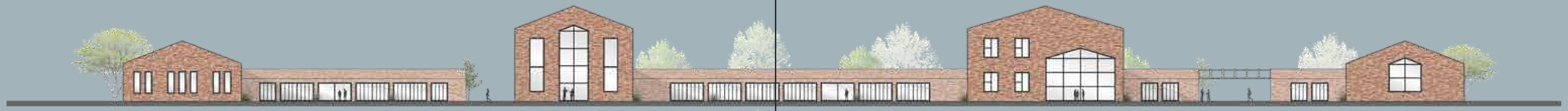
Innovation center interiors are spaces that can be transformed. Open spaces-offices were designed without interrupting the visual connection between the working areas. Interior suggestions made without interrupting the visual interruption are as follows;

-step difference in building level
-use of color in floor coverings
-light-moving divider panels
-rail curtains
-furniture differences
-transparent dividers



View from patio- East Elevation

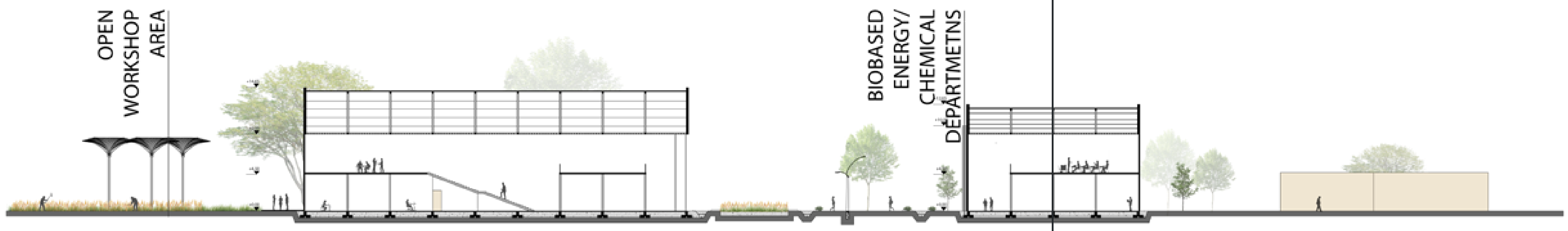
The maximum roof top point elevation of the designed buildings is 12, 6 and 4.5 meters. The tallest building has 2 floors. The heights of the buildings have been chosen in accordance with the registered structures in the immediate vicinity, which are respectful to the historical environment, between trees of close to 20 meters.



View from patio- West Elevation

Project design is targeted in the context of diversification and experience of agricultural practices, innovation, 21st century learning methods and sustainable campus. Accordingly, the courtyard between the agricultural innovation buildings is a recommended area to fully experience traditional farming methods. For this purpose, gardens were placed at a level 50 cm lower than the pedestrian walking level. Crossing over these gardens is provided by pedestrian bridges at the pedestrian level.

Since the innovation institute buildings are lined up in the east and west directions, the sun of the plant-fruit-vegetable areas produced in the courtyard is not interrupted.




C-C Section


D-D Section

With the project section, it is desired to reveal the material, membrane or wall that separates the interior and exterior profiles, interior and interior space from the exterior at the same time, and to provide a generally invisible view of the object.

The buildings, which are emphasized by the project section created together with the land, provide a connection from the image to the performance, from the surface to the intersection of structure and materiality that creates the tectonic logic of the architecture. The contrast between the space created by the section and the façade materials of the building sequence that follows it creates a connection between the interior and exterior of the section.

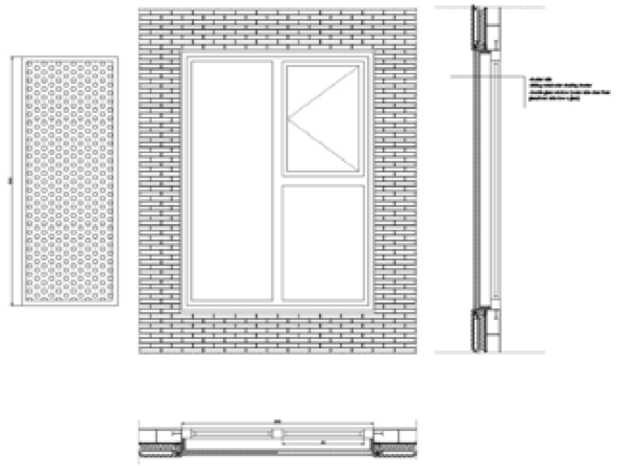
View From North Entrance - North Elevation

View From South Entrance - South Elevation



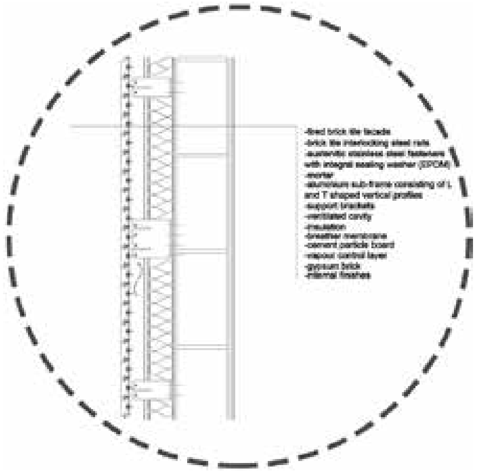
In the views, the sustainability decisions of the design area, the heights of the buildings, the positions of the buildings in relation to each other, the type of the shell materials of the buildings can be seen. Accordingly, the elevations of the building were drawn on a 'sustainable approach to town simplicity' as we say.

## Details



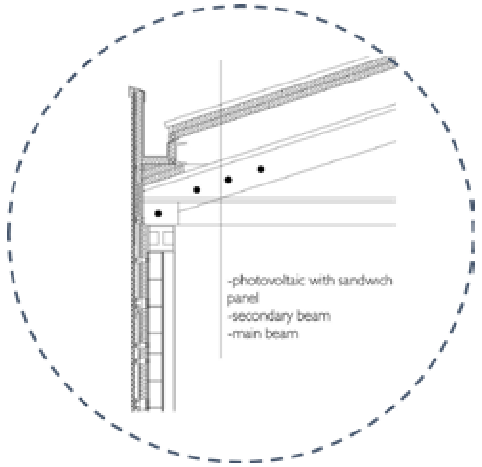
### Typical window and shutter detail for south

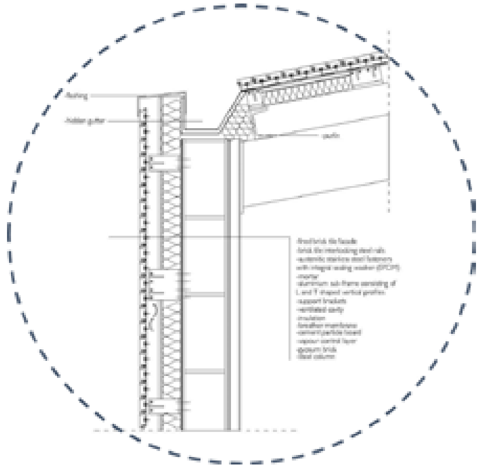
Horizontal sliding mesh solar control is proposed for all windows facing south.




### Typical Wall Detail

The typical wall detail we apply to all buildings is L brackets mounted on the aerated concrete wall built between the steel column, and a vapor barrier and an insulation layer are added on it. Cut brick facade carrier system and rail are fixed to L brackets.



### Wall and roof corner detail (2 types)

Concealed gutter is suggested for the corner joint detail of the roof, and it is of two different types, with and without a pediment.

## Master Plan Perspective View

The innovative perspective of the innovation institute has made the interior and exterior relationships appear holistic, as well as in the load-bearing details.

Since the buildings come together in a **modular** arrangement of 5 meters, their heights vary as 25, 35, 45, 80, 90 meters. The innovation institute design area is approximately 210 meters in the north-south direction; It is approximately 100 meters in an east-west direction. In addition, the agricultural area, which is the subject of the innovation institute, is approximately 220 meters x 200 meters.

A maximum **2-storey built** environment was created around agricultural areas, and building heights sensitive to the historical background of that area were selected. Emphasis is placed on the historical spirit of the place by using both natural materials such as brick, glass, steel, and recyclable carrier materials.

# Conclusion

In this study, 21st century learning spaces vision for Gebze province and Gebze Technical University is foresaw and a bio-based agricultural innovation campus design is recommended as part of this vision. We have analyzed bio based agriculture through innovation topics for Gebze Technical University profoundly. Even though Turkey is not a leading producer in the global bio products sector, agricultural-forest-waste productivity and potential are high, compared to leader-producer countries.

With that in mind, the specification of bio-based products' production, research and development, technology, marketing, education problems in Turkey, support the right strategies for the desired bio based innovative agricultural oriented campus. The examination of Gebze informed the innovative agricultural campus program ve future's agricultural tourism proposed for Gebze Technical University. Our approach to the bioeconomy and agriculture has shaped our campus program and our motto: 'bioproducts are the idea of using innovative agriculture.'

In our study, after examining the upper scale master development plans and the agricultural history of Gebze Technical University, agricultural tourism routes passing through the GTU plots in the future are suggested. On a route of academic, social-cultural activity-accommodation functions in the campus program for GTU; It is suggested that the technopark-academy-research and development-management functions should be gathered on another route. These two routes are intersected at the point of Marmaray and academy functions. Accordingly, taking into account the campus program, it is aimed that the location of the agricultural innovation center is located in an area that allows production and transportation easily. Considering the strong connection of the GTU land between the coast and the city and the commercial area-educational structures around it, it will support the agricultural tourism of the campus and Gebze coast in the future.

The possible stopping points are proposed at the GTU site between Gebze ve Marmara coasts as we called the agricultural tourism and agricultural innovation. Thus, the innovation campus has shaped around agriculture, in other words its technology, its innovation, its production, its products, its research and development. The innovation campus has been designed in the west zone of existing GTU's north campus. The needs of the city and GTU campus are evaluated within the scope of the project.

As a result, the campus and its around program has been divided different strategical zones: AGRITOURISM ZONE, FUTURE AGRICULTURE DEVELOPMENT ZONE, ENERGY PRODUCTION ZONE, WASTE MANAGEMENT ZONE (5R-Refuse-Reduce-Reuse-Repurpose-Recycle), HOUSING ZONE (single, couple, rent room, free room, academic lojman), AGRI PARK ZONE, BIO BASED INDUSTRY ZONE, TECHNOLOGY DEVELOPMENT ZONE, SPORTS ZONE, ACADEMIC ZONE, FOREST ZONE, COMMUNITY GARDENING ZONE, HOBBY GARDENING.



The campus master plan aims to attract a population from younger to older people attracted by the campus. Thus, they are willing to carry out R&D studies, to use modern and new technologies, to learn together with industry and agriculture. The proposed GTU campus and new agriculture innovation institute program is composed not only for students, academicians but also for the local people, tourists and businessmen. Open space workshops and certification programs for local people, agriculture festivals, and exhibitions for the tourists are proposed on the campus to enhance the awareness of agriculture and bio-based products production in the region.

'It is aimed to design an innovation institute as an campus experience and continuous learning space.' The project (B)iobased, (A)gricultural, (S)ustainable, (I)nnovation, (C)ampus -BASIC- is proposed with its design principles based on the innovative agricultural bioeconomy vision.

As a conclusion, -BASIC- project presents macro and micro-scale scenarios for GTU to be considered for future potential. We hope the designers, engineers, entrepreneurs, government, local authority, and non-governmental organizations develop further studies to promote the agricultural characteristics of Gebze and GTU and its capacity.

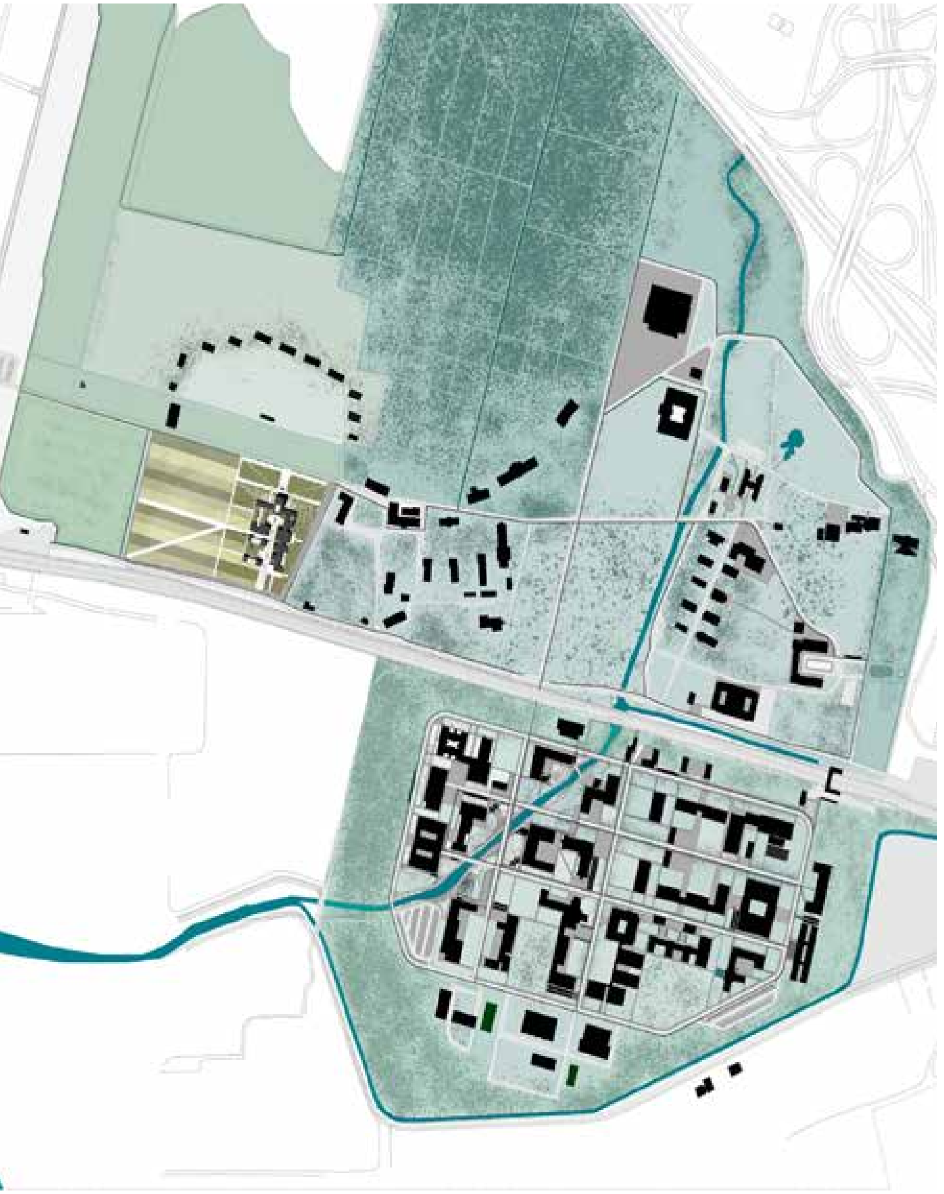
# +6

## Project 2

This is a design formed under the roof of sustainability which is one of the broadest concepts to have buildings with longer and environmental friendly lifecycles. That at the same time supports ecological and economical dynamics in an advantages way.

