Producing Project

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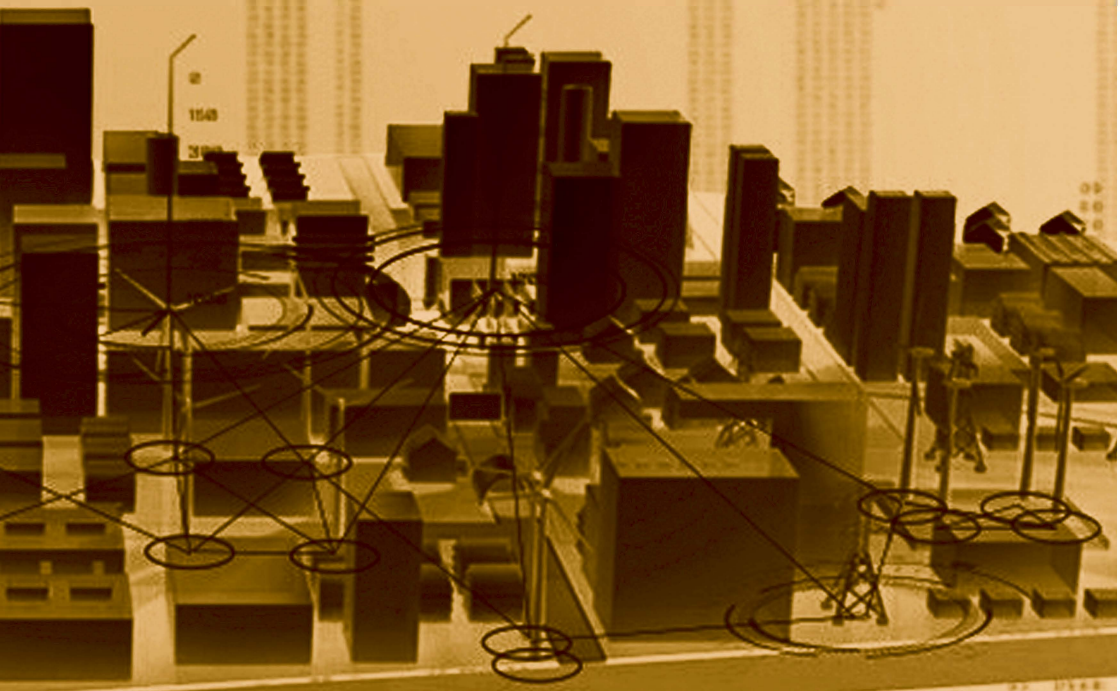

