2nd International Conference on Sustainable Development Goals: Higher Education & Science Take Action

5-6th March 2020
Barcelona

GUNI
GLOBAL UNIVERSITY NETWORK FOR INNOVATION
Transformation of a City Black Hole to be a Green Educational Hub in Italy to Attain SDGs and Adapt to Climate Change

Aboulnaga1 M., Mousa2 H., Elhadidi3 M., Abdelhafez4 H., Tonini5 P., Fellin6 L., Frongia7 A. and Castellucci8 V.

1 Professor of Sustainable Built Environment
2, 3, 4 Researcher, Faculty of Engineering, Cairo University, Egypt
5, 6, 7 Researcher, Dept. of Agricultural Sciences, University of Bologna, Italy
8 Research, Dept. of Economic and Business Sciences, University of Trento, Italy
maboulnaga@eng.cu.edu.eg / mohsen_aboulnaga@yahoo.com/

Session 1: Integrating Student Leadership in Sustainable Actions
Thursday, 5th of March 2020
11.15 AM – 12.45 PM
About Cities

The world has experienced unprecedented urban growth in the last and current centuries. Cities are growing toward megacities with higher density urban planning, narrower urban corridors, and more high-rise urban structures.
About Cities

Cities worldwide are responsible for:

- **70%** Global total primary energy
- **65%** Emissions of The world’s total GHG
- **75%** of the global natural resources
- **80%** Global GDP

*United Nation Habitat, UN-Habitat – Energy\nThe Work Bank 2019\nWorld Energy Recourses\nWorld Energy Council 2016\nUnited Nation Sustainable Development Action 2015*

*United Nations Environment Programme (UNEP) 2019*

*The International Resource Panel - UNEP 2017*
Sustainable Development Challenges

Cities needs development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Humanity has already exceeded the Earth’s capacity to sustain our societies indefinitely at our current rate of use and consumption of resources.
Climate Change

Climate change knows no borders. It will not stop before the Pacific islands and the whole of the international community here has to shoulder a responsibility to bring about a Sustainable Development.”

Angela Merkel - The Chancellor of Germany
Save our World

A transition is needed from local governments to lead our cities towards sustainability, in order to ensure city’s livability (quality of life) and save the environment.

Hafen city, Germany
The Agenda 2030 and SDGs
The Agenda 2030 and SDGs

The most direct and vital SDGs to achieve Resilient and Sustainable Cities are mainly 4 SDGs
The Agenda 2030 and SDGs

**SDG 7**
Affordable and Clean Energy –
Ensure access to affordable, reliable, sustainable and modern energy for all.

**SDG 9**
Industry, Innovation and Infrastructure –
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**SDG 11**
Sustainable Cities and Communities –
Make cities and human settlements inclusive, safe, resilient and sustainable.

**SDG 12**
Responsible Consumption and Production –
Ensure sustainable consumption and production patterns.

**SDG 13**
Climate Action –
Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.
Architecture & Sustainable Development

Course description

The course aims at:

• Introducing the concept of sustainable development (SD), SDGs

• Presenting the main pillars of SD and its six dimensions as well as green economy sectors as a tool to achieve SD.

• Addressing SD indicators and the role of architecture and cities in accomplishing the SD goals – SDGs: 6, 7, 9, 11, 12 and 13.

• Focusing on how to develop green building to support the sustainability of urban areas and adaptation measures to fight climate change risks.
Architecture & Sustainable Development

Intended Learning Outcomes of Course (ILOs)

By the end of the course the student should able to:

• Exhibit knowledge of sustainability and SD at the global, regional and local scale.

• Integrate sustainable means of clean energy into buildings and urban areas.

• Assess building performance and use of sustainable materials and technologies to achieve energy efficient buildings within a sustainable built environment.

• Exhibit innovation in the challenge project to meet sustainable development and SDGs.
Transformation of a City Black Hole to be a Green Educational Hub in Italy to Attain SDGs and Adapt to Climate Change
Issues and Challenges

• Revitalising the site, as it is a dumped one and the old building is abandoned.
• Transform the building to be productive and serve the community.
• Inefficiency in the adaptive reuse policy of this abandoned site for more than ten years, and site is huge, more than 165,000 m² in area.
• Lack of green areas and public spaces.
• Unhealthy food and pollution.
• Urban population increase and high resources use.
Objectives

• Revitalising the abandoned site and factory of the ex-Zanussi area to be an educational centre and a city hub of sustainability.