Designed team:
Homa Raeissi
Pablo beltarn
Remy Thaller

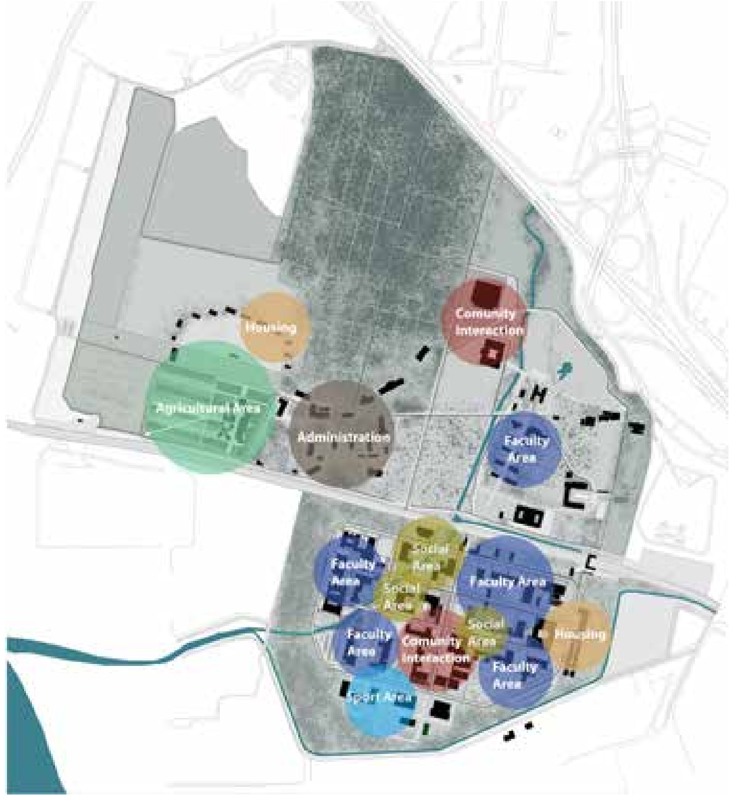
# 6.1.1 GTU Master Plan Sustainable Innovation Campus



Gebze Technical University provides education and teaching to the benefit of the society, industry, and the region, delivering practical solutions for the society's and industry's problems without compromising on scientific, ethical and social values. There is a university life full of career days, entrepreneurship summits, science and technology days, supporting the social campus.

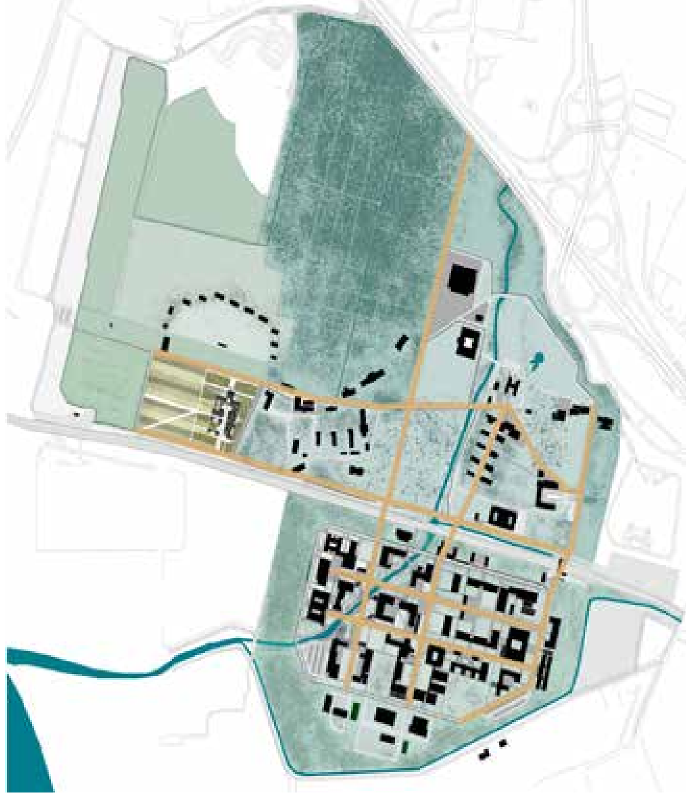
The campus awaits you right beside the Sultan's Meadow (aka Hünkar Çayırı) where Mehmed the Conqueror (Fatih Sultan Mehmet) established his pavilion and drew his last breath. Our campus is breathtaking with a green area as big as Kınalıada (one of the Princes' Islands in Istanbul) and faculty buildings that do not harm the natural texture.






## Functions and Zones

- Agriculture Zone
- Faculty Zone
- Housing
- Social Zone
- Administrartion Zone
- Community Interaction Zone
- Sport Zone
- Forest Zone



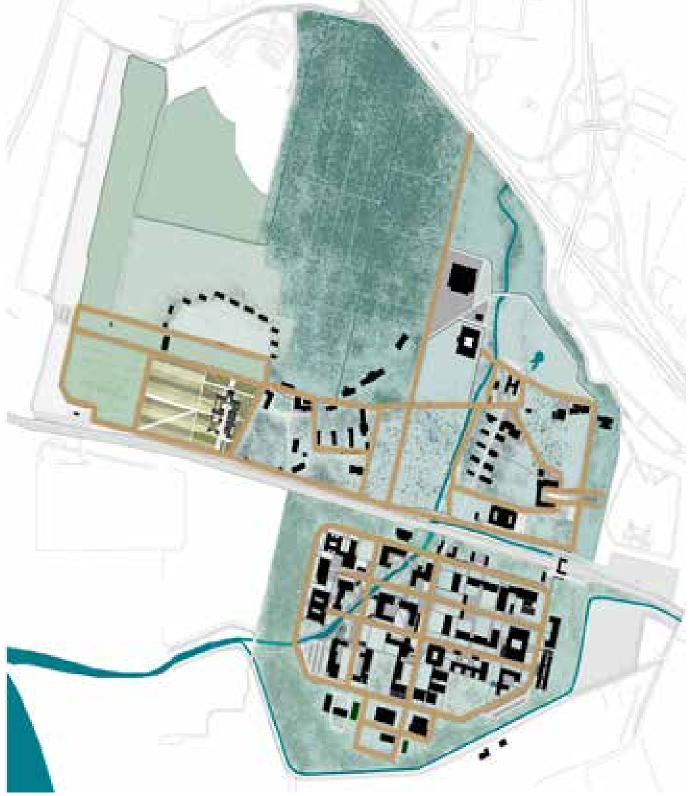
## Main Axes

In the campus there are 3 main axes one of them is extended from the north to the west. The second one links the west to the east, and there is a an other access which is parallel with second one to provide easy access to other sections.

## Entrances for Pedestrians

Therearesomeentrancestothecampusincluding cars, pedestrains and public transportation.





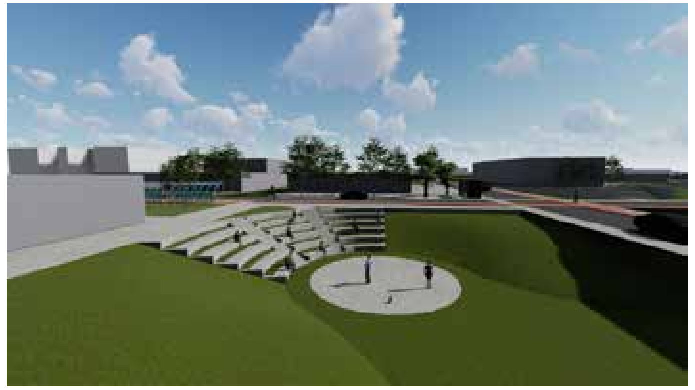
## Entrances for Motor Vehicles

There are 6 entrances for motor vehicles, that are shown in the figure.

## Bicyle Road and Parking Area

As the campus is expanded we need some sustainable transportation. Bicycle is the best choise that provides access to whole part of the campus specially faculties and social area and also link the south and north campus together. Yellow circles demonstrate spots that bicycle station available.

# Campus Landscape Approach



Seminar/Conference

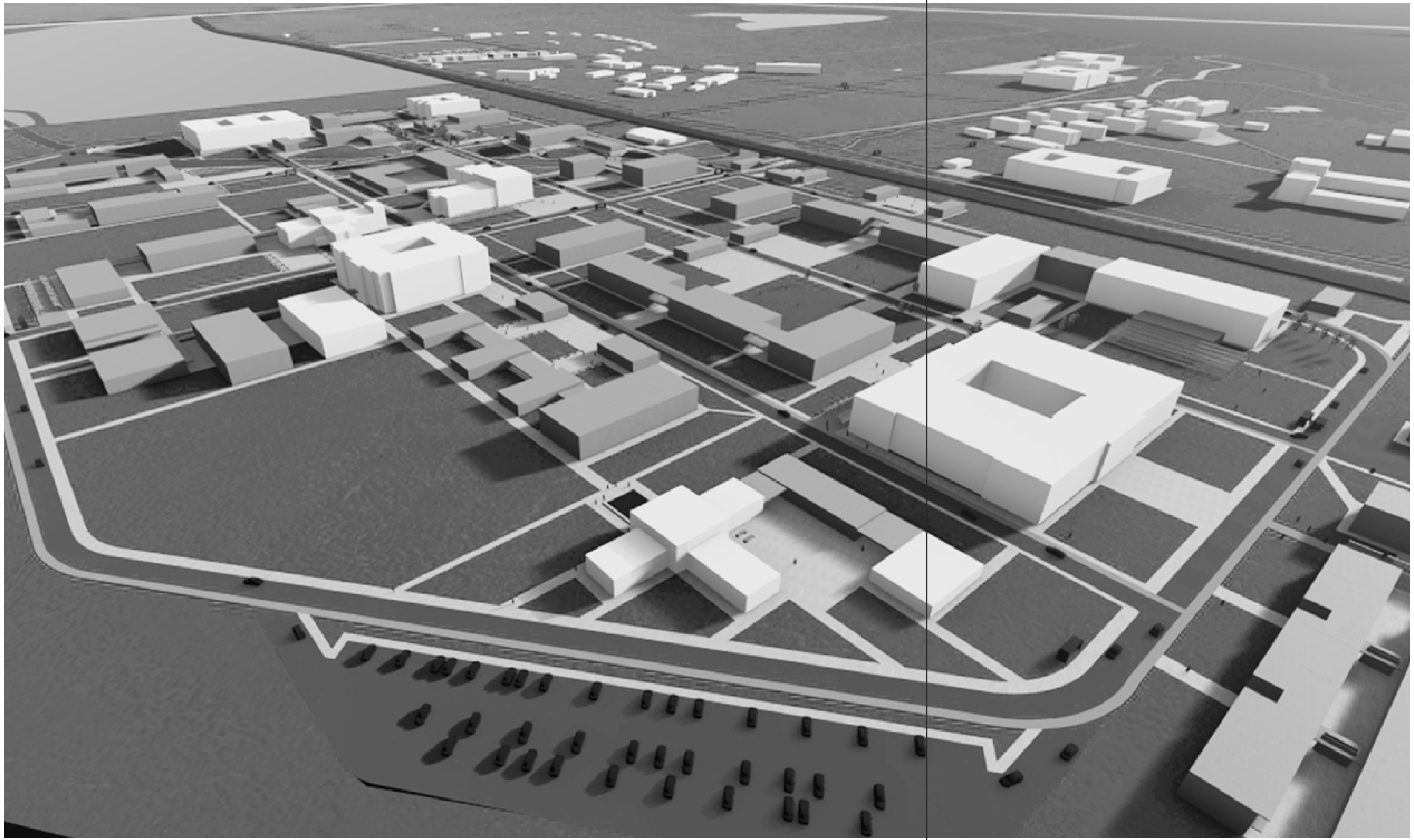
Foyer Area

Study/lounge

## Event Circle & Researcher’s Hub

The event circle is located in the south campus near by the river, that lie down between the faculties. This area is also considered as a center hosting the activities of the campus area in different functions. Common Student Work Space, positioned just behind this area, is conceived as a research hub. That is open to common use of all institutes and can provide a collective working environment.

At the same time, by giving access to the event circle level from this area, it is thought that the Event Circle will work like a foyer area. This event area, which has an amphitheater layout, can work as a free study and recreation area, as well as an open-air seminar, conference or concert area.





## South Campus

A new road is place on the campus to provide extended links between various department and sections that leads to short distances and fast access between different zones.

We change the building scale to the human size, turning the sections to a more attractive and also leading to decreased energy consumption that is one aspect of sustainable buildings.

To support an active and creative atmosphere we design new spaces to increase mobility including new bicycle ways, bicycle parking and green ways for pedestrians. The Marmaray line creates easy access to the students and people throughout the campus and we placed dormitories near the metro station. Collaborative aspects of campus are improved by placing Event Circle & Researcher's Hub, Restaurant, Conference hall and Exhibition hall. University play an important role nowadays so in our plan we situated startup center, Innovation hub to provide novel chances for young pioneers. As there is a huge area in the campus we noticed the possibility of public areas in the university. One of the goals is increasing the relation between people and university that our design is based on the advantages of this situations including public area and open air activities.

## 6.1.2 Campus Program

### Current Program

- Library
- Research Laboratory
- Indoor Sports Hall
- Indoor Swimming Pool
- **Faculty of Engineering**
- Computer Engineering
- Bioengineering
- Environmental Engineering
- Electronics Engineering
- Industrial Engineering
- Civil Engineering
- Geomatics Engineering
- Chemical Engineering
- Mechanical Engineering
- Materials Science and Engineering
- Aerospace Faculty
- Aeronautical Engineering Department

- **Faculty of Science**
- Physics
- Chemistry
- Mathematics
- Molecular Biology and Genetics

- **Faculty of Business Administration**
- Economics
- Management
- Science of Strategy
- Faculty of Architecture
- Architecture
- City and Regional Planning
- Industrial Product Design



## Institute Program

### New sustainable approach program

- Workshops Space
- Innovation Hub
- Work And Study Center
- Common Student Work Space
- Study And Consultation Rooms
- Startup Center
- Co-working Space
- Meeting Space
- Laboratories
- Faculty of Energy & Materials
- Micro Systems Laboratory
- Laboratory of Advanced Semiconductors for Photonics
- Laboratory of Macromolecular And Organic Materials
- Laboratory of Nanoscale Magnetics Materials And Magnetics
- Laboratory of Nanoscale Electronics and Structures
- Supramolecular Nano-Materials And Interfaces Laboratory
- Programmable Biomaterials Laboratory
- Faculty of Chemistry & Chemical Engineering Department
- Student Residence Buildings
- Housing: 6*12 Beds
- Health Center
- Research Laboratory Center Support Buildings
- Recreation
- Art Gallery
- Art Workshops
- Cinema/Theater Space
- Shops: Way of take necessities for life next to housing buildings
- Food Court: Multiple Food Options Located in one space, mixture of private retail vendors
- Coffee Shops

## Campus Design Principle

Proper site selection is the first step in creating a sustainable building. The location of a building affects a variety of environmental factors, as well as other factors such as security, accessibility, building energy consumption, and energy consumed by occupant, transportation system, impacts on the local ecosystem, and the use/reuse of existing structures.

Optimizing site potential is about using existing space and elements of a site rather than destroying a building and throwing the scraps.

During the design and development of a building, we need a comprehensive and integrated approach to the process for:

-Passive measures like as climate-responsive design, daylighting, and conservation practices can help to reduce heating, cooling, and lighting demand.

