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Doing Something Scenario: Teaching Students an Incremental Approach to Design Strategies for Development Countries

Marta Maria Conconi and Alessandra Maria Pandolfi

***Abstract* – The 90% of the global population growth in the next 30 years will happen in developing countries, where the urban population rise will create increasing issues related to informal settlements and growing inequality. Improving the health conditions of the built environment and reducing the related risks will be a crucial challenge for future urban professionals. This paper is aimed at describing a learning experience built as a workshop for students, in which they designed a social facility modular system for developing countries, inspired by the organic and hypogeum architecture principles. The result is a list of guidelines for the design of similar functions, that should help a conscious construction process to reach some fundamental sustainability goals.**

***Keywords* – Design Strategies, Development Countries, Inclusion, Self-Construction, Software Modeling.**

I. Urban Development Trends in Developing Countries

The **urbanization process** has been affecting settlements of different ranks for 2 centuries now, with similar effects, happening in different periods of times. In developed countries, small villages have gradually grown into settled metropolitan areas and megacities, but **in some developing nations the trend is still at its initial stage**, with small settlements sprawling around farmlands and forests [1]. Small villages and towns borders are fast enlarging, after the increase of population and infrastructure needs, that is affecting parts of this World, where, according to the United Nations, communities are not historically ready to manage this quick development. The 'World Urbanization Prospects 2018' website [2], provided by the Department of Economic and Social Affairs, Population Division, of the United Nations, highlights a trend, leading to **the incessant growth of city borders, that will tend to spread out in bordering urban areas, up to form mega-cities**. The UN data highlight that there were only three mega-cities in 1970, that grew up to 17 in 2000, and by 2030 the number should rise up to 24 more [3].

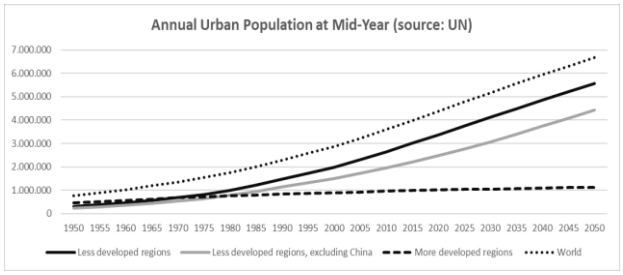


Fig. 1. Urban Population trends (1950-2050). Global ratio compared to more and less developed regions. Population axis represented in 10^3 units (data source: UN).

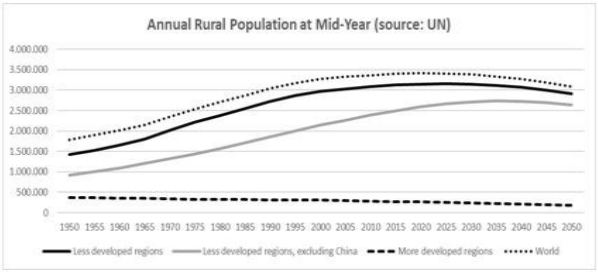


Fig. 2. Rural Population trends (1950-2050). Global ratio compared to more and less developed regions. Population axis represented in 10^3 units (data source: UN).

According to the UN predictions, the less developed regions, compared to the more advanced ones (Europe, Northern America, Australia, New Zealand and Japan) will lead the trend of urbanization up to 2018, when the Urban population at mid-year in Africa, Asia (except Japan), Latin America and the Caribbeans (plus Melanesia, Micronesia and Polynesia) should exceed the rural one (51.72-48.28%). This trend will go on up to 2024 in the less developed regions (without China), and to 2034 in Africa (2035 in the Sub-Saharan Africa, which refers to all the continent except of its Northern countries). It is crucial, then, to **train the urban managers of the future to face this problem correctly**, learning from the past experiences and from the local traditional materials and construction techniques.

Considering the country classification by income level, based on 2016 GNI per capita (provided by the World Bank), the urbanization trend will continue in low-income countries up to 2050, meaning these nations will soon have to face the problem of improving housing and facilities conditions, to be able to manage issues caused by slums and fast urban growth trends. This improvement could «save lives, reduce disease, increase quality of life, reduce poverty, mitigate climate change and contribute to achievement of the Sustainable Development Goals for Health (SDG 3) and Sustainable Cities (SDG 11)» [4].

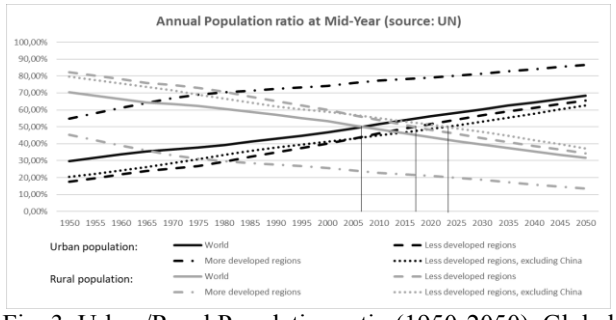
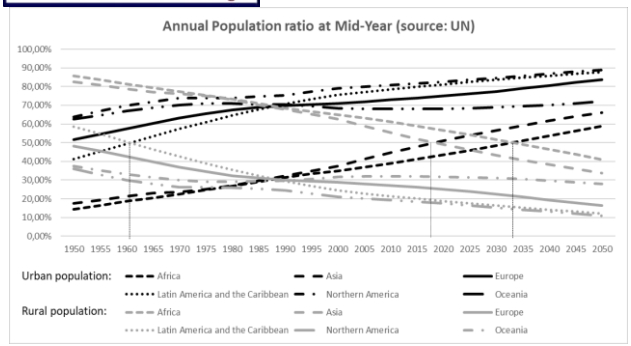


Fig. 3. Urban/Rural Population ratio (1950-2050). Global trends compared to more and less developed regions (data source: UN).



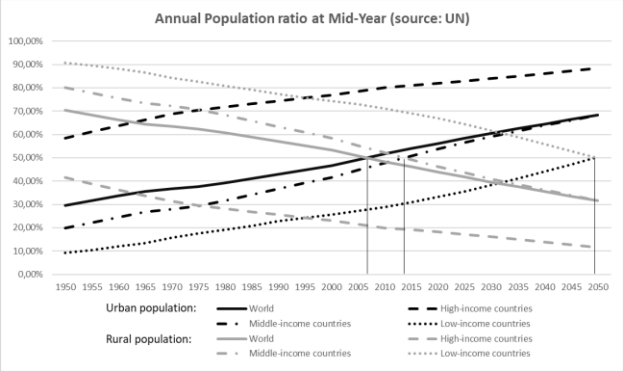


Fig. 4. Urban/Rural Population ratio (1950-2050). Continental data and Income level trends comparison (data source: UN).