• Transform the current old building to be sustainable, resilient and liveable.

• Creating green and sustainable site by utilising innovative urban farm technologies (soilless solutions).

• Strengthen the city’s capacity economically, socially and environmentally.

• Re-energizing the community.
The importance of urban agriculture

«It is growing or producing food in a city or highly populated town or municipality, in order to provide a solution for growing needs of cities to expand without harming the ecological balance»

Source: https://inhabitat.com/lush-green-oasis-and-rooftop-farm-will-reinvent-paris-streets
The Ex-Zanussi area

The abandoned site and black hole in Conegliano, Italy
Assessment and planning

**Strengths**
- Design synergies linked to multi-disciplines;
- Large scale and good condition of the existing structure;
- Location of the site in the city center;
- Local interest in agriculture and art.

**Weakness**
- Numerous preliminary projects have been proposed by both public and private stakeholders;
- The Ex-Zanussi area has a strong impact on the city center & neighbourhood attractiveness.

**Opportunities**
- Strong need for public spaces devoted to the citizens;
- Lacking of public spaces to achieve greater social connection & innovation;
- Creating green lungs for the city fully satisfies the city's requirements for mitigating air pollution;
- European policies allow strong support for urban farming.

**Threats**
- Innovative activity in the area of reference not used before;
- Management know-how;
- Difficulty in estimating the managerial skills to ensure excellent governance.
The concept of Transformation is used to underline human potential to transform the abandoned factory into Educational Facility of Art and Agriculture blended together through Architecture.
Planting the art

• Art and Agriculture are blended in one public space of the site to provide an educational multi-approach.
• The artists and farmers work together and teach the youth about new techniques to produce an artistic product from the plants.
• The educational process is established to create a cycle of training of trainer and capacity building as well as raising awareness of citizens.
• Ensuring day lighting provision, domes are designed for rentable studios for artists since they need spaces to be inspired, while they are working.

• The rooms' ceilings are replaced with a dome for a wider view for the surrounding, and then light wells are inserted onto these spaces, to catch the inspiring nature of Conegliano.
• To arouse people’s curiosity to grow crops using technology, an educational mobile game application will turn the process into an URBAN GAME.

• It is about a teamwork in levels, where the application provides the each team with the basic information they need.

• It also organize the process of plantation through tips and schedules for irrigation and fertilization.
Architectural Interventions

The old factory is divided to hold different functions, while keeping the old structure, to host an integrated art-agriculture training centre.
Architectural Interventions

Restaurant

Microbrewery

Ground floor plan
- Restaurant
- Kitchen
- Art studio
- Art gallery
- Market
- Beer tasting, crafts & selling
- Beer production
- Courses hall
- Labs
- Zip grow & mushroom
- Zip grow
- Services
- Shared space

© Prof. Mohsen Aboulnaga, Haidy Mousa and May Elhadidi et al. 2020
Architectural Interventions

Outdoor Farming

Indoor Farming
Farming Technologies

Zip Grow Technology

- It is a **vertical hydroponic system** best suited to allow a continued production along the year and it permits to relocate it easily whenever necessary.
- Supported by the heat produced during beer production and a dedicated **LED illumination**.
- With the main purpose to offer an **educational journey through an evolving agriculture**, based on a technological approach.

![Image source: https://urbanagnews.com/blog/the-bright-agrotech-zipfarm/](https://urbanagnews.com/blog/the-bright-agrotech-zipfarm/)

Drawing explaining the ZigGrow towers developed by Dr. Nate Storey at the University of Wyoming.
“The key is simply to uncover value in waste.”
Sustainable Technologies

- LED Facade
- Algae Panels
- EFTE Cushions
- Graffiti
- Rainwater Harvesting
- Recycled Blocks
- Zip Grow
The result of Urban Farming development