-Utilize energy modeling during the design process to improve building performance.

-Especial sensors and air quality alerts are able to optimize system control techniques.

-Monitor project performance by metering, yearly reporting and periodic re-commissioning strategy.



## Our Approach

A whole-system approach to sustainable site planning should include the following ones:

-Understand the local watershed organization, current watershed plans and environmental goals that may be regulated

-Use native plants and eliminate any invasive species found on the site.

-Incorporate transportation solutions into the site plans, leading to enough bicycle parking, carpool staging, and closeness to public transportation.

-Encourage people to novel transportation models rather than traditional ones.

-Existing aesthetic viewsheds from existing buildings, landscape elements, and historic locations must be respected.

# 6.1.3 Campus Landscape Approach

## Optimizing Operational Practices

No matter how sustainable a building was designed and constructed, it is pivotal that the building should be managed responsibly and maintained properly. For instance, Toxic cleaning chemicals can damage indoor air quality and any problem in sensors might compromise energy efficiency and also inadequate training can result in early system failures.

Sustainable operations and maintenance (O&M) practices are largely concerned with the activities of building occupants, and they include safety, health, safety, comfort, and productivity, as well as an appreciation of the need for future generations to reuse and recycle building components.



# 6.1.4 Sustainable Strategies

## Minimizing non-renewable energy consumption

The majority of energy consumption in buildings is still derived from nonrenewable and fossil fuel resources. There is a rising demand for fossil fuels, entailing the availability of fossil fuel sources in the future, concerns about energy security, and greenhouse gases. It is critical to find ways to increase efficiency and renewable energy resources in all types of facilities.

During the design and development of a building, we need a comprehensive and integrated approach to the process for

-Passive measures like as climate-responsive design, daylighting, and conservation practices can help to reduce heating, cooling, and lighting demand.

-Utilize energy modeling during the design process to improve building performance.

-Especial sensors and air quality alerts are able to optimize system control techniques.

-Monitor project performance by metering, yearly reporting and periodic re-commissioning strategy.

# Agriculture Innovation Center

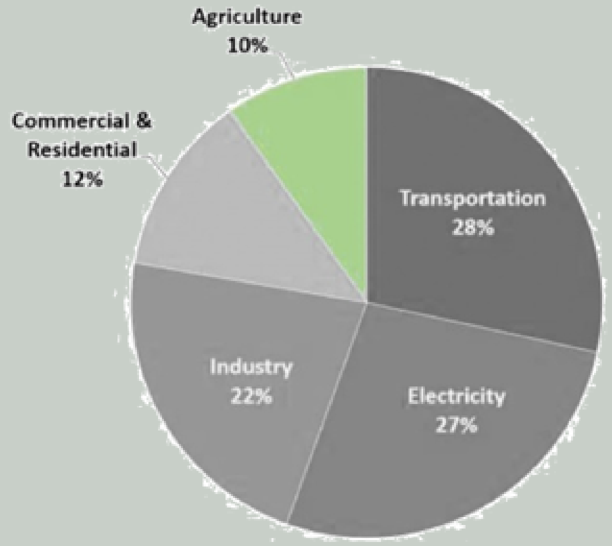
# Scenario

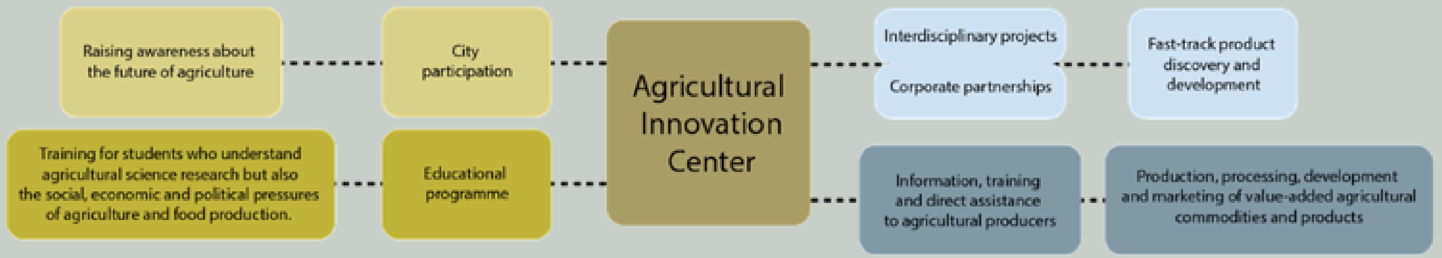
Due to population growth and climate change, we have to produce more food for more people with fewer resources. Thus, agricultural bioscience research will need to adopt new research models including interdisciplinary projects and corporate partnerships, to help fast-track product discovery and development The agricultural Innovation Center will pave the way for new research.The new Agriculture Innovation Center located on the Gebze Technical University site will provide information, training and direct assistance to agricultural sector in the production, processing, development and marketing of value-added agricultural commodities and products. Thus, the building will be composed of two main departments, one for Theory (Mind department) and one for Practice (Hands department).

# 6.2 GTU Master plan Sustainable Innovation Center

## 6.2.1 Architectural Design Brief

It is also important to make people from the city feeling included in the project and to raise awareness about the future of agriculture as it represents between 11 and 13% of the world's total anthropogenic Greenhouse Gas emission. Agricultural objectives that are meeting quantitative production and environmental goals can be achieved by educating people. For example, food demand can be managed by reducing food waste. Thus, the building will also have public areas for lectures, exhibition, workshops, and an educational program to produce students who will understand agriculture science research but also the social, economic, and political pressures of farming and food production. A market will also take place on the site to provide local food and create a connection between producers and local people.

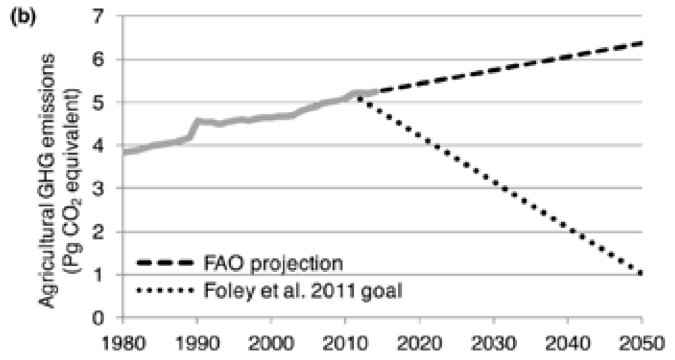


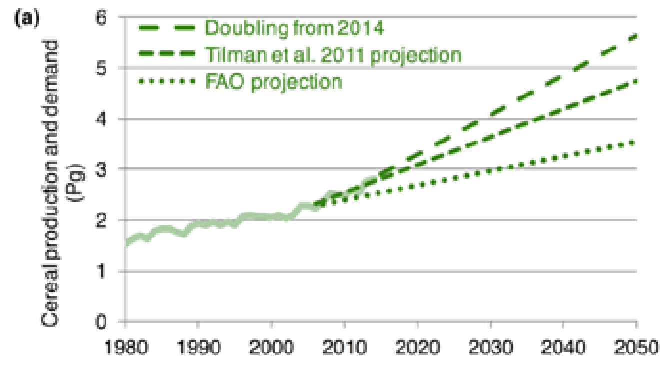






## Innovation Techniques

- Site analysis and planning, orientation of the building
- Passive and active sustainable design
- Eco-friendly, high quality building materials and recycled content
- Energy-efficiency and renewable energy systems
- High indoor air quality
- Energy efficient lighting and daylighting
- Water conservation and rainwater harvesting
- Stormwater management



# 6.2.2 Institute Program

## The “HAND department” and the “MIND department:

Within our program we target two different atmospheres, one of them is dedicated to the mind, with all those elements related to the world of ideas, the world of knowledge and its development, and another department shapes to the practical part.

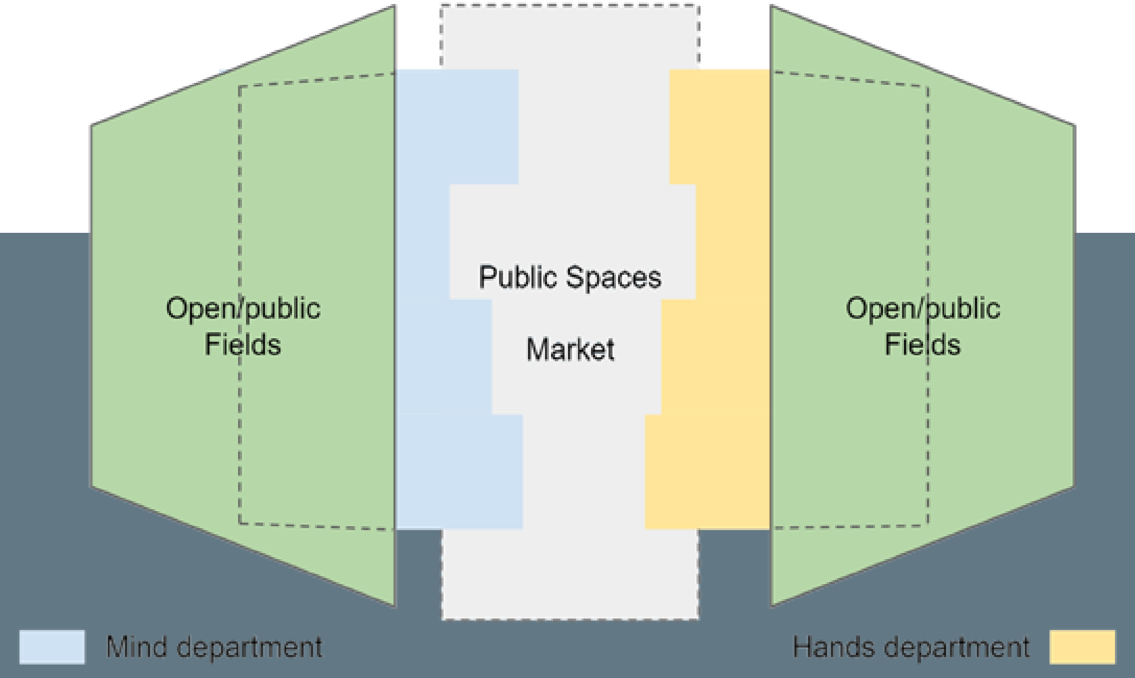
## Public spaces:

This area is designed as an interface between the departments as well as a point of articulation for activities in the two worlds. And flexible spaces that is able to cover various social activities.



## Open/shared Field Areas:

Cultivation areas where everyone is able to practice, and share develop techniques and methods.



# A Zoom In The Hand Department:

## Within this department we find everything related to material interactions.

This department provide different areas of knowledge and research:

- Sustainable Greenhouse with bio lab
- Growth chambers
- **Laboratories:**

### Herbal research center:

Learn different herbalism methods for health treatments, prevention and hygiene.

Produce products from plants for aromatherapy, different cosmetics and other medicinal treatments

### Vegetable refrigeration:

Research on optimal ways of storing and preserving agricultural plants and food products.

### Seed lab:

Ways to improve seed quality, as well as seed identification analysis of agricultural products.

### Soil test lab:

Chemical analysis of the soil to determine the level of fertility of the soil and to be able to develop better cultivation areas.

### Water quality lab:

Physic-chemical research and water pollution assessment.

### Hydraulic and fluid mechanics laboratory:

Study and experimental development of models of small hydraulic structures, especially those needed in an agricultural irrigation system.

### Surveying workshop:

The set of procedures to determine the positions of points on the productive surface or base, for the development of the soil and its knowledge.



### Soil mechanics laboratory:

Development of quality control, assessment of the mechanical behavior of soils and soil classification.

### Horticulture group lab:

Development and research in consumer vegetable production.

### Agro technology lab:

Application of technological advances to the agricultural environment, promoting the digital transformation of the countryside to achieve greater efficiency in this environment.

## Mind Department:

Comprises all programs that are mostly related to theoretical research and study.

This part of the program is divided into different areas:

- **Open/shared Laboratories:**

Laboratories designed for networking, where project information, resources, decisions and proposals are shared.

- **Closed offices**

- **Designated offices/laboratories for corporate partners:**

**Spaces designed so that companies can develop proposals under the infrastructure and with the help of the innovation center.**

- **Auditorium**

- **Exhibition hall**

**A space designed for the permanent and temporary exhibition of the work and advances in the field of agriculture presented by the innovation center.**

- **Theoretical classrooms**

- **Library**

- **Meeting rooms:**

Rooms designed to host different activities to improve ideas and research.

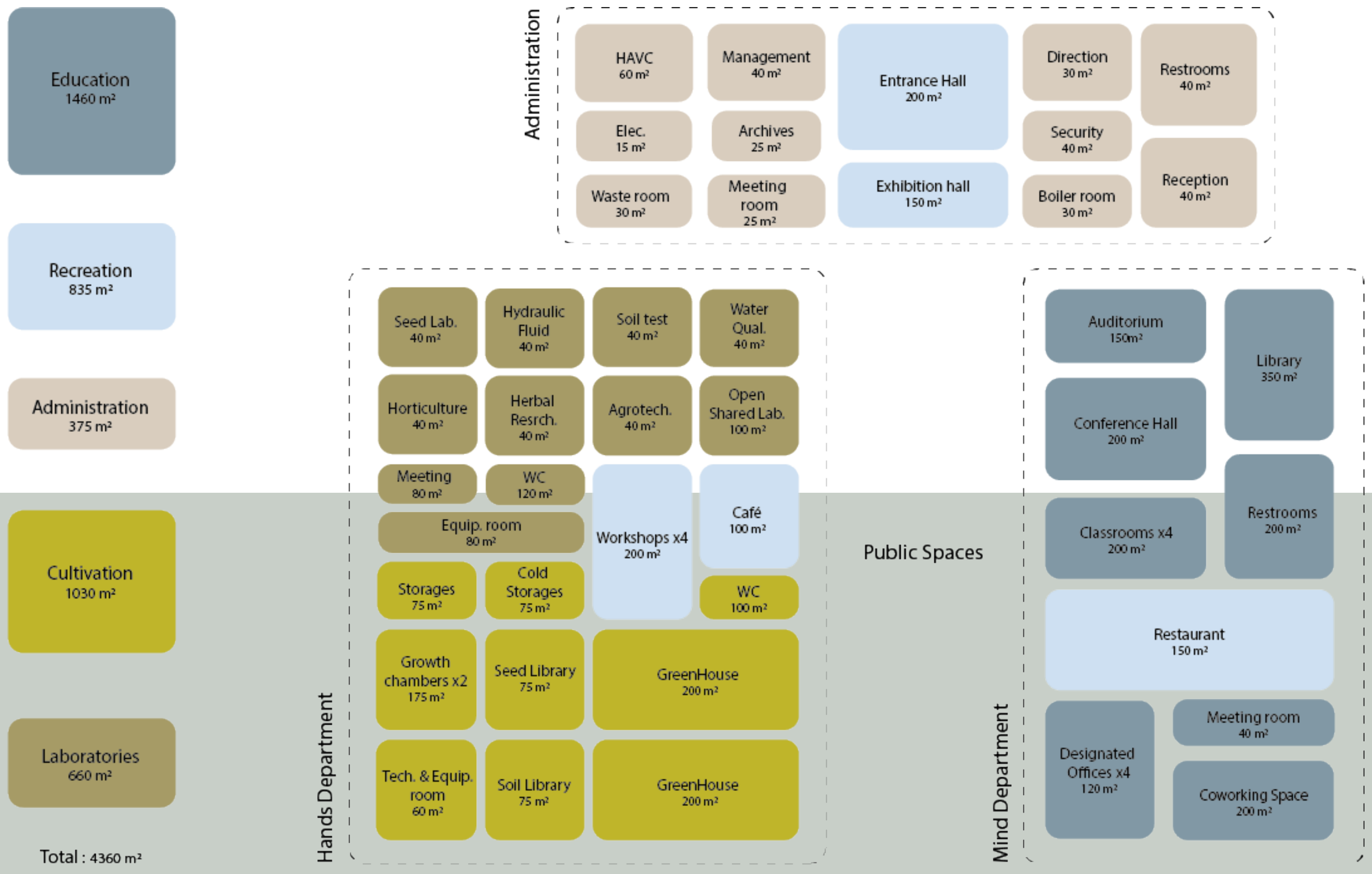
### Open/shared field areas:

provides novel practical outcomes based on research and development.

