A329

open + building 2030

FOR FUTURE HEALTHCARE ENVIRONMENTS

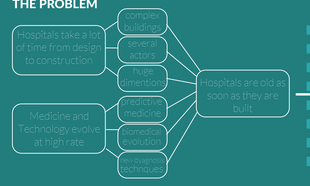
#design #prefabrication #modularity #quality #flexibility

ABSTRACT

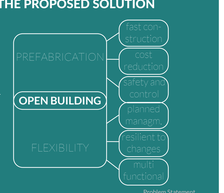
In recent years, many studies have revealed the increasing rate of hospital obsolescence: this fact is a reflection of the fast pace at which contemporary society and medical knowledge evolve. The main purpose is to realize flexible healthcare facilities based on different countries organizational systems, able to update their services in time. Considering that there are several companies that realize prefabricated technologies and starting from the Open Building approach and the current application of Plug-In users' rooms in hotels, our research group developed a new approach in flexibility for hospital wards with the "Open Room", already predisposed to respond to several functions through the substitution of finishing prefabricated panels.

The conceptual design is feasible to be developed and realized in several advanced countries able to support long-term investment and technological experimentations in the close future (2030).

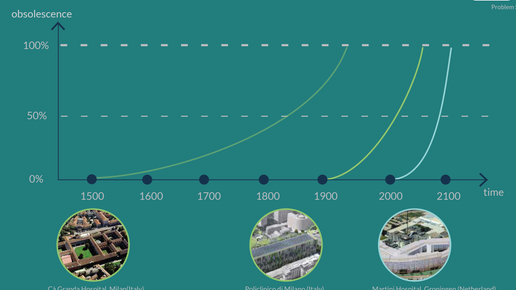
THE PROBLEM



THE PROPOSED SOLUTION



Problem Statement



Ca Granda Hospital, Milan(Italy) 1466 -1943

Policlinico di Milano (Italy) 1930-2010 (new design)

Martini Hospital, Groningen (Netherland) 1991-2031(expected)

Hospital obsolescence

THE RESEARCH QUESTION

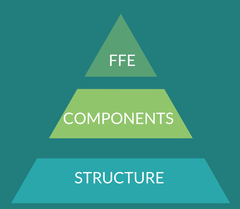
One of the most important challenges that architectures for health must address is to be resilient to economic, social and health aspects, as well as ensure that the system services and activities globally, meet the needs related to the fast evolution and the peculiarities of hospital management and organization. Flexibility is the ability of a structure to change its functions and organization in the short, medium or long term, based on cost containment and user requirements.

To deal with this need, among the constant surface flexibility strategies, starting from the Open Building approach, a research group developed the Open Room approach based on prefabricated rooms with the aim of optimizing installation and construction time.

TERTIARY SYSTEM
5-10 years
FFE (Furniture, Fixture, Equipment) and plants system terminals

SECONDARY SYSTEM
20 years
Inner walls, floorings, ceilings, secondary plant system and space plan

PRIMARY SYSTEM
100 years
Structure, building envelope, main distribuon and building plants system



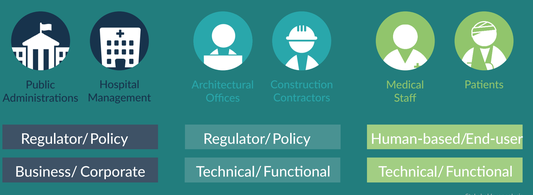
Open Building philosophy

FROM THE OPEN BUILDING TO THE OPEN ROOM

Starting from the current knowledge in Open Building, the Open Room is structured by:

- Primary System, in which the modules are plugged in the structural framework;
- Secondary System, through the Plug-In approach, represents the prefabricated sub-structures that host the skeleton with all the implants and needs for all the typologies of hospital rooms;
- Tertiary System, that features both the furniture and all the finishing elements and allows to transform immediately the healing environment.