II. An Innovative Teaching Program For the Urban Managers of the Future

In the light of this evidences, the Workshop 'BIM and hypogeum architecture' was conceived, in order to give students a better insight on **the topics that would become fundamental in the development of future settlements in developing countries**, starting from the concepts of self-sufficient construction techniques, flexibility of uses and sustainability of the design options. In this experience, students designed a social facility modular system for developing countries, inspired by the organic and hypogeum architecture principles, in which materials and shapes have been selected for being integrated in the local environment. The goal was to **highlight a new design approach**, using modern technological tools, together with relations, that affect the development of contemporary facilities and community structures, with specific attention to adding and correctly placing them in a highly fragmented urban context. The aim was developing students' capability of understanding the specific needs of complex functions, according to specific elements in architectural/urban projects, referring to the local scale.

The aim of teaching the basic principles of the Project Appraisal sciences was to share their main scientific-disciplinary contents, describing the most advanced models and techniques, both in the field of the monetary and non-monetary tools for **assessing assets, projects and resources**, exploring the issues related to social, economic and environmental sustainability. The secondary goal of the course was to share the principles and models of the economically sustainable development, as well as their application to regional policies. Plus, the teaching team specified the criteria, used for evaluating the renovation strategies and the most appropriate models, implied to ensure the actual participation of communities, involved in the definition of their goals and in the examination of the connection between the proposed solution and the needs of pursuing a balanced system of economic growth and improving the life quality.

Starting from a **functional schedule**, students were asked to design a basic structure for 'social facilities', according to a standard morphology, aimed at integrating it with the urban context. The practical activity concerned the design of a building, to be used as a reference flexible element for the basic social facilities, located in a selected context in Tanzania. The aim was to develop a minimum core building for social facilities in developing regions, studying an organic/ hypogeal architectural system, to integrate, as much as possible, both materials and morphologies in the local context. The **innovative teaching activities** included lectures and seminars, held by the teaching team, with the contribution of external speakers, complemented by direct tutoring activities, to support the development of the design process in a professional workflow, with programmed steps in which the progress of projects, developed by groups of 2 people, was checked. The activities, that students worked on **during lectures**, included:

- Research, study and graphic elaborations for the study and the formalization of the design choices, directly supervised by the teaching team;
- Due diligence of the system of design limitations (related to environmental, regulatory, structural and construction components, and so on);
- Evaluation, selection and design of different morphological, typological and technological alternati--ves.

The study and training activities, independently carried out by students, revolved around:

- The analysis of paradigmatic projects, in terms of materials, design principles and architectural factors;
- The graphic representation of the project at different scales, in relation to different development steps.

Each student carried out a **self-directed research and study activity**, related to buildings inspired by organic and hypogeal architectures, with insights into their main morphological, typological and technological features. Each student presented the outcome of their research, according to a timetable provided by the teaching team.

III. Health Issues and the Built Environment in Developing Countries

The correct design of built structures can help **relieving some of the most important risks for human health**. The poor conditions of the built environment can even trigger multiple risks, causing some significant diseases and deaths reasons, that can be easily prevented by correctly teaching urban professionals and citizens how to deal with some of these issues. Inadequate housing and facility structures also tend «to be energy inefficient, in terms of cooking, heating and power systems, as well as poorly protected from

weather conditions, creating an array of immediate health risks as well as increasing climate emissions» [4]. The main issues for developing countries are, then, related to fresh water availability, sanitation and hygiene levels, overcrowding, indoor air pollution, and lack of safe, healthy and durable indoor spaces [*ibidem*]. Any project should be, then, «supported with the reconditioning of the slum [s] to change [their] general appearance and consequently people's prejudices. But more importantly, **the social integration and rehabilitation projects** should be the core of the change, because changing the physical environment will serve only as an effective contribution towards the paradigm shift of the society. And the real betterment will be experienced with the holistic approach» [5]. This is a significant shift in the traditional planning/design flows, for the social component of the project should become a central point in the entire development process.

This means that future designers will have to start working on **spreading some important principles**, in order to make citizens aware of the risks that built structures in poor conditions could imply, by helping them in understanding some simple rules. The first of these instructions considers that **people should be the aim of urban policies**, while built systems should be the means to support human beings in their lives, offering them the chance of achieving their own goals and providing them support, when needed. Urban systems must be thought for their citizens (and not conversely), as people, their freedom and creativity are the only real resources to be preserved [6]. «Protection of equality and respect for differences are not only universally shared objectives, although often disregarded in practice… **Poverty, in fact, is not just a problem of income, but its drivers can be identified in the lack of access to resources** necessary to sustain life, in the inadequacy of the education programs, in high levels of maternal and infant mortality, and in the widespread gender and ethnic discriminations» [7].

These principles become crucial, considering that the inefficiency of governments in delivering adequate national and local policies for managing the urban growth through low-cost housing and facilities programs and for dealing with the delicate relation between cities and rural areas seems to be a major driver of the **increasing expansion of informal settlements** in many developing countries [8]. Urban systems should ensure «a sustainable future under equitable social and economic conditions and protection from the effects of environmental hazards and natural disasters [and] non-discrimination policies based on gender, ethnic background or social and economic status» [9].

Another important recommendation is related to the need for **ensuring the climate resilience** of housing and facilities to extreme heat, flooding and storms [4], mainly in low-income countries, where few correct policies can help reducing the resource use in the construction process and optimize the indoor comfort levels. Plus, technologies can help improving the thermal insulation of buildings and reducing the indoor air pollution [*ibidem*], by **containing costs**, primarily, on a long-term basis, teaching people in developing countries that investing in healthy and energy-efficient structures will reduce their management, maintenance and operational costs [10]. Plus, to face the increasing costs caused by sprawled settlements [11], a new concept of total flexibility should be introduced in the facilities planning and development.

Considering that most of citizens, living in informal settlements of developing countries, do not have incomes that can provide enough resources to enter in a standard construction process, the proposed solutions should consider the **self-construction techniques** as the preferable answer. «The urban upgrading raising of should be part of urban development and poverty reduction policies… through participatory processes» [12]. In this sense, «informal low-income settlements where in situ (on-site) upgrading is feasible are called 'upgradeable settlements'… [and they] must meet the following criteria: (a) The settlement should be located within an area that is suitable for human habitation. (b) A majority of the households should have established means of livelihood at this current location. (c) The settlement should not be in an area where (i) The land falls within a high security-risk zone, which creates constraints for free movement of the community, as (ii) Future development will be affected directly or indirectly under the compulsory land requirements of special legislation» [*ibidem*].

The **main goals** that are to be met by future expansions in developing countries, then, should drive projects to:

1) Teach people basic principles of correct structure development and maintenance,
2) Create built systems that support people in achieving their goals, by sharing equality and respect for differences,
3) Break the negative spiral caused by the chain "poverty-higher risks-energy inefficiency-climate fragility",
4) help relieving some of the most important risks for human health and life,
5) Increase indoor performance by using suitable local materials and traditional typologies/technologies,
6) Trigger the paradigm shift of the society through the holistic approach,
7) Create flexible public/semi-public spaces to reduce the increasing costs caused by sprawled settlements,
8) Promote low cost construction techniques and strategies,
9) Help people choosing the correct location for settlements, through a simple checklist,
10) Increase consciousness about the cumulative costs of informal settlements.