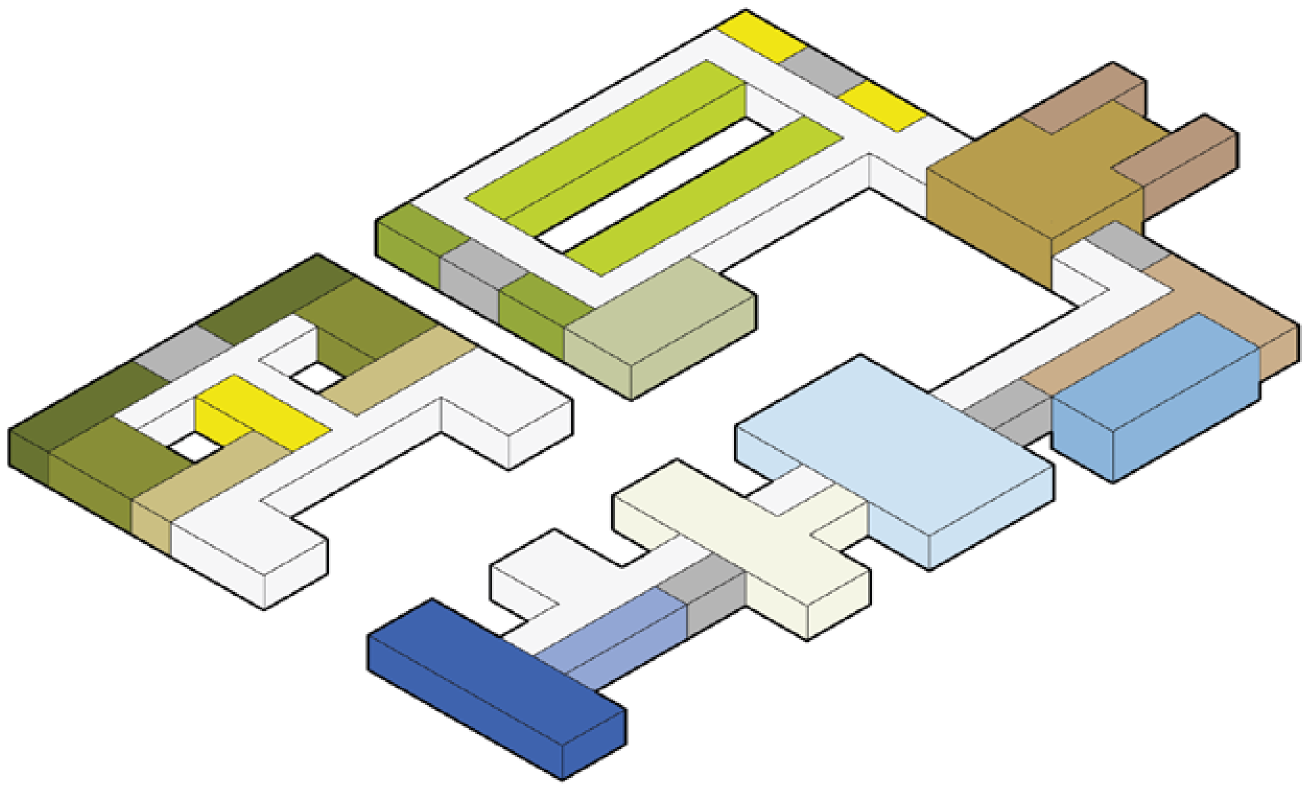
- Fertilizer Storage
- Farm kitchen workshops – Sustainable cooking:

Participants will learn how to prepare and cook plant-based meals and experience the beauty of a 'farm to table' lifestyle.





## Program Diagram



**Hands Department**

- Laboratories
- Meeting rooms
- Equip. room
- Café
- Restrooms

- Growth chamber
- Storage
- Seed and Soil library
- Equip. & Tech. room
- Restrooms

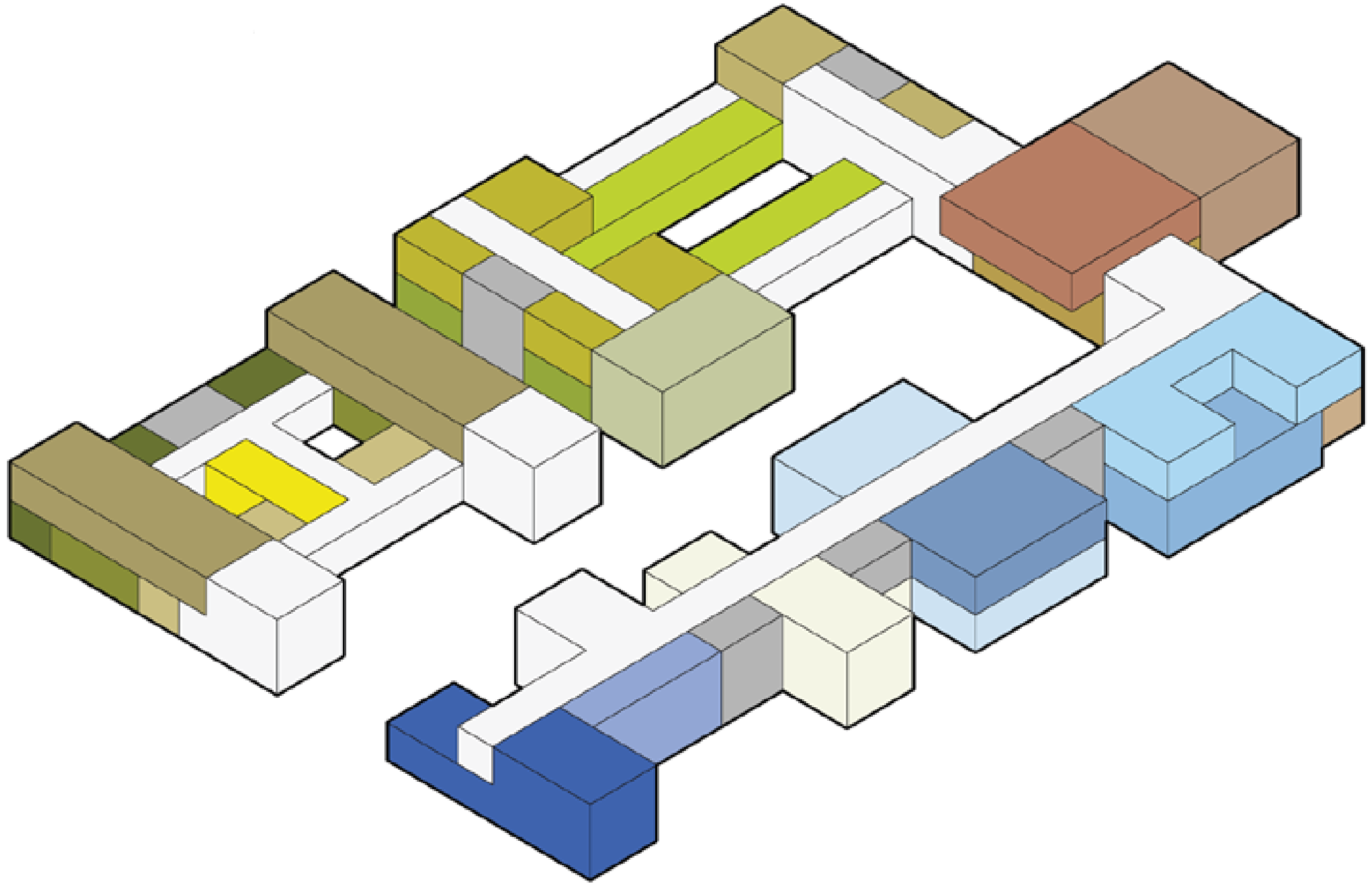
**Entrance Building**

- Offices
- Maintenance rooms
- Entrance Hall

**Mind Department**

- Auditorium
- Library
- Restaurant
- Designated Offices
- Coworking space
- Restrooms





**Hands Department**

- Open/Shared Laboratories
- Workshop
- Café
- Restrooms

- Greenhouses

**Entrance Building**

- Offices
- Exhibition Hall

**Mind Department**

- Classrooms
- Conference/Lecture room
- Restaurant
- Designated Offices
- Coworking space
- Restrooms


*"The underground has enormous potential for realizing spatial benefits."* **Sir Norman Foster."**

## Semi Underground Building

It is necessary to establish a virtuous relationship between human beings and their surrounding environment (sun, wind, atmospheric dampness, rain, vegetation, soil), So novel re-invention of settlement typologies are necessary.Semi-underground typologies can carry out an effective response to mentioned requirements, including new buildings, and the re-use of existing urban settlements. And more, they can be very useful in the refurbishment of existing building complexes. Moreover, they are also an answer to insert a building with a "non-violent way" in the landscape. Building that is the natural evolution of the landscape.

### Sustainable advantages:

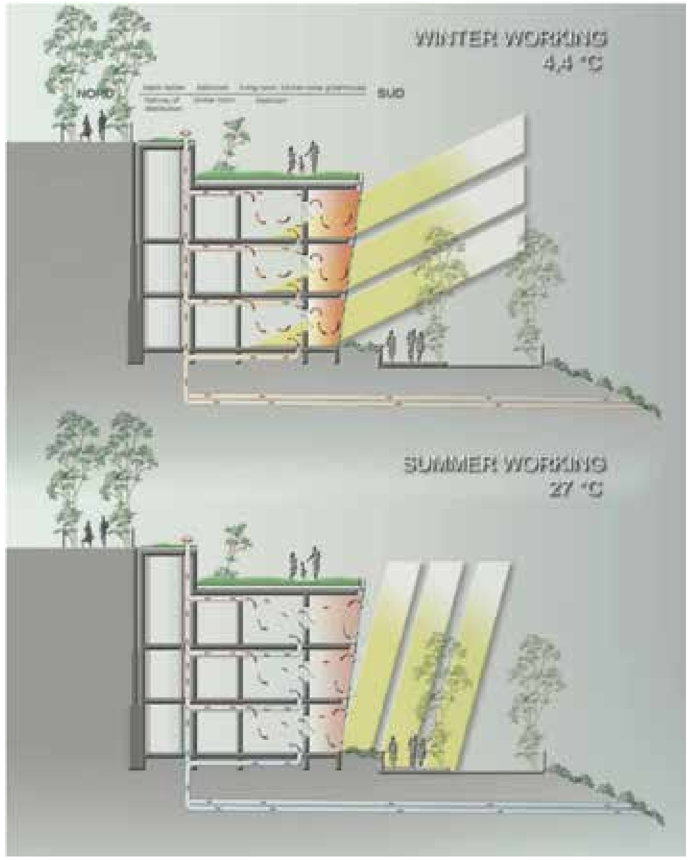
- Temperature fluctuation decreases because of the well thermal insulation of soil that maintains a temperature higher or lower than the outside.
- Due to lower surface area exposed to solar radiation, overheating reduces.
- The buildings is protected from the cold winter winds as the building becomes a whole with the land.
- Integration in the environment improved.



**Disadvantages** such as poor ventilation can be resolved by coupling two systems for passive cooling:

1) Indirect contact with the ground: it takes place by means of pipes laid deep in the ground, which cools outdoor air before ventilation at the building. (possible thank to the properties of the soil that maintains a constant temperature at a certain depth).

2) Bara Costantini system: it consists of ventilation chimneys connected to the interior by ducts which travel through the air vents located at the top of the wall, pulling out the internal air which is warmer. The building gets a plant system and technology that works for both heating and cooling environments.




### Lack of natural light

- Inclination of 10° to the outside of the glass, which accommodate protection from the summer sun but lead the low winter sun to penetrate
- Insertion of venetian blinds in the cavity of the glass to protect from excessive sunlight
- an insulated aluminium roll down at night that prevents heat loss to the outside
- opening of vents at the bottom and the top of the glass for adequate ventilation system

# A Sustainable Living Method

In the globalization era, the most important obstacles which mankind is faced with are climate change, energy resources shortage and population increase. Scientists recommended lots of methods to bring out human from these obstacles. One of these methods is living underground where average mean temperature is almost steady and equal to ground surface average mean yearly temperature.

## Underground living:

- provides a comfortable, tranquil, weather-resistant atmosphere.
- have appropriate performance during natural and unnatural disasters (earthquake, tsunami, nuclear accident..)
- are an exciting solution in order to increase energy efficiency and reduce energy needs.
- Reduce energy consumption thanks to

  their sustainable features
- provide green areas and give a big opportunity to expand the green areas above the surface of those facilities.
- have very effective role in protecting the surrounding environment.
- are build for long term period.

## Using passive sustainable design :

- Using light local material such as wood for the structure frame
- Orientate the building according to the sun light
- Using eco-friendly, high quality building materials and recycled content
- Energy-efficiency and renewable energy systems
- Energy efficient lighting and daylighting
- Water conservation and rainwater harvesting
- Storm water management
- Using the temperature of the earth for cooling and heating
- Minimizing waste during building and operation of the building
- Native landscaping including the use of trees and shrubs for shade and windbreaks

# Facts Related to Human Comfort In Underground Buildings

- Human comfort depends on various factors, entailing temperature, humidity, air velocity, solar radiation, illumination rate, environmental condition, air contamination and quality, odor, noise, ventilation and also body metabolism.
- Human can feel uncomfortably "hot" during the summer if the relative humidity is high, because of evaporative cooling of the body due to sweating.
- Human feel more comfortable and do not develop cracked or dry skin problems if the winter time relative humidity is not too low.
- Depends on the thickness and compact rate of exterior soil, ventilation can reduce or increase. Also, humidity can influence on necessary ventilation rate.
- Indoor air quality in underground buildings is more appropriate than up ground buildings due to the fact that today's cities air have a lot of contamination and is smog.
- Thermal comfort can be provided easily owing to the fact that soil is appropriate thermal mass.
- Solar radiation has less influence there and can be more pleasant in the case of appropriate design. Indeed, there isn't direct radiation and it can be very smooth.
- Illumination rate should take more attention due to less and indirect outdoor radiation.
- Wind has fewer effects there and cannot increase air velocity rate. However, less air velocity can cause feeling discomfort.
- Indoor environmental conditions absolutely depends on design in underground building, however, outdoor environment has appropriate potential to feel comfortable due to less interfere in nature.

