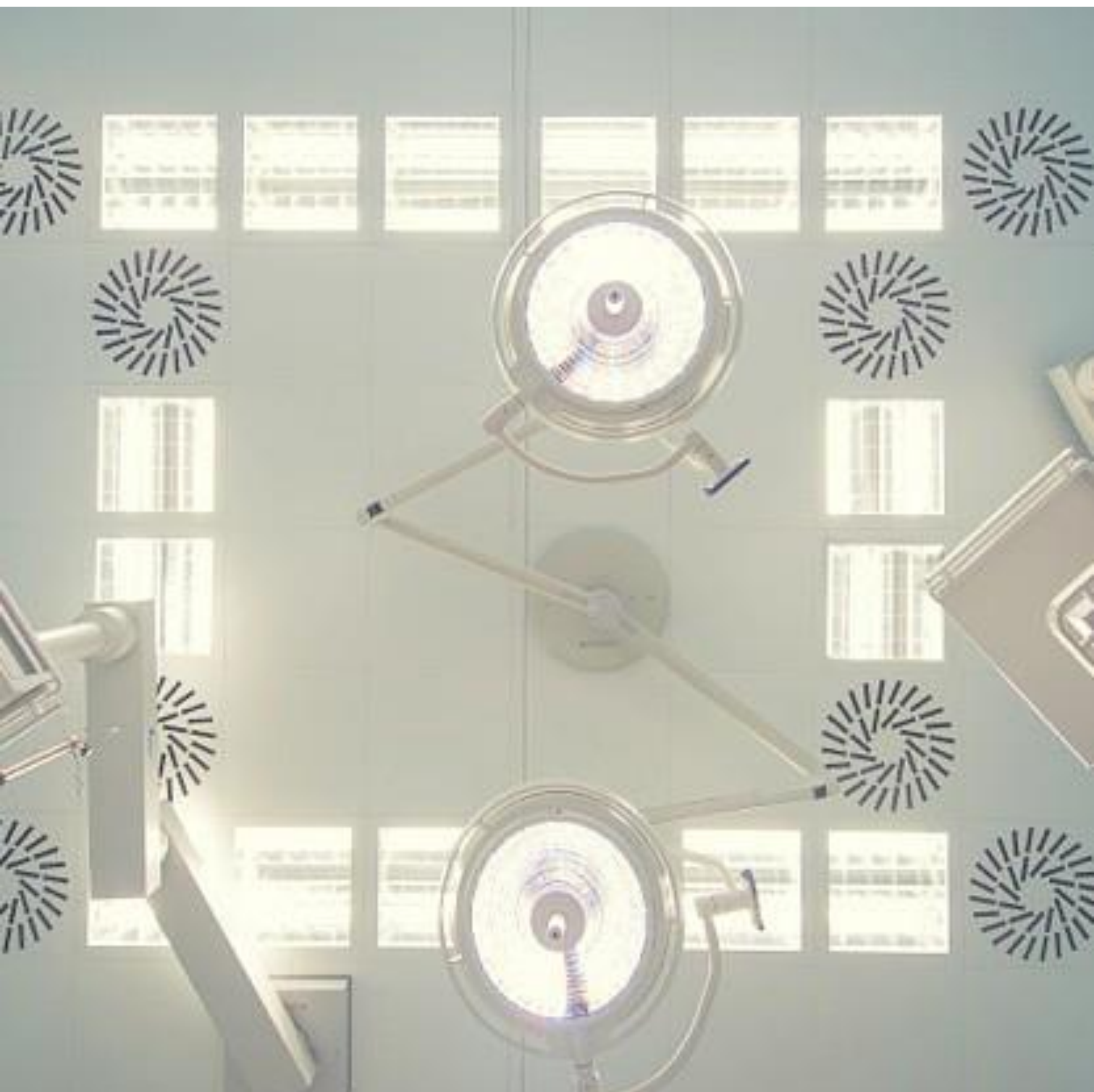


HOSPITAL DESIGN AND CONSTRUCTION

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Chapter I

Multiple parameters system for right decision making

Chapter 1

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ABSTRACT

Designing a hospital is a complicated task.

Construction the hospital is even more challenging mission with high level of risks.

After 20 years of involvement in the healthcare facilities design & construction, as an owner representative, as a chief engineer in project management firm and currently as a prefabricated hospital units manufacturer, I have been subjected, in many cases, to the question regarding the preferred construction system,

in order to reduce the risk of non-satisfactory level from the executed works, delays in the project timetable, construction budget unexpected growth and minimizing the interruption to the existing running facilities at the near vicinity.

Construction is a complex array of interdependent activities. Some would define as an "organized chaos".