IV. Correct Location means Lower Risks and Better Performance

To determine whether settlements are suitable for upgrading projects or not, in the light of the existing debate [13], an evaluation system has already been developed in a **previous research experience** [14], with the aim of determining whether the location of social and humanitarian projects was appropriate or not.

This first checklist moved from the analysis and the re-elaboration of the main systems introduced for **assessing the sustainability of projects and settlements** at the

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building level (including GBtool and SBtool, Leed, Green Globes, LoSI, BREEAM and Casbee), to adapt the best existing evaluative structures to this specific instance.

The checklist was designed to be applicable at **all stages of the life cycle of a humanitarian project**, being both a guideline for the selection of the site and for the design, and a handbook for the improvement of existing settlements in a sustainable approach.

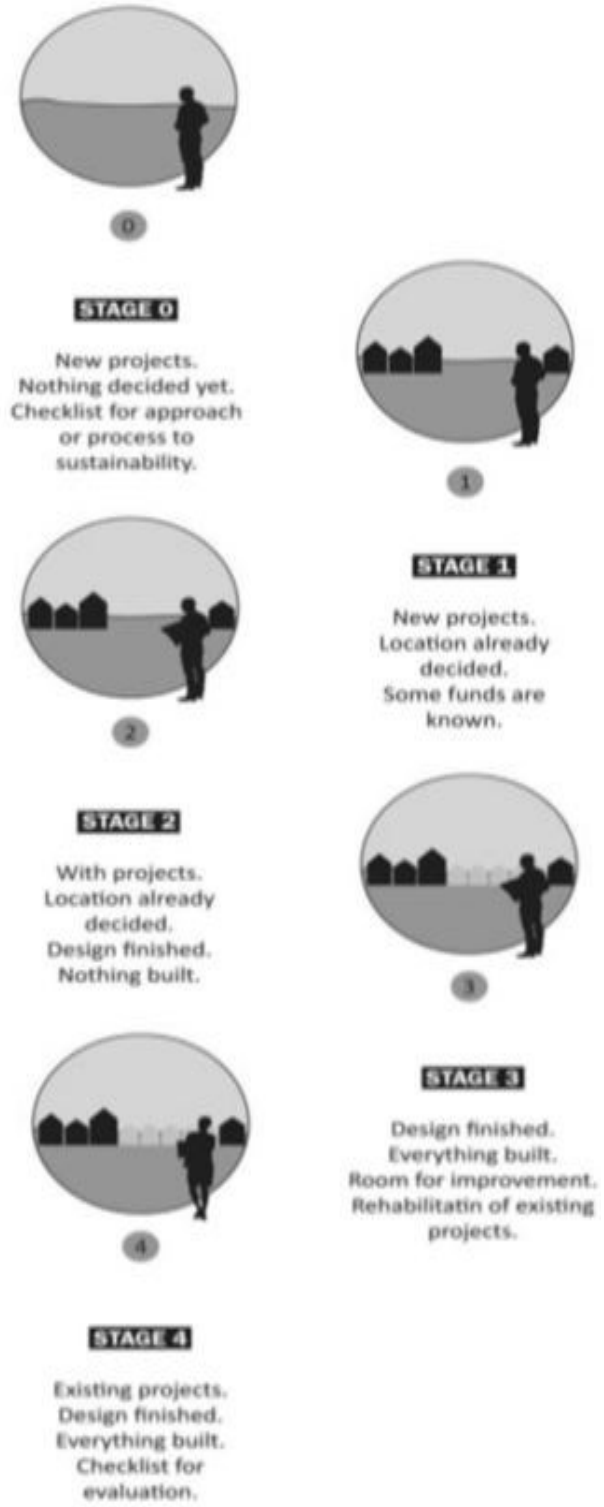

Fig. 5. A checklist for humanitarian projects: application stages [14].

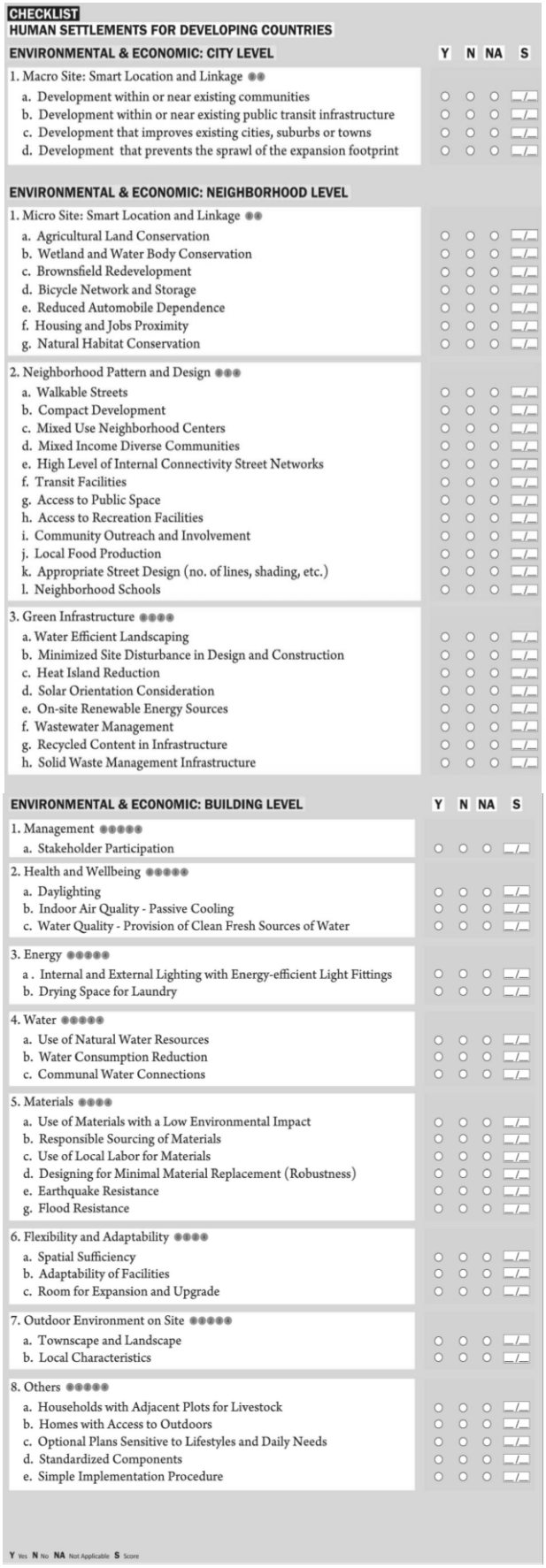

Fig. 6. A checklist for humanitarian projects: Environmental and economic parameters to be assessed at city, neighborhood and building levels [14].