## Building Sustainable Greenhouse :

orientation with the longest side facing the sun. Freestanding greenhouses, easy to ventilate through natural means, conserving energy in the process.

### Landscape sustainability techniques

Nature availability: views of native trees and plants allow for connectivity to nature and the landscape overall.

Stormwater management: a bioswale allows reuse of stormwater.

Rain gardens: a manmade depression created to promote proper drainage, like bioswales, this technique also features an array of plant life and provides suitable habitats for wildlife.

Green Walls: a wall, either free-standing or part of a building, that is partially or completely covered with vegetation and soil or an inorganic growing medium.

Xeriscaping: a solution refers to the practice of landscaping specifically for areas that are susceptible to drought. A common factor in xeriscaping is reducing the amount of grass used in your outdoor space, since its usually one of the most taxing elements when it comes to water conservation.



## Water Management and Water Conservation

Many nations face difficult economic challenges with limited resources and financial capability to meet the Clean Water Act (CWA) requirements for storm water and wastewater updates. To address these concerns, communities want to use cost-effective green infrastructure projects to address their water quality and quantity needs.An integrated plan is a process that identifies efficiencies from separate wastewater and storm water programs to best prioritize investments and achieve our human health and water quality objectives. This approach can also lead to more comprehensive solutions, such as green infrastructure , that improve water quality.

## What Is Green Infrastructure?

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits, reducing and treating stormwater at its source while delivering environmental, social, and economic benefits. Stormwater runoff is a major cause of water pollution in urban areas. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains also can cause erosion in urban streams, damaging habitat and infrastructure. When rain falls in natural, the water is absorbed and filtered by soil and plants. Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments.

When rain falls in natural, the water is absorbed and filtered by soil and plants. Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments.

## Various methods of Green infrastructure

### Bioswales

Bioswales are essentially rain gardens placed in long narrow spaces, being vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows.

### Permeable pavement

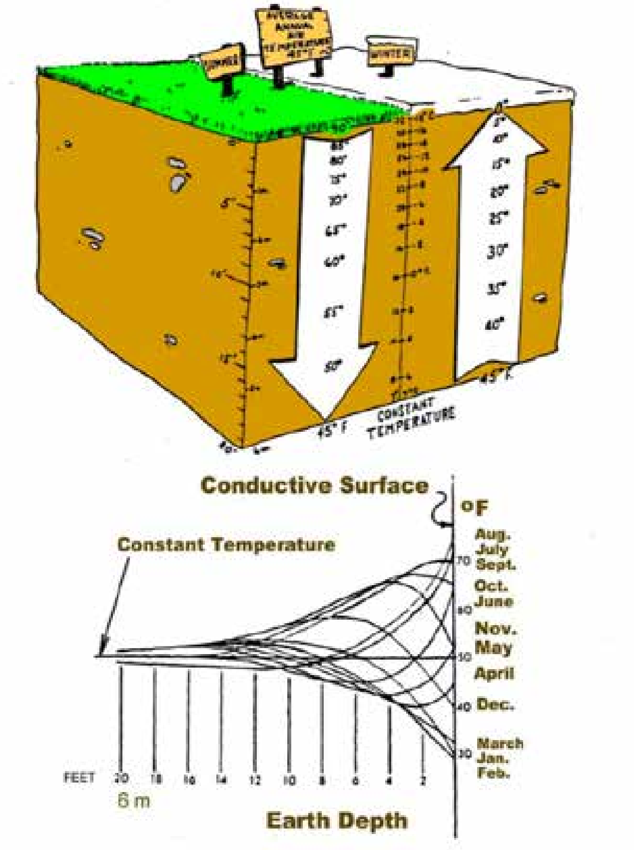
Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be cost effective.

## Underground Temperature

The depth between zero and 10 meters is characterized by insulation from outdoor temperatures, by increasing seasonal temperature stability, and by cool temperatures in the summer and warm temperatures in the winter. Thus, it is recommended that this depth level should be the zone that accommodates the most human diurnal activities, because it is most comfortable physically and psychologically.

### Method for maintaining a deep-earth constant temperature of about 21° C:

- Heat flows by conduction from warm places to cool places, and will only return when the original source cools to a temperature which is below the storage temperature
- Far more solar heat is available in the summertime than in the wintertime.
- Earth is an ideal thermal mass for storing heat over time periods well in excess of 6 months.
- The constant temperature 20 feet (6 m) into the earth is a reflection of the average annual air temperature.
- It takes six months to conduct heat 20 feet (6 m) through the earth.





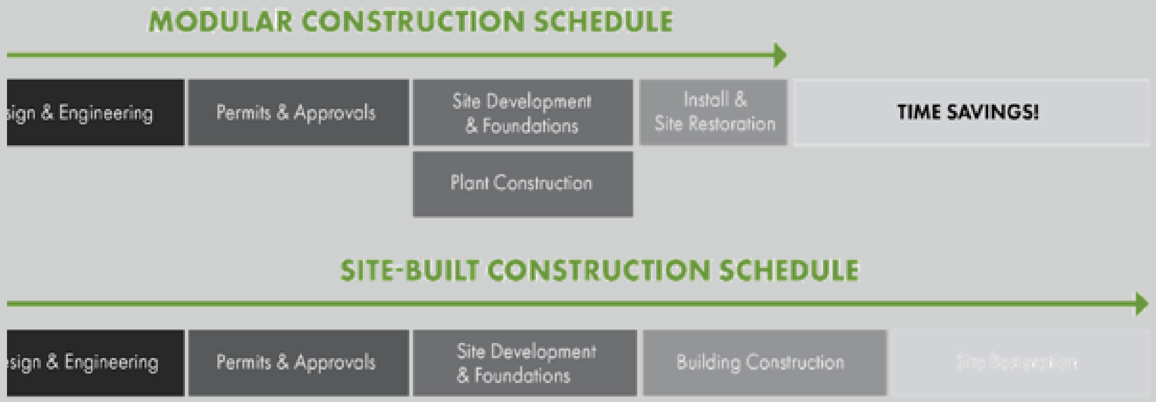

## What kind of solutions we can find?

As HMC Architects did in their project “Frontier Project” , we can add:

- Sloped walls. A narrower building allows light to penetrate deeper inside, and by sloping the walls, we allowed for even more window surface area.
- Cooling tower. A centrally located cooling tower uses water evaporation to force the cool air down the tower and into the building, while a separate tower allows the hot air to rise out.
- This two strategies can allow the project to have better control of the ventilation and, in turn, of the light, so that those benefits that were lost with a semi-underground project can be solved.

# Building Systems

- What is a Modular construction?
- It is a construction system that allows all the processes of a building to be controlled.
- Its high degree of precision and industrialisation in its construction process, together with its great capacity to adapt to the morphology of any project, make this system one of the most efficient in the architecture sector.
- Thanks to this construction system, construction times can be reduced.






# Modular Construction

## Sustainable

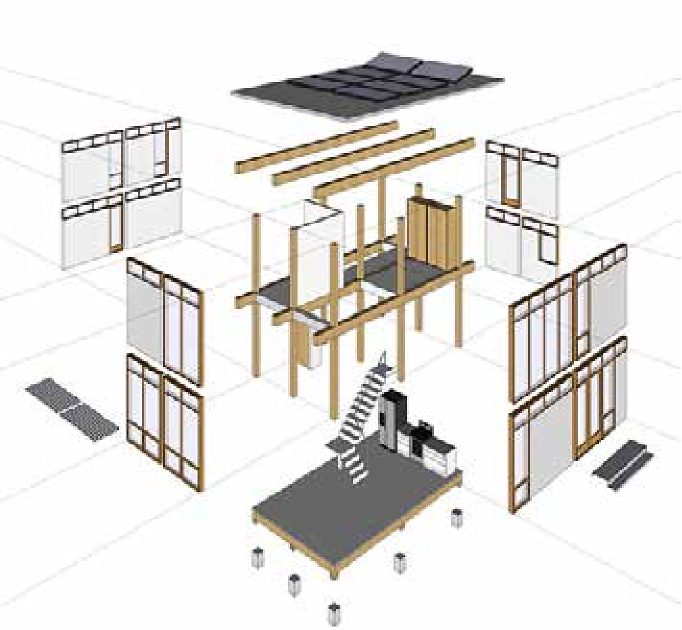
The factory-controlled process generates less waste, creates less disruption on site and allows for tighter construction.

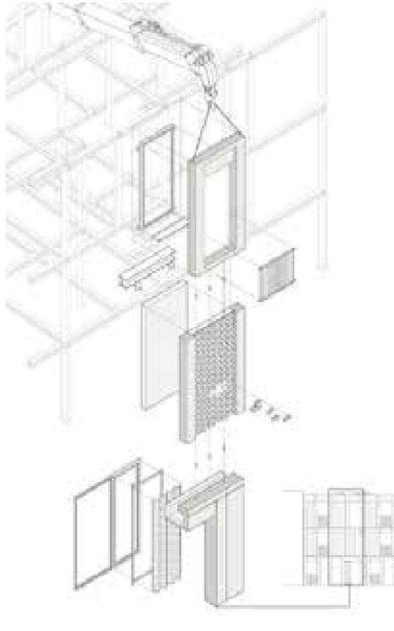
## Fast

The construction of modular buildings is carried out simultaneously with the building works, allowing projects to be completed in half the time of traditional construction.

## Smart

Modular buildings are constructed with the same materials and to the same building codes and architectural specifications as traditional construction. Once assembled, they are virtually indistinguishable from their site-built counterparts.





## Agriculture Innovation Center

### Reticular Grid

**Structure:**

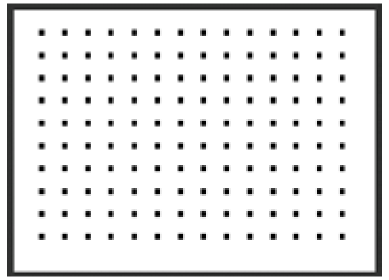
The structure marks and defines the development of the interior space. Through the structure we can observe a series of spaces that are equal to each other.

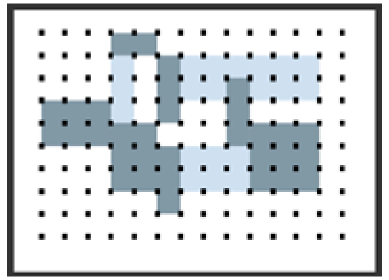
**Flexible and adaptable space:**

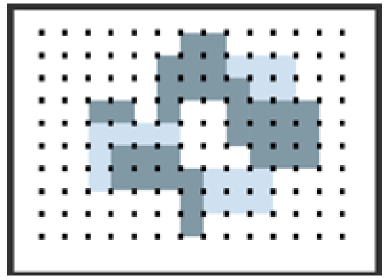
Thanks to this grid, we can generate different spaces from the same starting point, this gives us flexibility that can be linked to the temporary nature of certain spaces

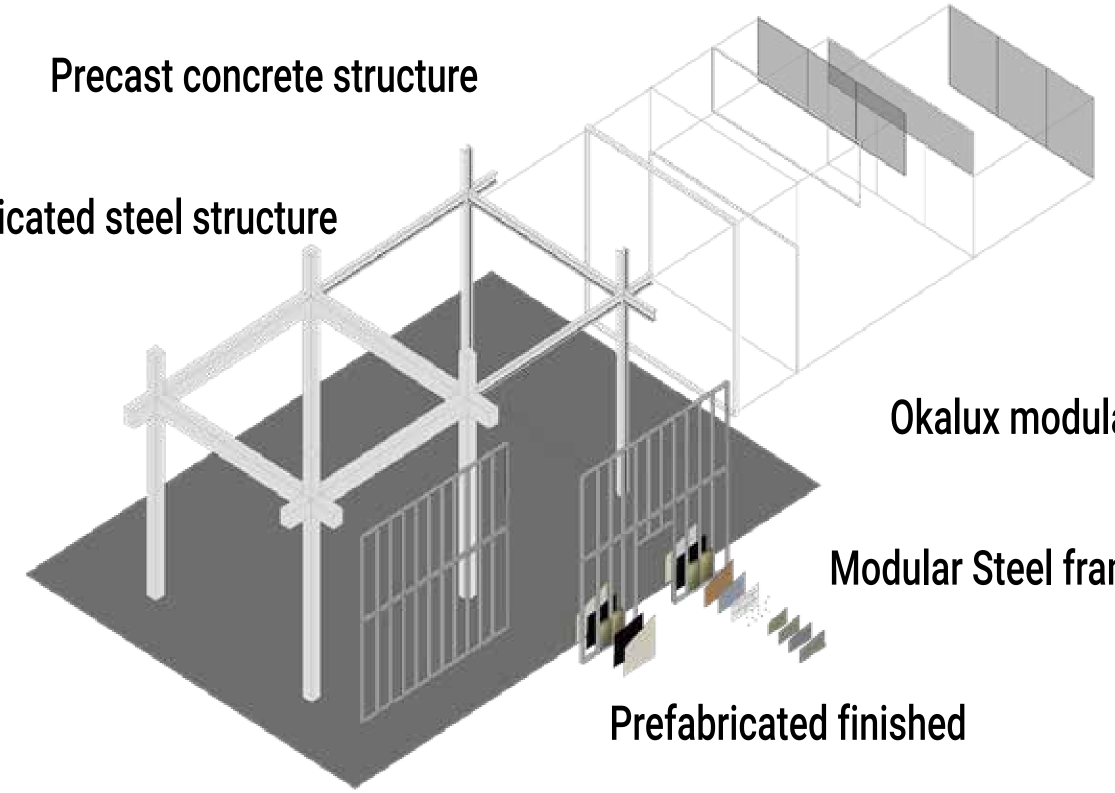
**Possibility of modular construction:**

The reticular grid is presented as a great starting point for modular construction because thanks to this type of geometry, both the structure and the enclosures and partitions can be mass-produced.





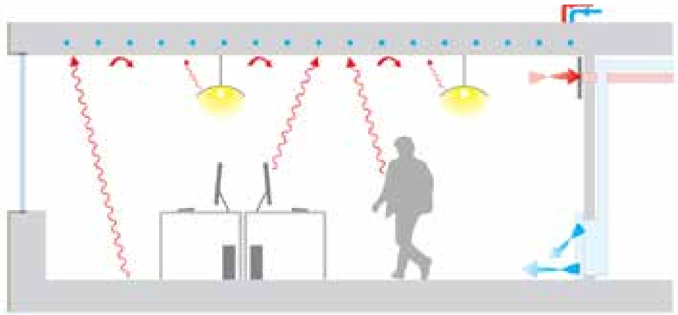




# Ecological Innovation

## Radiant heat:

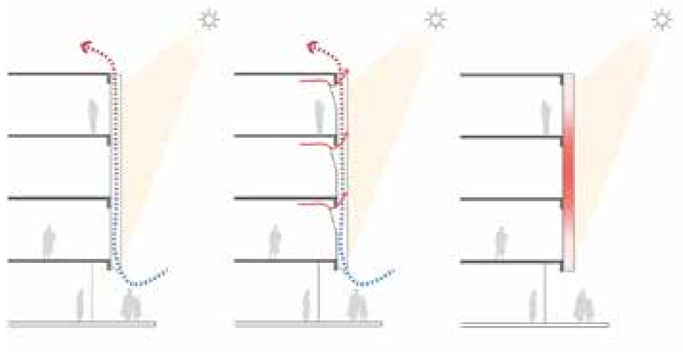
Thermal Energy is emitted from a warm element, (floor, wall or overhead panel) and warms people and other objects in rooms rather than directly heating the air.