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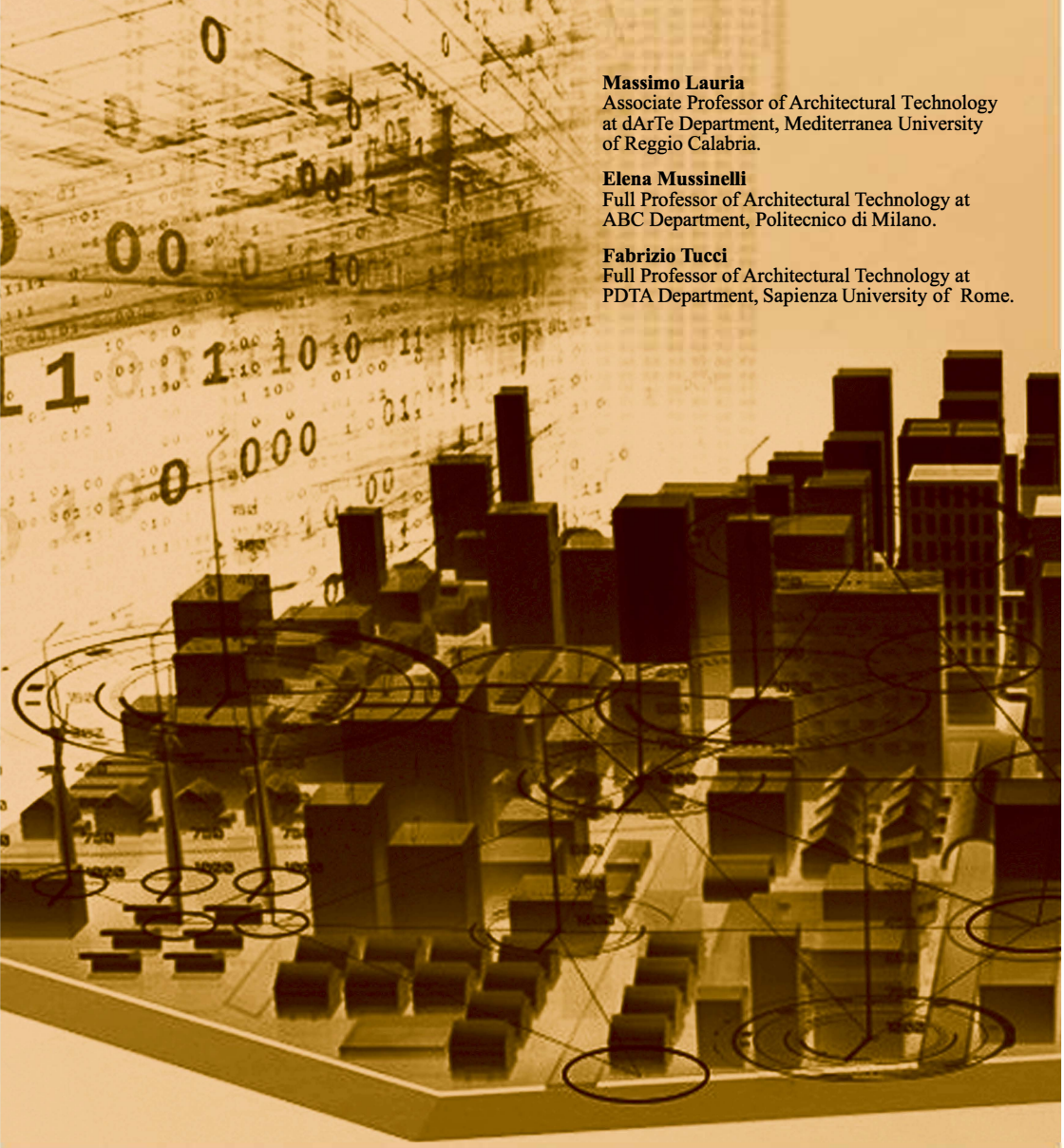

The transformations created about the design activity by the several challenges started by the economic crisis, climate change and environmental emergencies, together with the impact of the Web and ICT on social and productive systems, highlight many critical issues, but also significant prospects for updating concerning places, forms, contents and operating methods of "making architecture", at all levels and scales.
In this context, the cultural tradition and disciplinary identity of Architectural Technology provide visions and effective operating practices characterized by new ways of managing and controlling the process with the definition of roles, skills and contents related to the production chains of the circular economy/green and to real and virtual performance simulations.
The volume collects the results of the remarks and research and experimentation work of members of SIT*d*A - Italian Society of Architectural Technology, outlining scenarios of change useful for orienting the future of research concerning the raising of the quality of the project and of the construction.

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2.1 DIGITAL INNOVATION AND DESIGN COMPLEXITY

Eliana Cangelli[*]*, Valeria D'Ambrosio*[*]

Abstract

Industrial production, from its origins, has allowed the acceleration of activities and processes in numerous fields, speeding not only the movement of capital, goods and information, but also the creation of value. In the face of the great potential for transformation due to industrial revolutions, the value of the processes has not affected only the economic component but has invested the spheres of ethics and society, modifying, through the incidence and effects of innovations, uses, consumption and lifestyles. The developments of contemporary production methods schematically identify continuity models in modernisation or, on the contrary, transition scenarios towards other models (from time to time defined as post-industrial, post-modern, etc.). Innovation is associated with a gradual transition to dematerialised and destandardised processes, as well as differentiated from conventional industrialisation due to continuous innovation strategies in relation to the creation of new products, markets, needs, design concepts.