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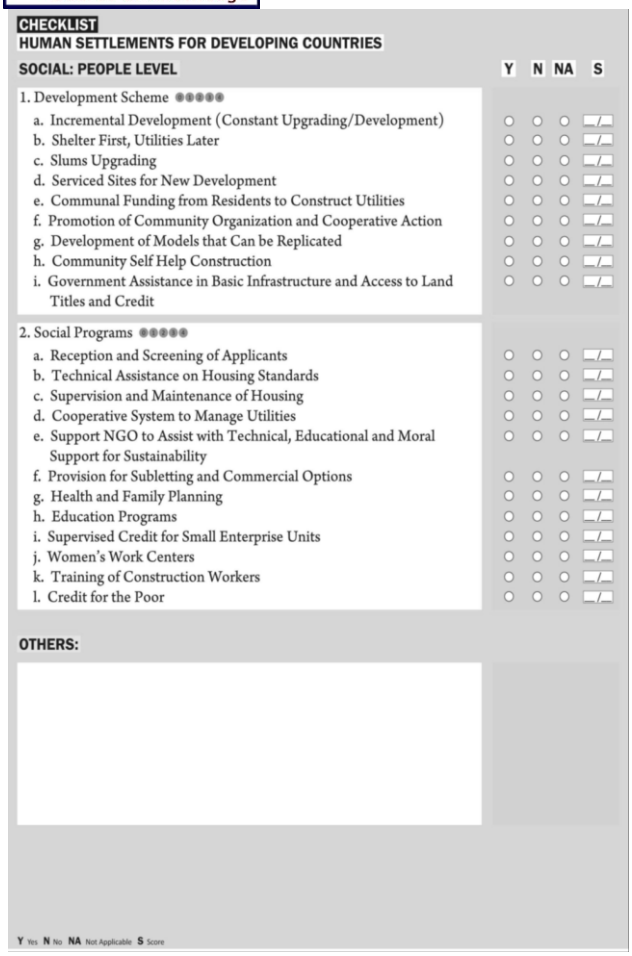


CHECKLIST
HUMAN SETTLEMENTS FOR DEVELOPING COUNTRIES

SOCIAL: PEOPLE LEVEL	Y	N	NA	S
1. Development Scheme ●●●●●				
a. Incremental Development (Constant Upgrading/Development)	○	○	○	__/__
b. Shelter First, Utilities Later	○	○	○	__/__
c. Slums Upgrading	○	○	○	__/__
d. Serviced Sites for New Development	○	○	○	__/__
e. Communal Funding from Residents to Construct Utilities	○	○	○	__/__
f. Promotion of Community Organization and Cooperative Action	○	○	○	__/__
g. Development of Models that Can be Replicated	○	○	○	__/__
h. Community Self Help Construction	○	○	○	__/__
i. Government Assistance in Basic Infrastructure and Access to Land Titles and Credit	○	○	○	__/__
2. Social Programs ●●●●●				
a. Reception and Screening of Applicants	○	○	○	__/__
b. Technical Assistance on Housing Standards	○	○	○	__/__
c. Supervision and Maintenance of Housing	○	○	○	__/__
d. Cooperative System to Manage Utilities	○	○	○	__/__
e. Support NGO to Assist with Technical, Educational and Moral Support for Sustainability	○	○	○	__/__
f. Provision for Subletting and Commercial Options	○	○	○	__/__
g. Health and Family Planning	○	○	○	__/__
h. Education Programs	○	○	○	__/__
i. Supervised Credit for Small Enterprise Units	○	○	○	__/__
j. Women's Work Centers	○	○	○	__/__
k. Training of Construction Workers	○	○	○	__/__
l. Credit for the Poor	○	○	○	__/__

OTHERS:

Y Yes N No NA Not Applicable S Score

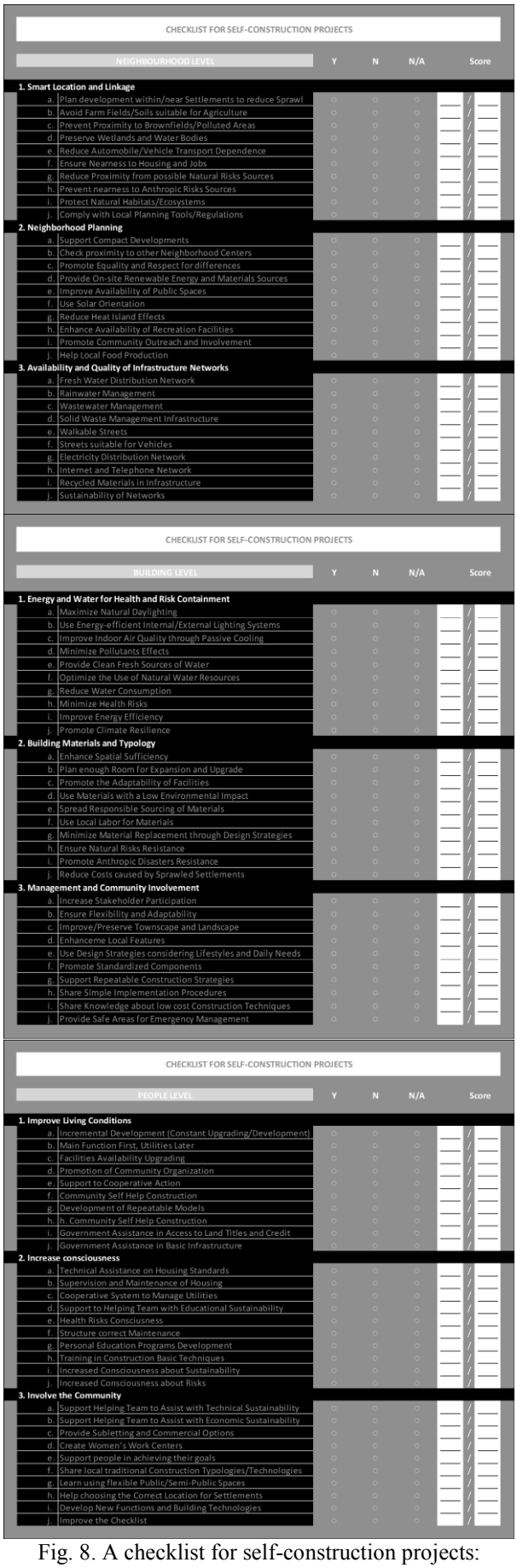
Fig. 7. A checklist for humanitarian projects: Social parameters to be assessed at people level [14].

In fact, the checklist was divided into 5 sections, which could be completed in different periods of time, depending on specific instances, plus, the assessor could also introduce a scoring system for other possible evaluation goals [14].