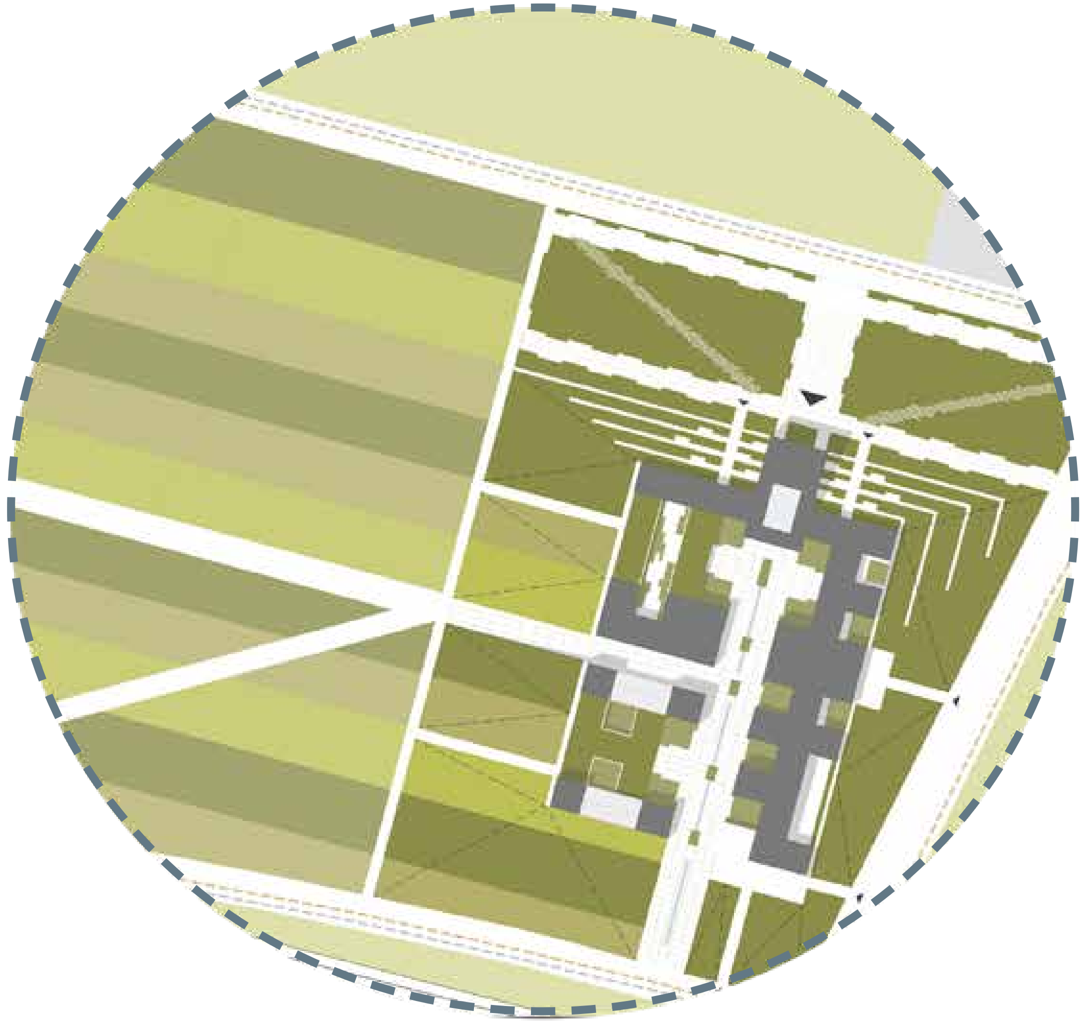
▲ Section view of room with internally cooled and heated concrete slab ceiling

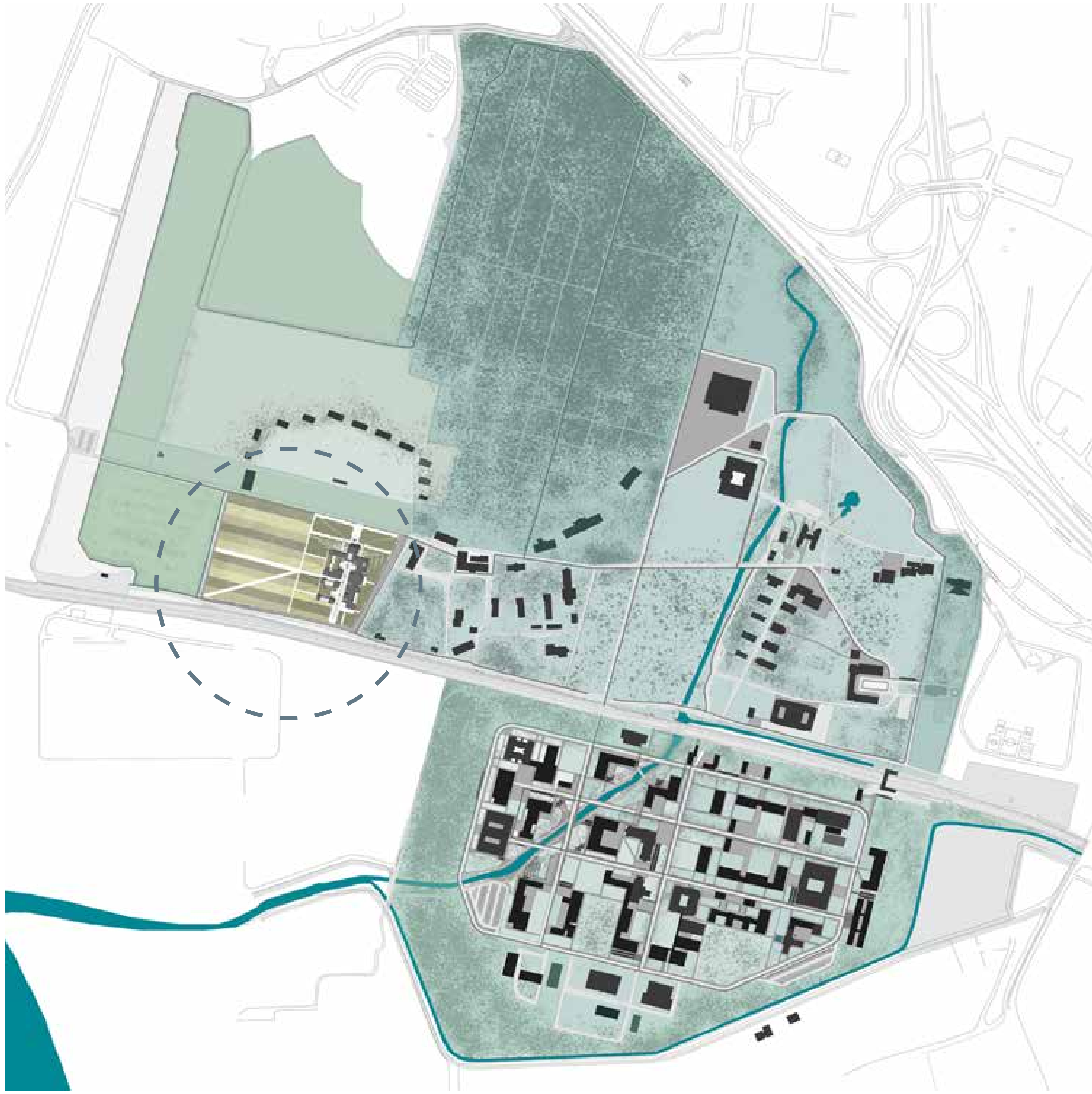
Advantage : much decreased circulation of air inside the room and the corresponding spreading of airborne particles.

System consists of two layers (usually glass) wherein air flows through the intermediate cavity. This space acts as insulation against extreme temperatures, winds, and sound, improving the building's thermal efficiency for both high and low temperatures.



## Master Plan





## 6.2.3 Design Principles




## Agriculture Innovation Center Ecological Innovation

| | Features | Impact |
|---|---|---|
| Ventilation | Radiant Slab | Reduce mechanical equipement sizing |
| | Underfloor air distribution | Reduce energy consumption |
| | Windcatcher | |
| | Outdoor public spaces | |
| Water | Recycled grey water system | Collect and reuse stormwater |
| | Hydroponic system | Optimize the use of water |
| | Green and recycled waterpools | |
| Green space | Green landscape | Provide green and natural aeras |
| | Green Roof | Create ecocsystem |
| | Vegetative and Shading devices | Reduce energy exchange |
| Natural Light | Patio | Optimize natural sunlight |
| | Clear and translucent glazing | Provides extensive daylight |
| | Double skin facade | |
| Heating/cooling | Semi-underground building | Stable/comfortable thermal temperature |
| | Geothermal Heating/Cooling system | Reduce energy consumption |

# MATERIALITY

## OKALUX EVO

The capillary slab in the cavity allows for an even and shadow-free illumination with daylight deep into the space. It provides excellent sun and glare protection and heat insulation. The fiber glass mat located only between the two capillary slabs is visible from both sides and creates an attractive lively surface.

### High Functionality:

- Optimal,even illumination of the room, without hard shadow
- Effective sun and glare protection
- High light transmission, light entry can be adjusted indivually
- High color rendering
- Good hear and sound insulation
- Protection from UV rays
- Bird-friendly solution
- Fire protection according to requirements

### Sustainibility

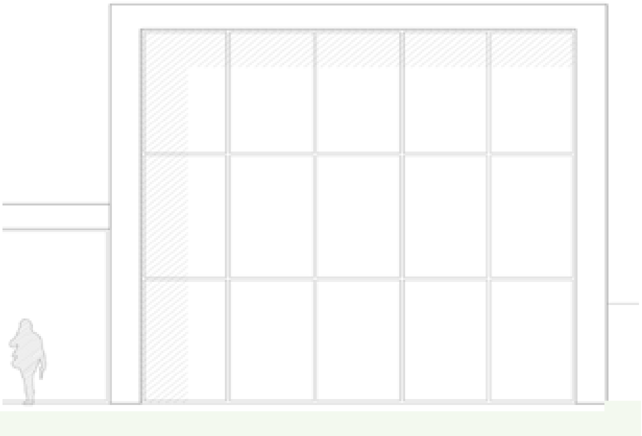
- Daylight entry reduces amount of artificial light required
- Reduction of cooling loads in summer
- Fully recylable
- Mong-Lasting, maintenance-free and easy to clean

### Attractive Aesthetics :

- Attractive appearance
- Vivid surface with depth effect
- Capillary inserts can be printed with colour and decor

### User Comfort :

- Comfortable daylight atmosphere
- Effective privacy protection
- Reduced amount of solar input into the building





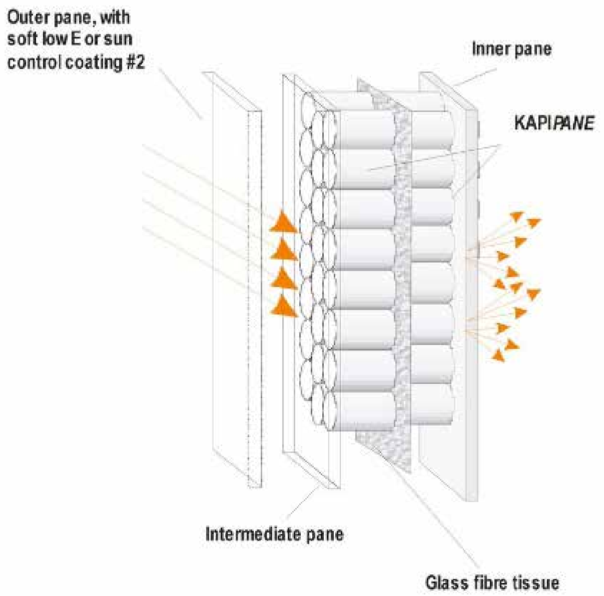
## TRAVERTINE

Travertine tiles

Size : 100x150 cm; thickness : 3 cm

### Advantages :

- local material
- Turkey has massive travertine deposits and production capacity
- lot of color variety :
- Light, classic, noce, red, silver, walnut, yellow
- reasonable price
- cheaper than its counterparts without compromising the quality
- high durability
- resistant to extreme weather (direct sunlight, snowy weather)
- High color rendering
- Good heat and sound insulation
- Protection from UV rays
- Bird-friendly solution
- Fire protection according to requirements



## 6.2.4 Technical Drawings


Underground Plan



When we look at the plans of the Agricultural innovation center, it is seen that the entrance is at the level of the street of the campus and the entrance hall faces public street. Visitors can go down fews steps to access both the mind and hands department. They can also access the building from the inner street where it can be used in various functions/events to easily take place with the aim of increasing callobration and social aspect of the center.

The inner street has a water line design with natural flow that will naturally guide the visitors to the main entrance building.

The center includes small public squares where people can gather during their breaks and feel more comfortable.

Inside the building, we have created some patios to bring more natural lights to enhance energy and accordingly the creativity and performance of the students.

## With this prediction, a courtyard was designed in this semi underground section.

Here, people can experience, natural area including semi river and trees.

Thus, they can work and collaborate in a pleasant area.

Hands department is located on the right side and mind section is on the other side.

Experts are able to research and **innovate state-of-the-art** outcomes in the transparent spaces of the laboratories.

Growth chamber which is situated in this section creates the benefits of innovative functionality, versatility, and replication of any environmental condition within a secure and robust modular enclosure.

Equipment and technical rooms which are planned to be specific to the Gebze Technical University and can be used by all target academic staffs and students.

Restaurant and cafe have been designed in this block and it is foreseen that this place will also be used together with the green space.

This structure also brings people together with the nature at the underground level.


## When we come to the functions at Ground level,there

is a exhibition hall which we can entrance from main entrance.

This place has been considered as a flexible and open space that can be decorate according to the function and need. It can be used in various functions by organizing according to the activity.

This floor of the plan holds greenhouses and workshops which is accessible from green field.

Conference hall is able to be used by various groups to demonstrate innovation and outcomes, and different disciplines can work together. It has a direct connection from the street.This offers people quick and comfort access.

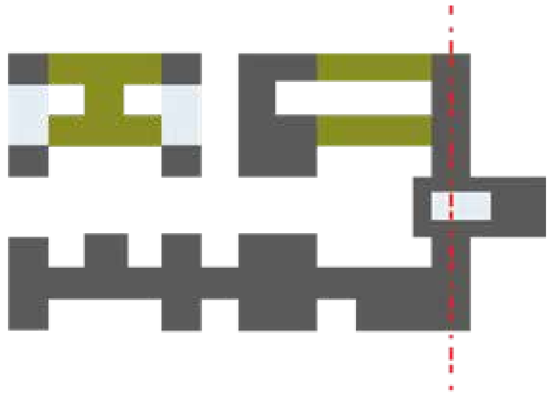
**Right section is our mind department,** there is a exhibition hall which we can entrance from main entrance.