Before

After
### Sustainable development pillars’ and SDGs assessment of the project

<table>
<thead>
<tr>
<th>No.</th>
<th>Mission</th>
<th>Economic Sustainability</th>
<th>Social Sustainability</th>
<th>Environmental Sustainability</th>
<th>Achieved SDG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Presence of various functions indoor and outdoor</td>
<td>ü</td>
<td>ü</td>
<td>NA</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Keeping the old building structure</td>
<td>ü</td>
<td>NA</td>
<td>Ü</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Host an integrated art-agriculture training centre</td>
<td>ü</td>
<td>ü</td>
<td>NA</td>
<td>4,11</td>
</tr>
<tr>
<td>4</td>
<td>Blend Art and Agriculture in one space</td>
<td>NA</td>
<td>ü</td>
<td>NA</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Create an Art Center and Gallery</td>
<td>ü</td>
<td>ü</td>
<td>NA</td>
<td>4,8,11</td>
</tr>
<tr>
<td>6</td>
<td>Create a space for restaurant &amp; organic food market</td>
<td>ü</td>
<td>NA</td>
<td>NA</td>
<td>4,8</td>
</tr>
<tr>
<td>7</td>
<td>Integrate the production area of the microbrewery with the selling, tasting and crafts area</td>
<td>ü</td>
<td>NA</td>
<td>NA</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>Develop one universal space shared by all types of users</td>
<td>NA</td>
<td>ü</td>
<td>NA</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Create an underground rentable studios for artists</td>
<td>ü</td>
<td>ü</td>
<td>ü</td>
<td>11,12,13</td>
</tr>
<tr>
<td>10</td>
<td>Build an educational mobile game application will turn the process into an URBAN GAME</td>
<td>ü</td>
<td>ü</td>
<td>ü</td>
<td>4,9,11</td>
</tr>
<tr>
<td>11</td>
<td>Architectural sustainable technologies</td>
<td>ü</td>
<td>NA</td>
<td>ü</td>
<td>7,12,13</td>
</tr>
<tr>
<td>12</td>
<td>Uncovered raised beds areas where the concrete is already compromised</td>
<td>ü</td>
<td>NA</td>
<td>ü</td>
<td>12,13</td>
</tr>
<tr>
<td>13</td>
<td>Planting three local varieties</td>
<td>NA</td>
<td>NA</td>
<td>ü</td>
<td>11,13</td>
</tr>
<tr>
<td>14</td>
<td>Providing education in the field of plant production &amp; managerial skills</td>
<td>ü</td>
<td>ü</td>
<td>ü</td>
<td>4,8,11</td>
</tr>
<tr>
<td>15</td>
<td>Apply vertical hydroponic system (ZipGrow)</td>
<td>ü</td>
<td>NA</td>
<td>ü</td>
<td>12,13</td>
</tr>
<tr>
<td>16</td>
<td>Greenhouse for mushrooms</td>
<td>ü</td>
<td>NA</td>
<td>ü</td>
<td>12,13</td>
</tr>
<tr>
<td>17</td>
<td>Redevelopment of the building</td>
<td>ü</td>
<td>ü</td>
<td>NA</td>
<td>7,11,12</td>
</tr>
<tr>
<td>18</td>
<td>Rain water harvesting and waste water purification by algae.</td>
<td>NA</td>
<td>ü</td>
<td>NA</td>
<td>6,12</td>
</tr>
</tbody>
</table>

Main SDGs achieved are: © Prof. Mohsen Aboulnaga, Haidy Mousa and May Elhadidi et al. 2020
Conclusions

- Education is key and central part of the project that is aimed at providing an exemplary model to the future generation on how to keep the cities in the most sustainable way (intergenerational impacts and Human capital increase);
- GILGAMESH is a model of regenerative project based on circular economy approach that integrates Urban agriculture and smart technologies with local interest;
- Urban Agriculture could provide a solution for growing needs of cities without harming the ecological balance;
- High cost of the project, Important social aspects and Low return of money suggest that the most appropriate investor should be the public sector (Municipality, Region).

https://www.youtube.com/watch?v=slq_TNFZzb8

© Prof Mohsen Aboulnaga, Haidy Mousa and May Elhadidi et al. 2020
“Urban challenges are often addressed in an isolated way, while an integrated assessment is recommended for managing global resource systems”
Acknowledgment

Special thanks to:

• Mr. Ashraf El Kady – Chairman Board of Directors and TUB
• Mrs. Nevine Kashmiry – Deputy Chairman and CEO - TUB
• Mrs. Germeen Amer – Head of Corporate Communications - TUB

For sponsoring and funding Haidy Mousa’s and May Elhadidi’s full trip to Barcelona and to be at GUNi 2020 conference
Thank you

Prof. Dr. Mohsen Aboulnaga, Haidy Mousa, May Elhadidi
and the rest of the Team

Faculty of Engineering, Cairo University (CUFE), Egypt
mohsen_aboulnaga@yahoo.com / maboulnaga@eng.cu.edu.eg

© Prof. Mohsen Aboulnaga, Haidy Mousa and May Elhadidi et al. 2020