In this new context, aimed at creating guidelines for settlements in developing countries, it is important to **identify some best practices and repeatable procedures** [15], in order to define a checklist for upgradeable settlements, which can guide new self-built projects towards the themes of sustainability, integration and multiculturalism, respecting the principles of liberalism and self-determination.

After these considerations, a new checklist has been developed, **adapting the existing structure to the new goals**. The first element is related to the main aim of applying the checklist to: orientate a new project, improve the design stage, enhance an existing project, re-orientate existing settlements, or evaluate existing communities to develop new policies [16].

All the possible applications of the new checklist should be **complemented by a lineup of recommendations**, specifically developed for any case study, aimed at stating clear operational suggestions, coming from completing the checklist. This will illustrate the tool potential with graphical diagrams, that can help clarifying which issues can be optimized through the checklist results, adapting its suggestions to the specific cultural and urban context.



CHECKLIST FOR SELF-CONSTRUCTION PROJECTS

NEIGHBOURHOOD LEVEL	Y	N	N/A	Score
1. Smart Location and Linkage				
a. Plan development within/near Settlements to reduce Sprawl	○	○	○	___/___
b. Avoid Farm Fields/Soils suitable for Agriculture	○	○	○	___/___
c. Prevent Proximity to Brownfields/Polluted Areas	○	○	○	___/___
d. Preserve Wetlands and Water Bodies	○	○	○	___/___
e. Reduce Automobile/Vehicle Transport Dependence	○	○	○	___/___
f. Ensure Nearness to Housing and Jobs	○	○	○	___/___
g. Reduce Proximity from possible Natural Risks Sources	○	○	○	___/___
h. Prevent nearness to Anthropic Risks Sources	○	○	○	___/___
i. Protect Natural Habitats/Ecosystems	○	○	○	___/___
j. Comply with Local Planning Tools/Regulations	○	○	○	___/___
2. Neighborhood Planning				
a. Support Compact Developments	○	○	○	___/___
b. Check proximity to other Neighborhood Centers	○	○	○	___/___
c. Promote Equality and Respect for differences	○	○	○	___/___
d. Provide On-site Renewable Energy and Materials Sources	○	○	○	___/___
e. Improve Availability of Public Spaces	○	○	○	___/___
f. Use Solar Orientation	○	○	○	___/___
g. Reduce Heat Island Effects	○	○	○	___/___
h. Enhance Availability of Recreation Facilities	○	○	○	___/___
i. Promote Community Outreach and Involvement	○	○	○	___/___
j. Help Local Food Production	○	○	○	___/___
3. Availability and Quality of Infrastructure Networks				
a. Fresh Water Distribution Network	○	○	○	___/___
b. Rainwater Management	○	○	○	___/___
c. Wastewater Management	○	○	○	___/___
d. Solid Waste Management Infrastructure	○	○	○	___/___
e. Walkable Streets	○	○	○	___/___
f. Streets suitable for Vehicles	○	○	○	___/___
g. Electricity Distribution Network	○	○	○	___/___
h. Internet and Telephone Network	○	○	○	___/___
i. Recycled Materials in Infrastructure	○	○	○	___/___
j. Sustainability of Networks	○	○	○	___/___

CHECKLIST FOR SELF-CONSTRUCTION PROJECTS

BUILDING LEVEL	Y	N	N/A	Score
1. Energy and Water for Health and Risk Containment				
a. Maximize Natural Daylighting	○	○	○	___/___
b. Use Energy-efficient Internal/External Lighting Systems	○	○	○	___/___
c. Improve Indoor Air Quality through Passive Cooling	○	○	○	___/___
d. Minimize Pollutants Effects	○	○	○	___/___
e. Provide Clean Fresh Sources of Water	○	○	○	___/___
f. Optimize the Use of Natural Water Resources	○	○	○	___/___
g. Reduce Water Consumption	○	○	○	___/___
h. Minimize Health Risks	○	○	○	___/___
i. Improve Energy Efficiency	○	○	○	___/___
j. Promote Climate Resilience	○	○	○	___/___
2. Building Materials and Typology				
a. Enhance Spatial Sufficiency	○	○	○	___/___
b. Plan enough Room for Expansion and Upgrade	○	○	○	___/___
c. Promote the Adaptability of Facilities	○	○	○	___/___
d. Use Materials with a Low Environmental Impact	○	○	○	___/___
e. Spread Responsible Sourcing of Materials	○	○	○	___/___
f. Use Local Labor for Materials	○	○	○	___/___
g. Minimize Material Replacement through Design Strategies	○	○	○	___/___
h. Ensure Natural Risks Resistance	○	○	○	___/___
i. Promote Anthropic Disasters Resistance	○	○	○	___/___
j. Reduce Costs caused by Sprawled Settlements	○	○	○	___/___
3. Management and Community Involvement				
a. Increase Stakeholder Participation	○	○	○	___/___
b. Ensure Flexibility and Adaptability	○	○	○	___/___
c. Improve/Preserve Townscape and Landscape	○	○	○	___/___
d. Enhanceme Local Features	○	○	○	___/___
e. Use Design Strategies considering Lifestyles and Daily Needs	○	○	○	___/___
f. Promote Standardized Components	○	○	○	___/___
g. Support Repeatable Construction Strategies	○	○	○	___/___
h. Share Simple Implementation Procedures	○	○	○	___/___
i. Share Knowledge about low cost Construction Techniques	○	○	○	___/___
j. Provide Safe Areas for Emergency Management	○	○	○	___/___

CHECKLIST FOR SELF-CONSTRUCTION PROJECTS

PEOPLE LEVEL	Y	N	N/A	Score
1. Improve Living Conditions				
a. Incremental Development (Constant Upgrading/Development)	○	○	○	___/___
b. Main Function First, Utilities Later	○	○	○	___/___
c. Facilities Availability Upgrading	○	○	○	___/___
d. Promotion of Community Organization	○	○	○	___/___
e. Support to Cooperative Action	○	○	○	___/___
f. Community Self Help Construction	○	○	○	___/___
g. Development of Repeatable Models	○	○	○	___/___
h. h. Community Self Help Construction	○	○	○	___/___
i. Government Assistance in Access to Land Titles and Credit	○	○	○	___/___
j. Government Assistance in Basic Infrastructure	○	○	○	___/___
2. Increase consciousness				
a. Technical Assistance on Housing Standards	○	○	○	___/___
b. Supervision and Maintenance of Housing	○	○	○	___/___
c. Cooperative System to Manage Utilities	○	○	○	___/___
d. Support to Helping Team with Educational Sustainability	○	○	○	___/___
e. Health Risks Consciusness	○	○	○	___/___
f. Structure correct Maintenance	○	○	○	___/___
g. Personal Education Programs Development	○	○	○	___/___
h. Training in Construction Basic Techniques	○	○	○	___/___
i. Increased Consciousness about Sustainability	○	○	○	___/___
j. Increased Consciousness about Risks	○	○	○	___/___
3. Involve the Community				
a. Support Helping Team to Assist with Technical Sustainability	○	○	○	___/___
b. Support Helping Team to Assist with Economic Sustainability	○	○	○	___/___
c. Provide Subletting and Commercial Options	○	○	○	___/___
d. Create Women's Work Centers	○	○	○	___/___
e. Support people in achieving their goals	○	○	○	___/___
f. Share local traditional Construction Typologies/Technologies	○	○	○	___/___
g. Learn using flexible Public/Semi-Public Spaces	○	○	○	___/___
h. Help choosing the Correct Location for Settlements	○	○	○	___/___
i. Develop New Functions and Building Technologies	○	○	○	___/___
j. Improve the Checklist	○	○	○	___/___

Fig. 8. A checklist for self-construction projects: neighborhood, building and people levels.