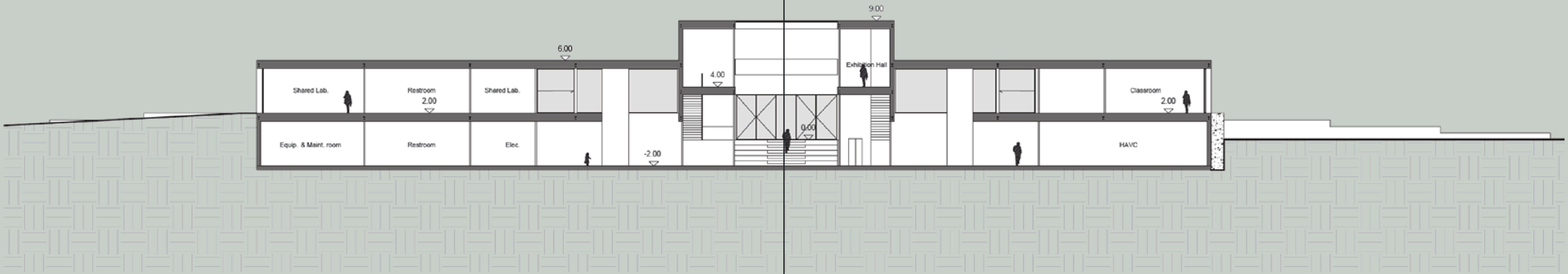
This place has been considered as a flexible and open space that can be decorate according to the function and need. It can be used in various functions by organizing according to the activity.

This floor of the plan holds greenhouses and workshops which is accessible from green field.

Conference hall is able to be used by various groups to demonstrate innovation and outcomes, and different disciplines can work together. It has a direct connection from the street.This offers people quick and comfort access.

Main entrance building is higher than other sections Purpose of this design to emphasize the building and create a target point for visitors during their walking in the public space. And also we create buildings in different height to catch human size.





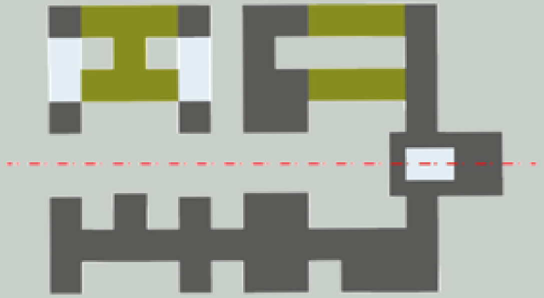

AA Section

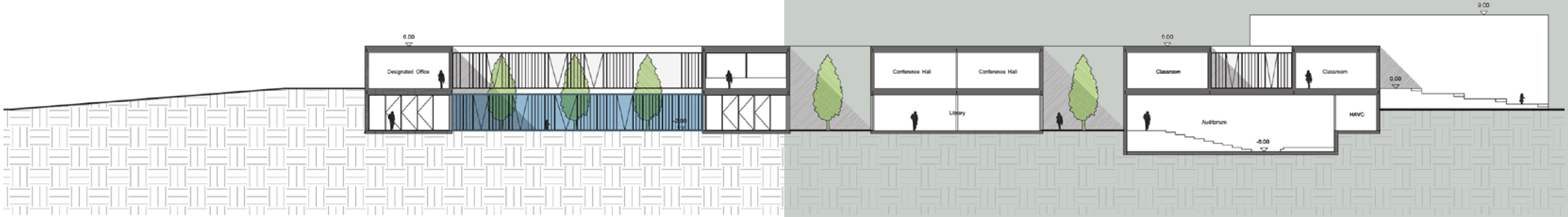
The building has a double height design in order to create a space with higher energy which enhances collaboration.

Our purpose is planning a novel research center with practical farms.

The major part of the campus has a numerous functions such as landscape area. meeting area, exhibition hall and research areas.

This place offers pleasant open spaces to be used for those on campus. It is also one of the most popular places to be used during the agricultural festival.






BB Section

Various types of

workspaces shape the

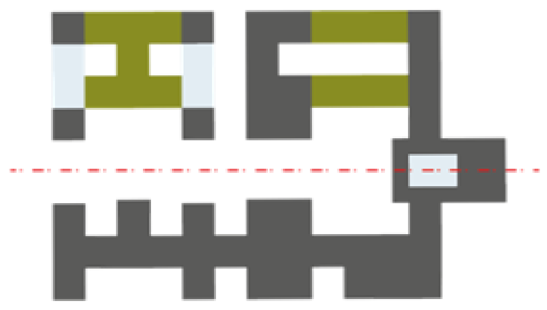
campus design principles.

Water line

Agriculture innovation center

Flexible spaces

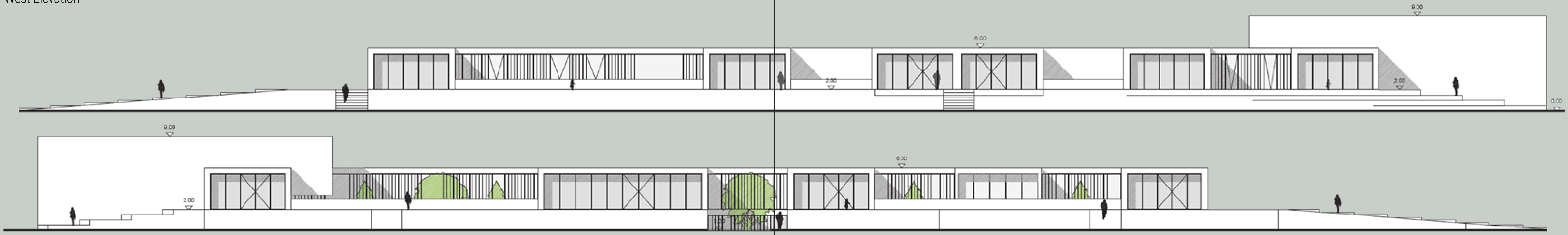
The interactions of human and nature in a miniature environment.



CC Section

The elevation on the left shows the heights of the levels and scale of our buildings, demonstrating the communication of landscape with our design. Due to keep the same level with the other buildings in the main site, our plan has a moderated height, creating a human size buildings from the street.This view offers an overview of the main entrance which is associated with the other buildings and workspaces.

West Elevation



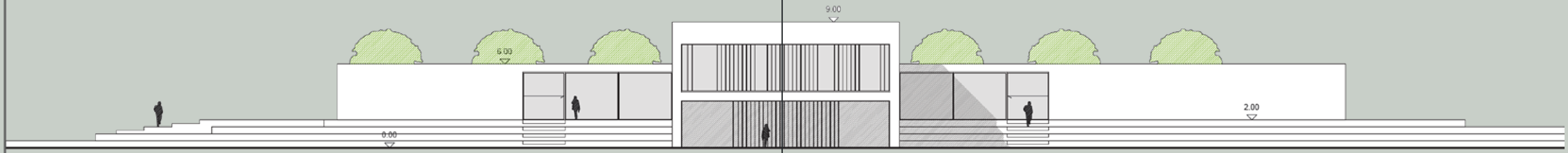
East Elevation

The building has a double height design in order to create a space with higher energy which enhances collaboration

Our purpose is planning a novel research center with practical farms.

The major part of the campus has a numerous functions such as landscape area, meeting area, exhibition hall and research areas.

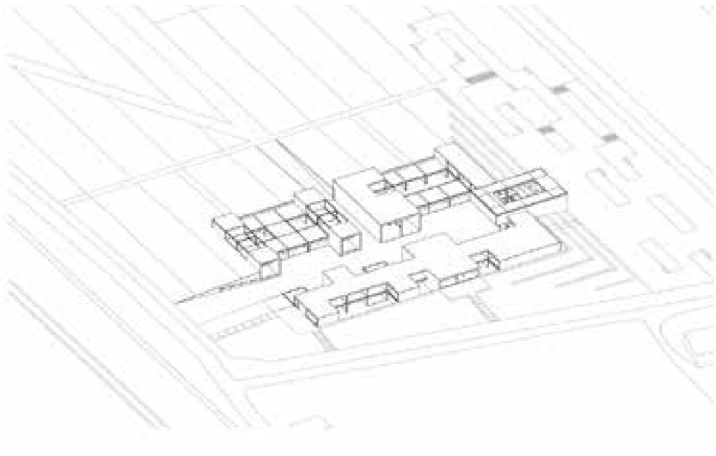
This place offers pleasant open spaces to be used for those on campus. It is also one of the most popular places to be used during the agricultural festival.

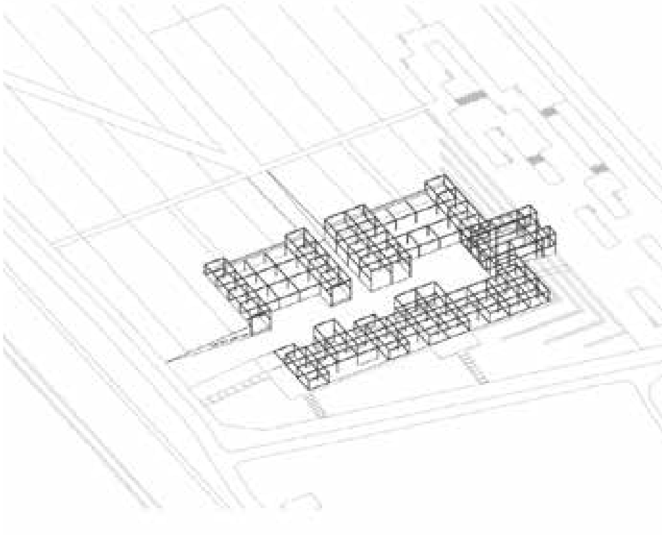



North Elevation

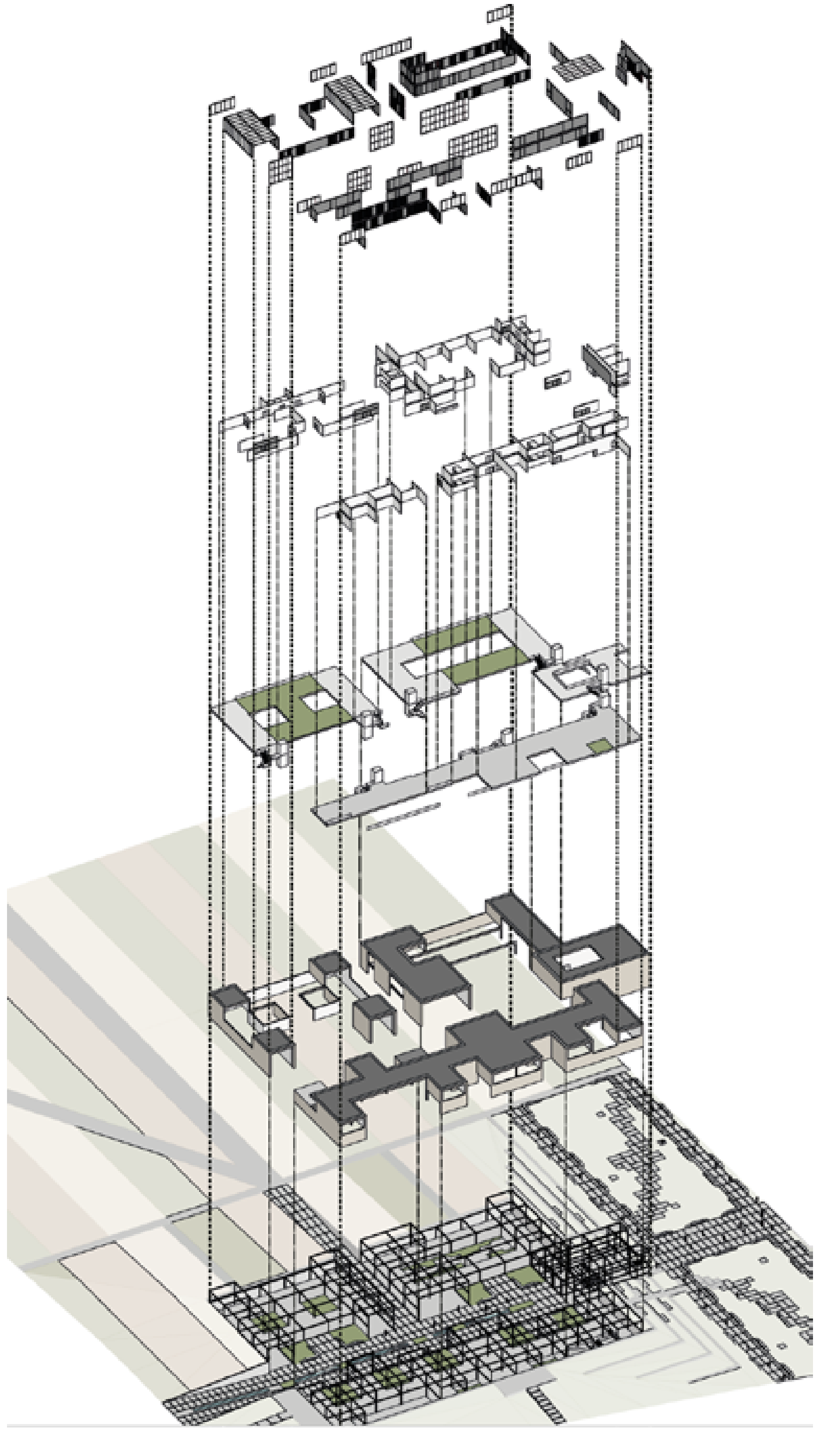
## Structure

A Steel Structure Grid that allow us to create dry construction structure and 4 types of pillars (4,5,8,10m), also 2 types of beams (4,8m) Frames and main walls with finish in the outside with plaster. This structure generates a frame that enhances the encounter with the windows and the volume. Two different character for the windows. One that finishes the volumes with semi-transparent glass. The other one closes the meetings between the volumes and the rest of the spaces, gives light to the courtyards and corridors.









# Details

## Wall Structure

This is the composition of our wall, steel structure IPE 220 including wood fiber insulation with technical details of our slabs. There is an underfloor air distribution and a radiant slab on the ceiling to create an air stratification and a comfort inside the building. It has sustainable reasons as it helps to reduce the consumption of energy and lead to sufficient ventilation system, heating and cooling system.