Keywords: Technological design, Building process, Digital tools, Technological innovation, Design complexity

New design dynamics

Current modalities for the production of the project, of the elements of innovation and of the interactions with the great contemporary themes have changed, in recent years, the horizons of its conception and its development.

The widening of the field of action and the increase in the complexity of the project are due, on the one hand, to requests in the areas of sustainability, the reduction of energy needs and energy efficiency in the integrated system of open space buildings, on the other hand to the evolution of the concept of urban systems and parts of the city, both for new projects and in the redevelopment and regeneration of buildings (Perriccioli, 2016).

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The reference to the evolution of new technologies completes the meaning of a design tool that is increasingly interacting with other skills, with wider contexts and with the challenges of modernity.

The production of the project also tends to change on the client's front: the conventional one is almost folded back on itself, and public entities are not always able to effectively and consistently set the strategy for the future of cities; more and more often the convergence between public and private and between research institutions and local administrations presents a component of greater dynamism. Within this evolving scenario, the transformations of the construction and labour market determine structural changes in the conventional relationships and contents of the project, which takes advantage of new job prospects, focusing on the requalification and regeneration of territories and urban areas. The project is addressed with attention to the most advanced contexts and business realities, implementing a transition from a scenario in which the concreteness of architecture was generally connected to construction companies, a central subject in the construction process, towards a new reference made up of the manufacturing companies of systems and components that carry out deep research and updating activities. The influence of the work due to industrial producers directs the project towards new scenarios for innovation, inevitably less marked in the case of construction companies. The manufacturers of industrialised components and systems are in a certain sense the new engine of innovation, contributing to the evolution of the project in terms of performance, therefore more measurable, in the effects as in the fallout, compared to artisanal and empirical procedures (Torricelli, 2011).

Placing the project in an area of greater awareness with respect to the performance that it must offer, opens up to a field in which the project produced to offer operating instructions responds to the panorama of certifications that are now increasingly indispensable in the Italian and above all European regulatory framework. From this point of view, many companies that work in the field of energy efficiency of buildings as well as in the system component, to give concrete examples, are fundamental for the technological transfer of know-how that has a deep impact on the quality of the project (Arthur, 2011).

Today, the development of new design dynamics cannot remain entirely within self-referential mechanisms, but it is necessary to balance the intuitions and design concepts with the inputs that come from the construction industry, and to work in the field of technologies that become an intellectual resource for the project (Losasso, 2017).

Performative design and local contexts

In this new phase of project production, the inputs of construction industry and other sectors ensure that the creative process can be better focused and

open to new horizons. The needs of the inhabitants can receive a concrete response through the use of performance-qualified industrial production.

A further qualification factor is the new design scenarios according to a technical evolution linked to the relationship with territorial contexts (Anderson, 2012).

If on the one hand, in fact, a great ability to dialogue with the international and European design experience is needed, it is also necessary to have the ability to understand that each project must have a relationship with the context in which it operates. The context is not only environmental based but also focused on local resources and production conditions.

It is necessary to be able to conceive and produce the project from a broad perspective, in which relationships are not rigidly localistic but capable of bringing back to the local scale the experiences and examples carried out in larger areas: only in this way a real project transition feed new scenarios for its innovative production. The evolution of the design processes towards those digital processes in which the so-called enabling technologies take a leading role, leads to activate numerous innovative strategies for the purpose of space/time compression. The effects of this action can constitute a value for the overall development of the company in the transition from a standardised production to an on-demand and personalised production based on an open and flexible design. This basic tendency does not have linear trends and introduces, with respect to conditions of greater stability and certainty, performances and new values such as instantaneousness and transience, as well as the request for flexibility and rapidity in responding to changes.

The potentials of innovation

Innovation in the field of production of the project is thus inserted into a moment of socioeconomic and cultural transformation, in which technology prompts revisions and new solutions with respect to pre-existing situations, through the adoption of new systems and criteria. In the field of the technological design of architecture, innovation today requires grappling with the new scenarios imposed by the digital revolution and by the themes of industry 4.0. The complexity of the themes relating to the production of the project is in fact to be set against the aspects of the impacts of the so-called fourth industrial revolution. Microelectronics and ICT have effectively modified the physical and social context we live in, but above all have changed the relational and behavioural models, and therefore our interaction with the environment.