V. A Checklist for Self-Construction Projects: the Neighborhood Level

The **need for a correct location** is a fundamental topic for selecting the right development strategies, mainly in countries where natural hazards determine a significant threat to the management of urban areas. In order to highlight the need for spreading the correct localization principles, even for informal settings and for regions/towns that do not follow any urban planning tool, the first checklist section is dedicated to the definition of some basic principles in terms of:

1. Smart location and linkage,
2. Neighborhood planning,
3. Availability and quality of infrastructure networks.

Referring to the **smart location and linkage principles**, the checklist is aimed at defining some basic references, that could drive to a more conscious selection of correct development strategies, by meeting some fundamental rules for a correct urban expansion, even in the poorest countries and regions, such as:

a. Planning developments within/ near settlements to reduce sprawl,
b. Not using farm fields/soils suitable for agriculture,
c. Preventing proximity to brownfields/polluted areas,
d. Preserving wetlands and water bodies,
e. Reducing automobile/vehicle transport dependence,
f. Ensuring nearness to housing and jobs,
g. Reducing proximity from possible natural risks sources,
h. Preventing nearness to anthropic risks sources,
i. Protecting natural habitats/ecosystems,
j. Complying with local planning tools/regulations.

All of these principles should be met, whenever possible, for the aim of this part of the checklist is ensuring that the **negative spiral of poverty** will not result in increasing risks and harmful effects, caused by localization choices driven by the lack of economic resources. It is well known that the **economic fragility** is one of the main drivers of the increasing poverty levels in low income population classes. It implies the fact that, not being able to afford smarter/safer (and more expensive) locations, underprivileged people tend to occupy that parts of urban systems that the higher classes 'would not buy' (such as polluted areas and brownfields, or secluded/ peripheral regions, usually related to lower accessibility levels and lack of basic facilities). Supporting citizens of informal settlements to select the correct location for their self-construction projects, through some simple positioning rules, could **help reducing the negative effects of poverty, cutting the costs related to a wrong location choice** (e.g. higher fuel costs, or reconstruction ones), and increasing their chances of improving their economic and education situation in the near future.

Speaking of **neighborhood planning**, the principles of correct location could be directed to the selection of a smart set of morphological rules, that can help preventing the main issues of informal settlements, usually related to the total lack of any basic development control. This checklist is, then, aimed at helping urban planners, designers and simple citizens in:

a. Supporting compact developments,
b. Checking proximity to other neighborhood centers,
c. Promoting equality and respect for differences,
d. Providing on-site renewable energy and materials sources,
e. Improving availability of public spaces,
f. Using solar orientation,
g. Reducing heat island effects,
h. Enhancing availability of recreation facilities,
i. Promoting community outreach and involvement,
j. Helping local food production.

In this way, providing a **wider mix of functions and facilities**, and preventing duplicated ones, neighborhoods could be developed in a more conscious way, in order to create a public system of functions, that could, then, make people the core of urban policies. In the light of this consideration, communities and their built systems should be designed as simple tools to support people in their lives, helping them accomplishing their own goals and providing them support, when needed.

To enforce the principles of the correct localization of settlements, considering the **availability and quality of infrastructure networks** becomes a crucial point, to cut the costs of sprawling developments and reduce the related effects on the weaker classes. The checklist compiling should include the availability of (and the chance of connecting to) the following public facilities:

a. Fresh water distribution network,
b. Rainwater management,
c. Wastewater management,
d. Solid waste management infrastructure,
e. Walkable streets,
f. Streets suitable for vehicles,
g. Electricity distribution network,
h. Internet and telephone network,
i. Recycled materials in infrastructure,
j. Sustainability of networks.

The user can **apply the different parts of the checklist independently**, completing them in different periods, based on the needs that could be met in the development process of a urban settlement. This means, consequently, that the assessor can decide to use this checklist as a collection of guidelines to orientate the design stage, but also as assessing method to determine the efficiency of the different stages of the neighborhood planning, development and evolution in the urban expansion process. E.g. this section of the checklist can become a list of recommenda--tions for the planning of a new settlement, or for supporting the densification of existing neighborhoods, in order to reduce the sprawl levels. It can even be complemented with **scores**, to be determined in a **qualitative** way (through a discrete and ordered scale), **or** calculating **quantitative parameters** to measure the efficiency of the design strategies in planning developments within/ near settlemen--ts, preventing proximity to brownfields/ polluted areas and possible natural/ anthropic risks sources, or ensuring nearness to housing and jobs (all in terms of relative distance). More complex parameters can be used to determine the capability of the design strategies of

supporting compact developments (e.g. through morphological indicators), reducing heat island effects (with indoor and outdoor comfort models), or promoting community outreach and involvement (through social sustainability factors).

VI. A Checklist for Self-Construction Projects: the Building Level

The building level is a fundamental part of this checklist, for it is aimed at orientating the design choices in terms of:

1. Energy and water for health and risk containment,
2. Building materials and typology,
3. Management and community involvement.

Starting from the **energy and water management for health and risk containment**, this part of the checklist promotes a new approach to the development of settlements in poor countries and regions, that is not just considering the need for producing as much shelters as possible as the only goal in this direction, but it is supporting a shift towards a more sustainable development strategy, even in emergency situations. The need for prompt housing conditions improvement can be complemented by a significant attention to the quality of the built environment and to its relation to the surrounding context. This can lead to **a design approach** also for self-constructed structures, that is aimed at:

a. Maximizing natural daylighting,
b. Using energy-efficient internal/external lighting systems,
c. Improving indoor air quality through passive cooling,
d. Minimizing pollutants effects,
e. Providing clean fresh sources of water,
f. Optimizing the use of natural water resources,
g. Reducing water consumption,
h. Minimizing health risks,
i. Improving energy efficiency,
j. Promoting climate resilience.