**1_ Outdoor finition t: 2 cm**

**2_ Gypsum board t: 1.25 cm**

**3_ Rain screen**

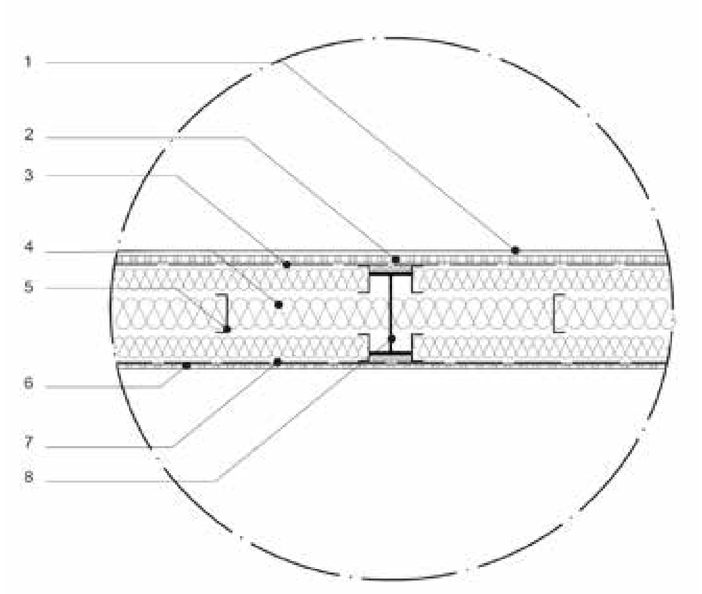
**4_  Wood Fiber insulation t: 10 cm**

**5_ Metal framing**

**6_ Gypsum board t: 1.25 cm**

**7_ Vapor barrier**

**8_ Structure IPE 220**






## Underfloor Air Distribution/Radiant Slab

1_ Raised floor t: 2 cm

2_ Supporting plate t: 10.5 cm

3_ Floor diffuser

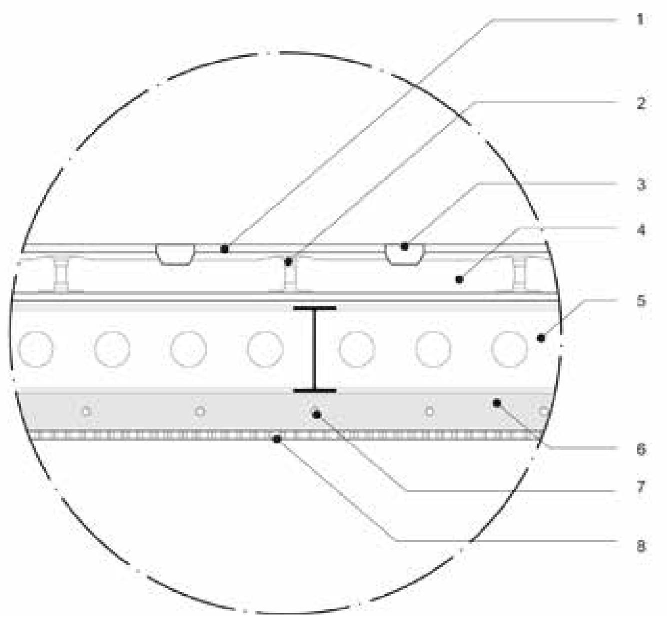
4_ Supply plenum

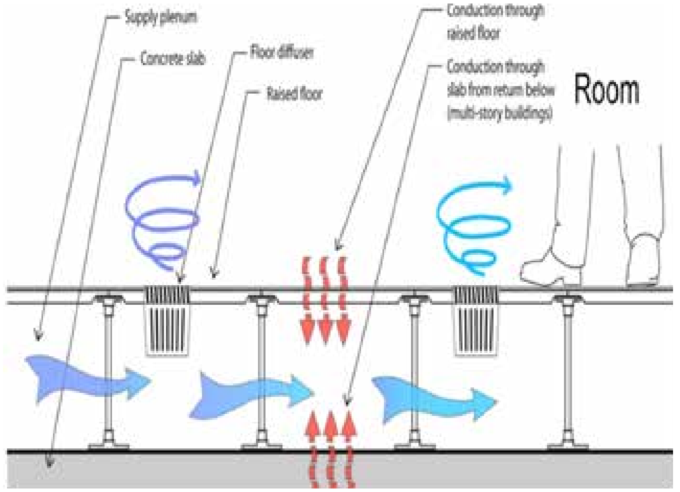
5_ Structure IPE 220

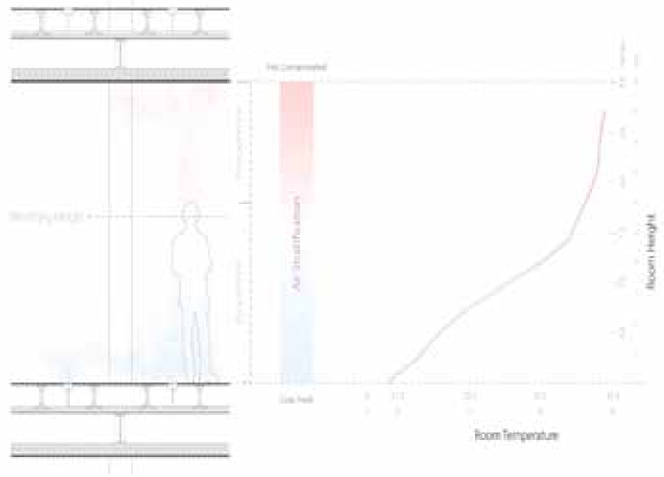
6_ Concrete voided radiant slap t: 10 cm

7_ Piping d: 1 cm

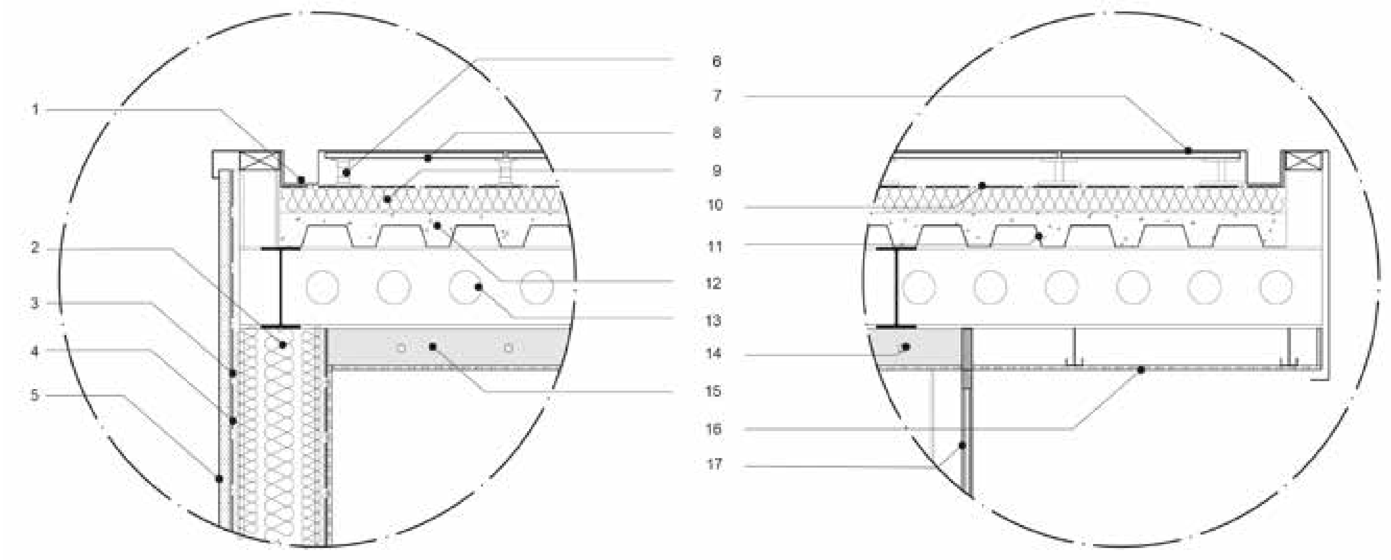
8_ Gypsum board t: 1.25 cm



## Roof Detail




1_ Recessed gutter

2_ Wood Fiber insulation t: 10 cm

3_ Rain screen

4_ OSB panel t: 1.8 cm

5_ Travertine tiles t: 3 cm

6_ Fixed plate 7.5 cm

7_ Roof covering

8_ Slab on plate t: 1.5 cm

9_ Wood Fiber insulation t:7 cm

10_ Waterproof film

11_ Steel sheet

12_ Concrete slab t: 10 cm

13_ Structure IPE 220

14_ Piping d: 1 cm

15_ Concrete voided radiant slab t: 10 cm

16_ OSB panel t: 1.8 cm

17_ Okalux Evo window t: 2.8 cm

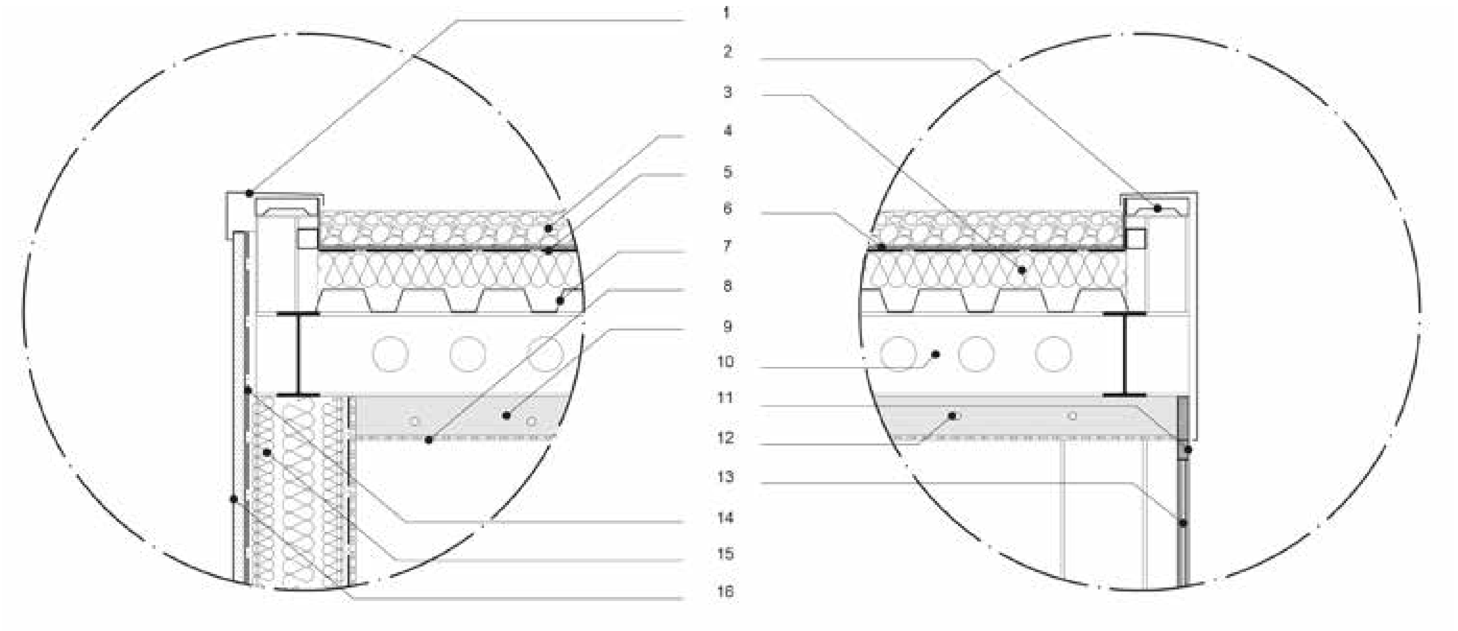


You can see the details of our wall and connection with the roof. In some parts, the roof stops directly by the wall and in other parts there is a small cantilever in order to emphasize our entrances in the street in between our buildings.

Perforated IPE in order to reduce the weight and the quantity of materials used.

We also plan to use the roof to collect storm water, so details of our green roof is proposed. We will use a synthetic draining layer to collect the water and reuse it for the irrigation of our greenhouse or the laboratories and restrooms.

## Green Roof Detail



1_ Acroterion

2_ Metal frame

3_ Wood Fiber insulation t: 7 cm

4_ Vegetal mat t: 8.8 cm

5_ Water proof film

6_ Synthetic draining layer

7_ Steel sheet

8_ Gypsum board t: 1.25 cm

12_ Piping d: 1 cm

13_ Okalux Evo window t: 2.8 cm

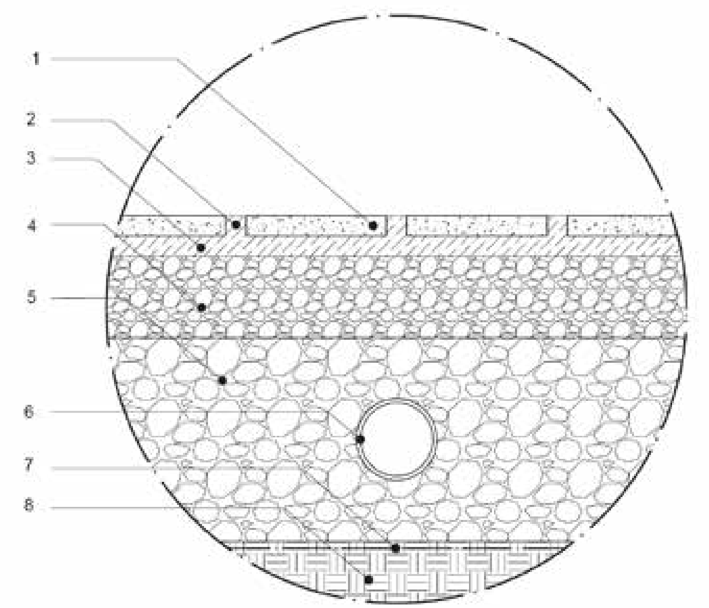
14_ OSB panel t:1.8 cm

15_ Outdoor finition t: 2 cm

16_ Travertine tiles t: 3 cm



## Permeable Pavement



1- White concrete pavers

2- Permeable joint material

3- Open-graded bedding course

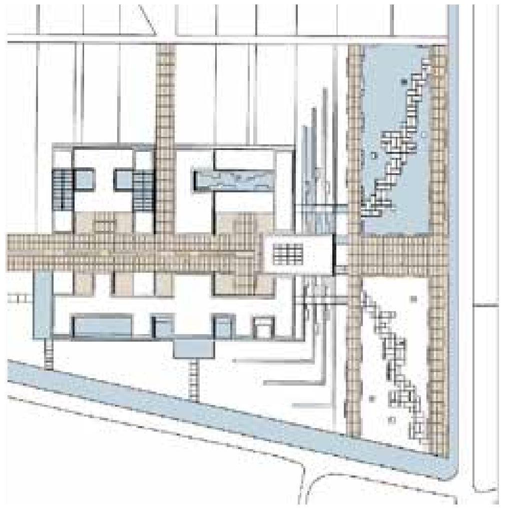
4- Open-graded base reservoir

5- Open-graded subbase reservoir

6- Underdrain

7- Geotextile under subbase

8- Uncompact subgrade soil



# Conclusion

As the earth is damaged by humans, we are responsible for correcting the disasters. In the 21st century, universities are the best chance to improve the conditions for us and the earth. Turkey is trying to play a beneficial role in the world by science and production, and Gebze province and Gebze Technical University bear a huge potential to advance and create positive outcomes. There are some national plans to improve the role of this university in the future especially in sustainability-related to energy consumption and building design. The campus of the university has the lion's share in relating the people to scientific aspects of life. So we plan to create a campus based on sustainable designs and aspects. In this study, based on the scale master development plans and the agricultural history of Gebze Technical University, sustainable buildings and designs are suggested. Pointing both academic and social accommodation functions in the campus for GTU, we suggest a main route including nature footprints in the heart of academic sections and also our study target reduced energy consumption by innovative buildings. One the major goals is developing the conditions to pedestrians and bicycles, designing attractive views and providing easily reached bicycles for people. Thus, the innovation campus has been shaped around green technology and sustainability, by which its technology, its innovation, its products, its research, and its development are noticed. There is a semi underground building in our design to provide some aspects of sustainable buildings entailing moderated temperature that lead to improved energy consumption. And also innovative methods related to green houses and sustainable design are used in our plan including prefab elements, modular construction, shading device, simple shape structure, green roof. Resource saving is one of the most important aspects of our project, that is done by bubble-voided concrete slab, Light perforated steel frame, permeable pavement, recycled grey water system. According to the disasters in the environment, novel approach should be considered from the very first steps in design of a building up to the end of the lifecycle of the it.

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