Chapter 1 | Multiple parameters system for right decision making

For example, construction differs widely from manufacturing in that;

- The work is often seasonal
- It's often involves remote sites with various access problems
- The process is not as predictable
- Difficulty in applying automation
- There is high potential for encountering unforeseen conditions
- Costs can vary according to conditions
- Difficult to manage and supply utilities and other resources.
- Technical innovations are adopted slower
- The work is not performed in controlled conditions, therefore highly impacted by weather (limited construction seasons) and other environmental conditions.
- Success is dependent upon the quality of project employee's Remote location of the construction site as a major challenge for onsite works inspection, on site professional effective manpower.

So, what would be the professional tools to be used in order to minimize the risks and overcome the complexity of the health care facility construction?

This article is offering to see the prefabricated - modular construction system as the preferable construction system in projects at the health care sector in comparison to any other on-site construction system, with significant advantages in a well-defined set of techno-economical parameters.

Chapter 1 | Multiple parameters system for right decision making

What is the prefabricated -modular construction system? This is a process that constructs a building off site, under controlled manufacturing conditions, using the same materials and designed to the same codes and standards as conventionally built facilities. Buildings are produced in 3D "modules" that when put together onsite, they reflect the identical design intent and specifications of the most sophisticated traditionally built facility without compromise. Structurally, each module is engineered to independently withstand the rigors of transportation and craning onto foundations. Once put together and sealed, the modules become one integrated wall, floor and roof assembly.

Manufacturing plants have stringent QA/QC programs with independent inspection and testing protocols that promote superior quality of construction every step of the way.

Modular construction removes approximately 90% of the building construction activity from the site location, significantly reduces site disruption, vehicular traffic and improves overall safety and security.

In these articles we shall deal with a well-defined set of parameters such as;

Project execution length, Project construction cost, Work productivity, Labor safety, Work quality, Contribution to "Green building" concept, Impact on environment, Employees professional training, Disruption to adjacent facilities, Transportation restraints, Users negative perceptions, Design flexibility, Design cost and more.

Chapter 1 | Multiple parameters system for right decision making

DESIGN MAKING AT THE PRIVATE AND PUBLIC SECTORS

Comparison to alternative revenues together with the payback period of time are the leading parameters for economic analysis, in the public sector, where most of the healthcare facilities are developed and maintained, the cost-benefit analysis consider not only the direct tangible parameters such as financial investment, interest rate and revenue stream, but also the indirect - intangible parameters such as: reducing risk at the construction site, reducing noise disruption and air pollution to the surroundings neighborhood, eliminating infection in the running hospitals adjacently located to the construction site, reducing debris quantities from the construction site, supplying earlier-faster medical goods to the public, incorporating modern industrialization into the "low tech" on-site construction sector, resulting highly trained employees with higher income level and more. Considering the "whole package" of direct and indirect, tangible or intangible parameters, the cost-benefit analysis, will guide the decision makers in the public sector to allocate the public budget, ranking the alternative-optional healthcare investments, in more - environmentally effective way.

Chapter 1 | Multiple parameters system for right decision making

The main questions the decision makers need to address when comparing modular prefabricated system to other methods such as conventional (onsite), prefabricated panel system and hybrid system are;

1. Does the modular prefabricated construction system reducing the facility **construction schedule** ?
2. Does the modular prefabricated construction systems reducing the facility **construction costs** ?
3. Does the modular prefabricated construction system **increase labor safety** ?
4. Does the modular prefabricated construction system increase the **overall labor productivity** (in terms of built area by an employee per time unit)?
5. Does the modular prefabricated construction system **reducing environmental impacts** such as: Noise destruction, Air pollution and infection risks (in the case of adjacency to an "on site" running health care facility)?

Chapter 1 | Multiple parameters system for right decision making

6. Does the modular prefabricated construction system increase building quality and craftsmanship?
7. Does the modular prefabricated construction system has potential to significantly contribute to the "Green Building" projects?
8. Does the modular prefabricated construction system has the potential to be widely spread in the medical facilities development sector?
9. Does the modular prefabricated construction system have the potential to be a solution for health care facilities in developing countries and/or in extreme construction site conditions?
10. Does the modular prefabricated construction system have the potential to increase the design efficiency?
11. Does the modular prefabricated construction system limits the ability to make changes to work on site ?

Chapter 1 | Multiple parameters system for right decision making

12. Does the modular prefabricated construction system increase the design costs?
13. Does the modular prefabricated construction system is limited by the standards and building codes which are applicable in the conventional construction system?
14. Does the modular prefabricated construction system limits architectural design options?

These main issues will be addressed, one by one in the authors next chapters, presenting statistical analyzed data as was collected from major groups of professionals in the medical facilities design firms, at the managements of private and governmental hospitals and at the State agencies, all in different parts of the world during the years 2013-2016.