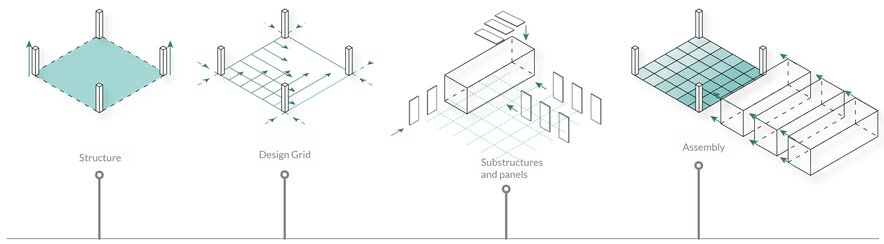
The research foster multidisciplinarity and involves different stakeholders potentially interested by the project.



Stakeholders analysis

The Concept Development

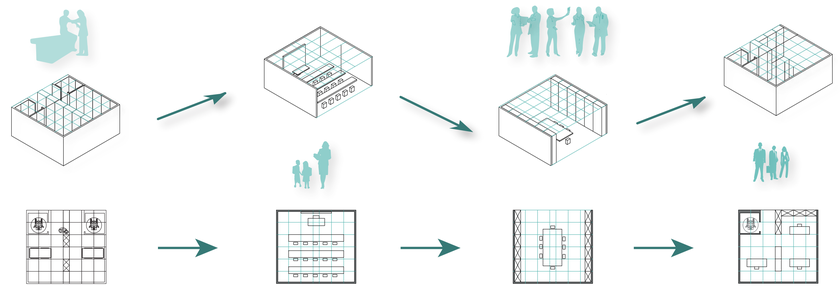
A sequence of operations to innovate healthcare facility design process