Supporting the correct definition of strategies for the energy and water management can help users to **reduce the consumption of critical resources**, **containing costs** and helping them living in a more sustainable context. This will also reduce the gap, in terms of access to basic survivor resources, between different social classes, giving poor communities the chance of using their resources in a more efficient way, in a win-win game (lower consumptions = lower emissions and costs = higher environment quality and more resources to use for other needs).

Considering the topics of **building materials and typology**, relying on the long-term experience of developed countries and of the local construction tradition, designers can find simple, but efficient solutions, to:

a. Enhance spatial sufficiency,
b. Plan enough room for expansion and upgrade,
c. Promote the adaptability of facilities,
d. Use materials with a low environmental impact,
e. Spread responsible sourcing of materials,
f. Use local labor for materials,
g. Minimize material replacement through design strategies,
h. Ensure natural risks resistance,
i. Promote anthropic disasters resistance,
j. Reduce costs caused by sprawled settlements.

The **local construction tradition**, if still available, can be a significant help in finding easy applicable solutions to solve some of the main climate and morphology issues, such as the correct management of humidity and heat levels in indoor environments and the proper control of the balance between natural and artificial daylighting. Using **local materials** can, obviously, improve the overall performance of the built environment, in terms of economic and technological feasibility, e.g. by reducing transporta--tion costs, improving the efficiency level of construction technologies and ensuring the correct knowhow development level.

The **management and community involvement** is a crucial step to ensure log-term effects and an effective shift towards a more conscious urban development. Spreading knowledge and awareness is one of the basic principles for the cultural advancement of communities. The design strategies for self-constructed buildings can, then, be focused on:

a. Increasing stakeholder participation,
b. Ensuring flexibility and adaptability,
c. Improving/preserving townscape and landscape,
d. Enhancing local features,
e. Using design strategies considering lifestyles and daily needs,
f. Promoting standardized components,
g. Supporting repeatable construction strategies,
h. Sharing simple implementation procedures,
i. Sharing knowledge about low cost construction techniques,
j. Providing safe areas for emergency management.

The direct involvement in the local community ensures different possible **results**, from sharing the know-how and repeatable procedures, to creating possible basic business opportunities for the citizens that will learn the self-construction techniques.

VII. A Checklist for Self-Construction Projects: the People Level

The modern project of developing and emancipating traditional and rural communities, by planning a total urban drift process for the society, reveals today a critical turning point in its late progress. This comes from the fact that the promise of new and better living conditions can be ensured only to a very small group of people, to few communities and only to specific areas. In this sense, urban planners and designers should reconsider the concepts of **'wellbeing' and 'comfort'**, analyzing how these theories changed over time. These concepts recently evolved from the original meaning, related to a transcendent component of the sense of life and death, to the most recent connotations, basically linked to the concepts of possession and consumption, that are directly connected to the mass production economy. A new sense of social wellbeing should be focused on the social components of the sustainable development.

The most important part of the proposed checklist is

related to the people level, for it is crucial to share some significant principles to **promote a new design approach**, focused on the development of new communities and the direct involvement of people in the city construction, even in the developing regions. This part of the checklist is related to some significant goals, that are synthesized in the following sections, recommending to:

1. Improve living conditions,
2. Increase consciousness,
3. Involve the community.

To **improve living conditions**, the checklist is promoting a significant shift in the attitude towards urban settlements and their development, by considering the following principles:

a. Incremental development (constant upgrading/development),
b. Main function first, utilities later,
c. Facilities availability upgrading,
d. Promotion of community organization,
e. Support to cooperative action,
f. Community self help construction,
g. Development of repeatable models,
h. Community self help construction,
i. Government assistance in access to land titles and credit,
j. Government assistance in basic infrastructure.

The checklist is also promoting to **increase consciousness** towards some crucial factors for the self-construction projects, such as:

a. Technical assistance on housing standards,
b. Supervision and maintenance of housing,
c. Cooperative system to manage utilities,
d. Support to helping team with educational sustainability,
e. Health risks consciousness,
f. Structure correct maintenance,
g. Personal education programs development,
h. Training in construction basic techniques,
i. Increased consciousness about sustainability,
j. Increased consciousness about risks.

These factors ensure the promotion of a **positive spiral** of knowledge, consciousness and know-how sharing, that can help the local communities to get uninhibited from the negative tendencies related to poverty and uncontrolled urban sprawl. Another significant part is supporting the cooperative attitude in local communities, to promote the increase of their educational levels.

The final part revolves around another crucial goal, that is to **involve the community** in the development strategies, to ensure long-term results, in order to:

a. Support helping team to assist with technical sustainability,
b. Support helping team to assist with economic sustainability,
c. Provide subletting and commercial options,
d. Create women's work centers,
e. Support people in achieving their goals,
f. Share local traditional construction typologies/ technologies,
g. Learn using flexible public/ semi-public spaces,
h. Help choosing the correct location for settlements,
i. Develop new functions and building technologies,
j. Improve the checklist.

Higher involvement levels ensure **better decisions**, for the stakeholders are usually contributing to the definition of the most preferable strategies for the communities during the entire decision-making process. Better decisions can lead to **long-term stable results**, reducing the fluctuations related to the uncertain outcomes that conflict instances obviously involve.

VIII. Conclusions

The purpose of the Workshop was to let students understand and experience the **complex system of relations**, connecting the conception and implementation of a building structure within the context of a developing country. From morphological features to typological and functional characters, passing from the system of organization, hygienic, sanitary, environmental, legal, regulatory and economic limitations, students were called to analyze techniques, materials and constructive elements, suitable to be integrated in the selected context. The **subsequent application of the method** will be developed through the future teaching experiences, improving the provided checklist and applying it to other existing contexts, in order to prepare a possible trip, in which the best concepts will be actually realized in the selected place(s).

The **educational method** combined the basic theories and knowledge with an experimental approach, based on a culturally and technically conscious professional practice in the design field, which allows students to experience the fundamental know-how, even in terms of soft and software skills, they acquired during their previous experiences. These teaching activities let students properly learn and practice how to finalize the structure dimensioning and to work on the main morphological and techno-typological options (performance factors), experiencing the several scales to which a project is designed (preliminary, definitive and executive stages). Another innovation in the teaching method is related to **training students to presenting their outcomes to their colleagues, getting used to discuss and debate with peers and with future customers**.

The Workshop was aimed at **investigating the design, landscape, spatial and distribution solutions** concerning the topics of 'BIM and hypogeum architecture', intended as a style of architectural design, characterized by high spatial and functional complexity. Basic school and health facilities are strategic elements, for the special role they play in the development of an integrated community, mainly, in the developing regions. They are complex systems for the specific spatial and functional special features that characterize them, enforcing relational concepts and innovative solutions in terms of distributive, constructive, structural and management concepts.

