Honors Thesis

Master of Science in Architecture Construction City

Abstract

**Prefabricated construction's industrialization processes
Contexts of experimentation**

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The thesis was created with the purpose of investigating the processes of industrialisation of prefabricated buildings, since the so-called "revolution" of Industry 4.0 has also touched this sector, changing its potential and reasons.

The survey of today's prefabrication market finds its assumptions in the roots of modular prefabrication, which date back to the early twentieth century, when some pioneers began to bring forward the idea of an architecture that could be built by assembling factory-made components. The first experimenters made prototypes in France and the United States, using modular building blocks and modern materials; these archetypes did not have a productive mass production following, but they remained as a trace of the first visionaries who built models to experiment with the possibility of creating prefabricated houses with modules.

To meet a new vision of prefabrication, i.e. an idea of architecture already in the industrialized sense, it is necessary to enter another phase of the Twentieth century, in which the experiments are already aimed at the construction of multi-storey buildings and in a circular perspective. Industrialization, intended as series construction, not only assumed but proven, can be traced back to the 1960s, when the first significant interventions in the field of prefabricated construction arose. These were useful to experiment with real industrialization programs.

The thesis, after the examination of the experiments of the past, continues with the comparison of the case studies of contemporary realizations and the relative factory of production of the prefabricated modules. These are representative of different types of buildings but also of diverse geographical and cultural environments, given their location in different areas of the globe.

To fully analyze and compare these representative cases, a flow chart has been designed for each one, highlighting the characteristic aspects, such as the production typology of prefabricated modules adopted by the company, the modalities of transport of the components from the production factory towards the yard and the entire management of the constructive process.

The above has led to the identification of the methodologies finalized to either reduce times and construction costs with attention to the circular economy and to have a greater control on the various phases, or to elaborate and to share a flow of information for increasingly complex projects. The common goal that emerged is therefore to industrialize the processes and foresee all the design aspects, through a framework of information shared among all those who take part in the design, production and construction process.

The thesis has reserved an important role to the study of digital tools and technological contexts, which characterize Industry 4.0 with their innovative aspects, which can be synthetically grouped into six categories:

• Automation / CNC Machines
• Integration / Cloud
• Data processing and analytics
• IoT (Internet of Things)
• Databases in interoperable format
• Integrated systems.

The interesting concept emerged from the thesis is that compared to the experiences of the past, so the Twentieth century, the technological innovation given by BIM, CNC machining processes, logistics and IT management, represents the support network useful for the development of a process of industrialization.

The future perspectives are therefore represented by the objective to reach greater efficiency in terms of time, costs, management of the supply chain and to reduce production waste. Critical issues are instead identifiable in the within of the repercussions in terms of environmental and social sustainability, just think about the logistic component (that is the transport), topic legacies to the interoperability, that it is more and more integration between BIM and GIS.

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