Concept dyagram

The Strategic Perspective

A hospital that is able to embrace the changes with resiliency and flexibility

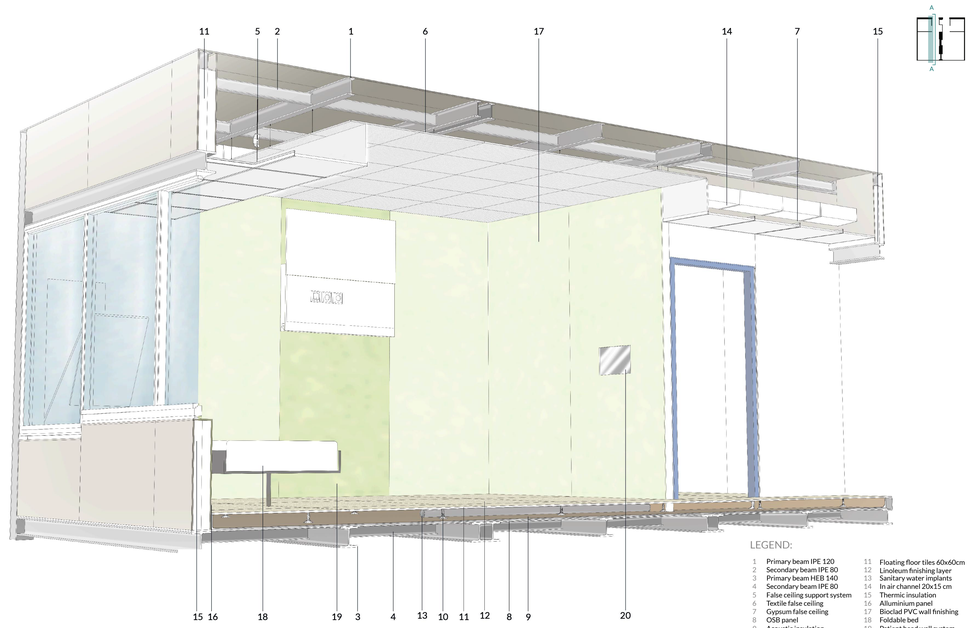


Concept dyagram

The Design Definition

Interior design and preliminary technological definition

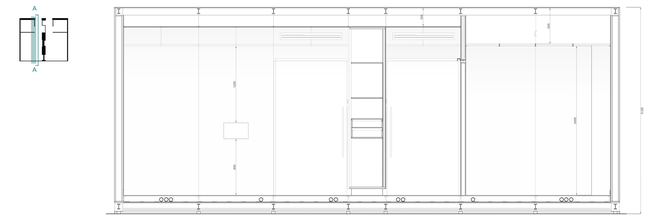
Floor plan



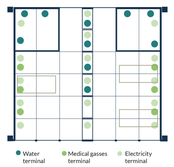
Axonometric section

The Technological Evolution

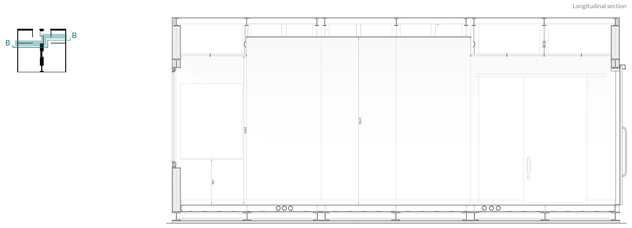
Space, Implants and Structure for a feasable innovative design



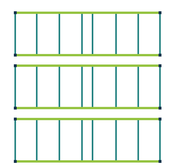
Longitudinal section



Implants terminals



Transversal section

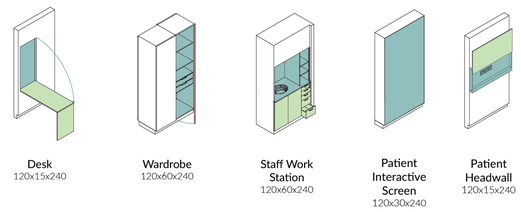


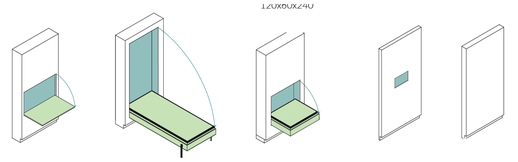
Secondary beams | Primary upper beams | Primary lower beams and columns

Structural elements

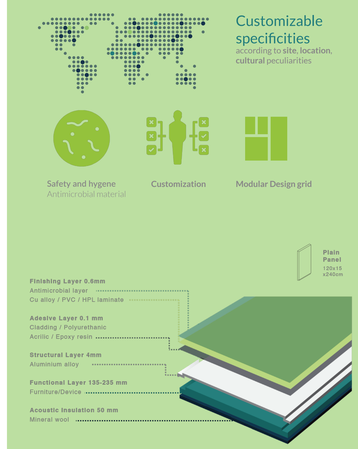
Modularity and Customization

Finishing elements for a functional, customizable and safe environment





Abacus of possible furniture



Conceptual stratigraphy

Material analysis

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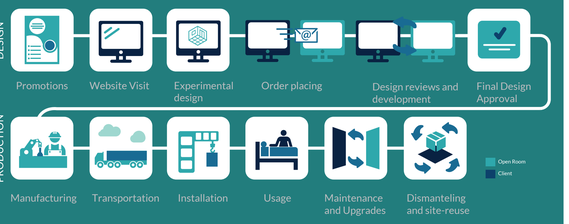
#global model #safe process #humanization #time savings #cost reduction