Providing facilities can be **the driving force of urban transformations in developing countries**: it is a basic factor for improving the living conditions in existing urban areas, representing a sustainable model for handling

contemporary urban systems towards development models, that embody strategies of soil consumption control, of limited resources exploitation and of reduction of the breakages between the metropolitan components, usually characterized by high fragmentation levels. Realizing a new 'facilities module' can become a great opportunity to redesign existing urban areas, conceived as a 'new centrality' for sprawling urban systems, in which **social aggregation** becomes the element that can generate a different functional organization scheme.

The course briefly focused on the axiomatization of the Project Appraisal theories and on direct and indirect assessment procedures, on the principles and models, as well as the cognitive and operative tools related to the **complex programming techniques for construction activities in developing countries**. Within a more general consideration on the technical, organizational and functional quality of the built and infrastructure systems, the teaching team focused on the following topics: technical and economic evaluation of construction works, identifying the project and the main alternatives, with specific consideration for the environmental, the technical and the economic feasibility components.

For the **feasibility assessment**, the course promoted the investigation of structures, from the initial concept to the final project, considering the works progress, with the aim of knowing and managing the complexity of the construction process in a developing country. The teaching team promoted lectures, case studies, practical exercises and simulations, focusing on the following issues:

- The complexity of the phases of project management and coordination,
- Planning and control methods for the project development,
- Knowledge and know-how needed to compare and choose the correct materials,
- Life cycle of construction materials,
- Comparison of requirements and performance levels,
- Budgeting and cost computation.

The **project progress scheduling** revolved around the development of a mix of school and health functions, consisting of a small classroom and doctor room, with some connected facilities. The project theme was related to a 'controlled complexity' and was specifically conceived to investigate performance approaches, related to spatial and technological elements, that can be managed by students, with their personal experience.

The project, developed during the Workshop, allowed each student to acquire **basic knowledge and application skills** regarding:

1. The correct proportions of educational and sanitary rooms, in a developing context, by organizing their morphological, typological and spatial configuration;
2. The definition of typological and distributive features;
3. The design of technological systems and elements;
4. The technical feasibility of the proposal, as a consequence of a design process, oriented to its viability and to the performance control for the built environment, also through the analysis of the construction costs and the economic assessment, relat-
-ed to bills of quantities and cost calculations.

In terms of **teaching method**, the students work included analyzing the project area and its surrounding, studying the functional program and some examples of buildings conceived as organic constructions, setting the overall concept and the project development in its typological, distributive, architectural and contextual integration elements. During lectures, students learned the main principles of architectural and urban design in developing countries and of social facilities concept.

The teaching team presented some **reference examples**, analyzed independently by students in the classroom work, carried out in groups and with the support of professors. The outcome was displayed during the intermediate seminar deadline, conceived as collective projects review. The goal was to **foster the mutual comparison and assessment between students**, through the constant critical review of the proposed results and the interaction between speculative and empirical learning levels, in the cognitive development on the project strategies. Therefore, students had to attend the course from the beginning to the end, following and participating actively to every and each lecture, through discussions and short presentations, to introduce their critical point of view towards the goals to be reached with their proposals and reviewing with the professors the solutions planned by other groups.

Students were guided in a **gradual process of accomplishment and application of the methodological and operational tools** used for developing their projects, along the following stages:

1. Preliminary concept, with the definition of the main architectural and performance features for buildings and of the main principles for the correct integration in the context, including the environmental profile;
2. Preliminary design, with the explanation of morphological, typological and technological options at the correct building scale, admissible in terms of legal and technical feasibility;
3. Final layout, with the validation and development of the preliminary project through a BIM model;
4. Further testing and validations to the final design layout, at the scale of an executive design, checking the technical accuracy of the proposal and the feasibility of the selected technological options, with graphical representations of the overall development and of the construction details.

The teaching team selected the main variables of the Workshop topic, providing support and educational documents, that made the results immediately operational, resulting in some main activities of investigation and framing. The main aim was **investigating the physical and socio-economic context and the related needs**, in terms of economic, technical, hygienic, environmental, distributive and legal limitations, but also considering the construction systems and the features of building materials and of compliant solutions, through check-list controlled activities. This allowed students to **concentrate their efforts in the design process**, using the information collected in the steps related to the analysis progression

(interpretation, configuration, evaluation and decision-making), with a gradual acquisition and application of the essential methodological and operational tools. The final work was developed according to a scheduled program of activities, initially defined with the teaching team, that configured a guided path towards the final proposal, under the constant monitoring of professors of the learning outcomes.

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AUTHORS PROFILE'

Marta Maria Conconi
After graduating in 1992 in the Master of Architecture at the Politecnico di Milano, in her Professional experience and University research, M. M. Conconi (Milan, Italy, 02/01/1968) studied the complexity of the components of materials and industrial products for buildings and the dynamics and relations of project choices in planning. She started working founding his own Atelier, never leaving her mission in research in material and teaching technological and innovative skills of new and traditional components. She is lecturer for international Course and PHD for Politecnico di Milano starting also her Mission as Visiting Professor Abroad as in Marocco, India and China. Since 1992 she is tutor of major Professors of Politecnico di Milano in Communication, Product Design and Interior Design. Since 2005, she is Contract Professor at the Department of Architecture and Design (INDACO) of the Politecnico di Milano (via Durando 38, 20151 Milan, Italy; e-mail address: marta.conconi@mail.polimi.it). Her main research interests span from Technical, performance, formal, sustainable, features in their holistic and non-sharable complexity, developing new trends and concept to afford new building and social needs. Dr. Conconi is member of the local Architects Association, and she took part to many Conferences and Seminars as speaker. She is also Expert consultant, enrolled in the register of the local Court, in the field of Public buildings tester and several specializations related to feasibility of the Project.

Alessandra Maria Pandolfi
After graduating in the Master of Science of Environmental Sustainable Urban Planning at the Politecnico di Milano and at the Politecnico di Torino (following a special double degree program), in her PhD program A. M. Pandolfi (Somma Lombardo, Italy, 05/13/1982) studied the dynamics and relations of econo--mic values related to development rights and their transfers in Italy and in some other major countries. She graduated also in the 1st cycle of Alta Scuola Politecnica in 2008. Since 2010, she is Contract Professor at the Department of Architecture (Dipartimento di Architettura e Studi Urbani) of the Politecnico di Milano (via Edoardo Bonardi 3, 20133 Milano, Italy; e-mail address: alessandramaria.pandolfi@polimi.it). She is author of more than 40 international publications, including several papers and books in the field of Project Assessment and Economic Evaluation. Her main research interests span from Sustainability, Feasible Architecture and Sustainable Development to Spatial Analysis, Urban Planning and Land Use Planning and Urban Sustainability. Dr. Pandolfi is member of the local Architects Association, and she took part to many Conferences and Seminars as speaker. She is also Expert consultant, enrolled in the register of the local Court, in the field of Economic Evaluation of Projects. She was awarded with the gold medal for the best graduated student in her BSc and MSc programs.