LOGISTIC SYSTEM PROCESS

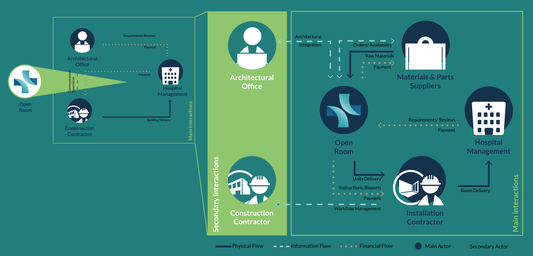
Starting from the prefabricated approach, the construction system will be very different from the usual one. The solution proposed wants to exploit in the best way all the advantages that prefabrication and dry technologies determinate: in fact, the Open Room (composed by three modules) will be brought by road transport to the construction site. After having placed a module on a wheeled support, a crane will lift it and slide it into the Primary System. Once the module has been placed inside the structure the wheeled support will slide out and the workers can start joining the first sub-structure, with its pipes and implants, to the hospital structure. The second module can now be lifted and put in place like the first one as the workers continue the joining process, also between the different modules themselves, and at the end the process is repeated a third and last time.



Logistical flow map

THE BUSINESS MODEL

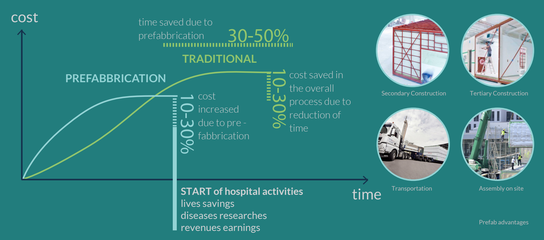
It is clear that the approach allows to the modules to be brought at the construction site ready to be plugged-in, that means panels will be already present inside the substructure but some of them will not be jointed if some operations underneath or behind have to be performed. Therefore, the design approach permits a significant decrease in the construction times, which was inspired by the growing tendency of placing prefabricated bathrooms in healthcare facilities, and the other is to increase in the safety of the work environment since the majority of the building operations are performed in the controlled environment of an off-site industrial facility.
From the economic point of view, the prefabricated strategy can allow cost reduction not only for site construction, but also in maintenance actions (macro or micro operations) or hospital transformation during the time.



Business model map

BUILDING SOON, IMPROVING HEALTH SOONER

In the contemporary society several market and real estate fields are radically transforming. It is the case of the hospitality sector where prefabricated technologies are fostering innovation and evolution.
The application of this hospitality theory and framework to the healthcare service and design allows the discussion around complex and relevant thematic both in the research and in the practice field.
Within this scenario, the development of a prefabricated room able to host different functions in time is considered and evaluated. The analysis of the environmental units allowed to understand each space in terms of structural, technological, functional potentialities and limitations and their spatial and architectural features.
In addition the case studies supported this process to define interesting and innovative solutions toward the definition of healing environments.



Prefab advantages

A Humanized Environment

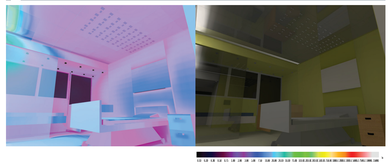
Soft qualities, innovation and human centered design for the hospital of the close future

Day visualization

Night visualization

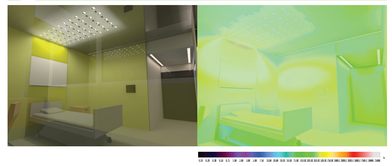
Night visualization

Night Sleeping Hours



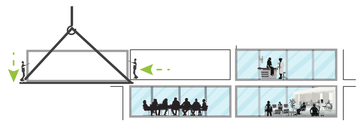
Night Medical Examinations

Day Base Case

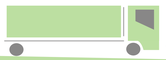


Light simulations

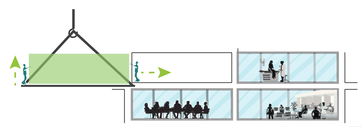
DIFFERENT FUNCTIONS ACHIEVED BY DIFFERENT MODULES



MODULES REMOVAL MAINTAINING THE HOSPITAL OPERATIVE



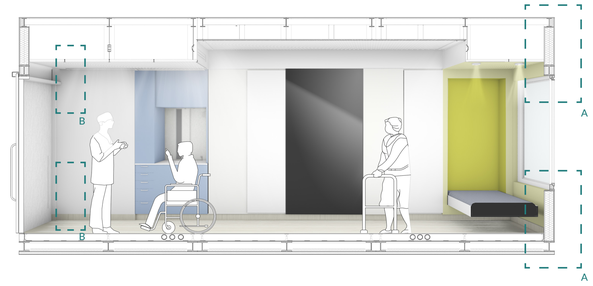
NEW MODULES FOR SUBSTITUTION



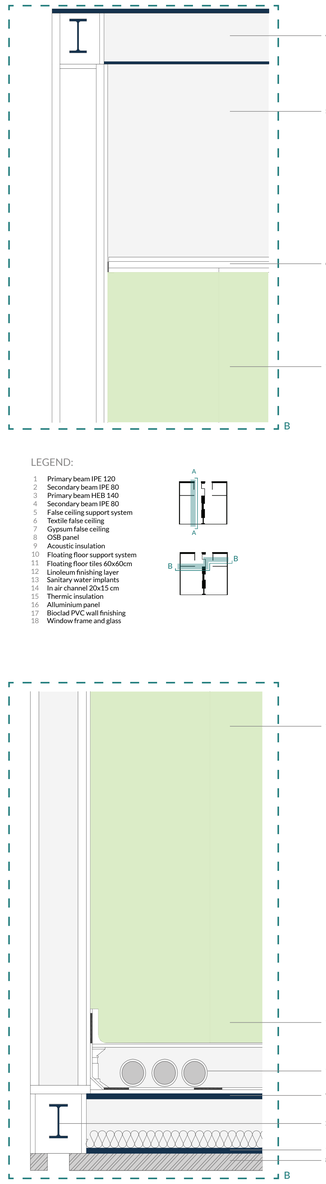
MODULES REPLACEMENT INSTALLATION WHILE HOSPITAL IS OPERATIVE

Dry Prefab Technologies

Safety, process control, time and cost reduction

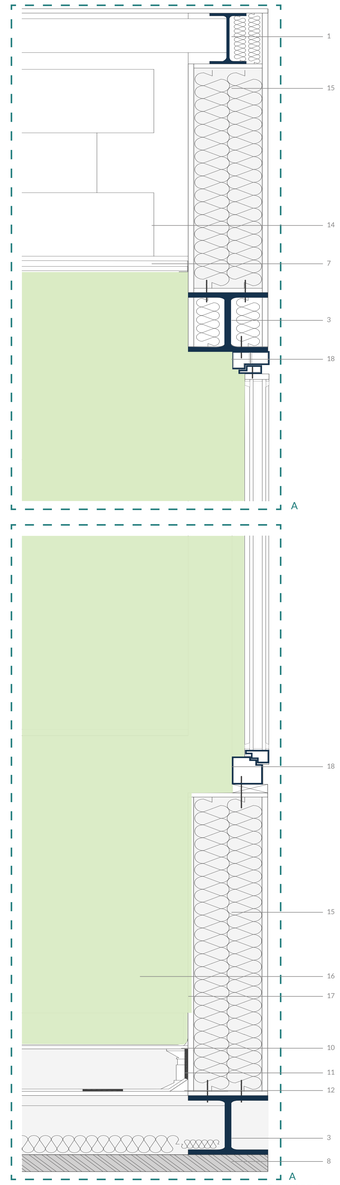


Perspective section



LEGEND:

1 Primary beam IPE 120
2 Secondary beam IPE 80
3 Primary beam HEB 140
4 Secondary beam IPE 80
5 False ceiling support system
6 Textile false ceiling
7 Gypsum false ceiling
8 OSB panel
9 Acoustic insulation
10 Floating floor support system
11 Floating floor tiles 60x60cm
12 Linoleum finishing layer
13 Sanitary water mains
14 In air channel 20x15 cm
15 Thermic insulation
16 Alluminium panel
17 Bioclad PVC wall finishing
18 Window frame and glass



Technological details