The fourth industrial revolution has broadened the ability to acquire information, to implement simulations, and to verify and assess complex questions, thus stimulating the creative process. While the first industrial revolution had introduced a fundamental aid for reducing the physical force employed in pro-

duction processes, the fourth industrial revolution directly supports our cognitive sphere, thus augmenting the ability to acquire and process information.

The issues at play are many, as are the innovations involving both the field of the project, and that of the construction of architecture.

These innovations include artificial intelligence, augmented reality, the internet of things, open source platforms from which to draw and at the same time enter information, digital traceability, robotics, and 3D printing, as well as new products and new materials. These are elements that modify both the cognitive process and the design and construction process, but also that of control and management in the use phase, by being able to re-enter the information relating to monitoring in the project development phase.

The practical applications show, for example, how the use of a tool like BIM permits a real time interaction among the various skills within the project, and a no longer empirical systematisation through the onsite verification of the different systems that allow the buildings to be made and to function, and how the mode of transmission of the project's operating instructions changes, as it transitions from static, two-dimensional representation "on paper" to a dynamic representation of a virtual 3D model. BIM, GIS, parametric software, and virtual simulations are some of the tools that now contribute towards the production and representation of the project. However, while not limiting them to the sole dimension of production of the project, the innovations impacting the field of carrying out the project, of the construction of architecture and therefore of the work site must not be neglected either. A new mode of prefabrication, "industrial mass customisation", prototypical industrialisation, onsite production, offsite manufacturing, and 3D printing is outlined, and it seems clear today that the adjective "industrial" effectively has a new connotation (Butt, 2012).

The term "industrial" in fact, is no longer automatically associated with mass production and with the homologation of architecture, but rather with extreme destandardisation, with prototyping, and with the possibility of industrially producing unique and customisable products. Lastly, the final phase of the process, impacted by the new technologies, is the use phase, in which the tools of predictive simulation broaden the detailed monitoring possibilities and allow their outcomes to be inserted as early as the design phase.

Complex design vs artisanal design

All these innovations come up against the environment and socioeconomic arrangements (just consider the green economy and the circular economy), grappling in the end with society, both in terms of direct involvement and participation, and in terms of spreading the outcomes of this revolution.

This, then, is a complex picture, in which it seems difficult to put the various tiles in order, in which everything is fleeting, even if placed in relation to

the others. It is in fact impossible to build an organic, logical, deductive picture. The concept of a network of complex relationships, of interactions that skip the knots, is absolutely in line with the framework of knowledge and innovations in the field.

When dealing with scenarios in profound evolution, the themes of technological research record underlying conceptual and operative permanencies: the spread of technical information, knowledge transfer and skills in developing or in building the project, the development and monitoring of the performance of the architecture project, the innovation of the technology transfer, and the hybridisation and modification of construction techniques. As things currently stand, although there is a broad debate in terms of research and experimentation, widespread building production in Italy continues to be of the traditional type, and of very low quality. The task of the technological area consists, perhaps, precisely of transferring the information and new potentials of construction to the building industry (Menges, 2011).

Today, in fact, we are on the one hand witnessing an experimentation taking place through the performance of complex projects, in which there is a strong economic investment. This involves the structure and form of the organisations that produce the project, able to offer increasingly innovative services in support of architecture, albeit developed mainly for types that do not belong to the Italian context. On the other hand, the experimentation, more wide-spread and more detailed, of certain vanguards is highlighted, attempting in effect to make these innovations available to society and proposing constructions in which the relationship between costs and design creativity, between costs and knowledge, is inversely proportional: on the one hand, costs are reduced, and on the other the development of an ability to design and to identify new solutions emerges.

The contribution of technological research

In such a complex framework, what can the contribution of research be? What can the innovations on building production be? The risk academia runs is that research will not be incisive, and will be limited, de facto, to describing a process in progress without seeking to govern it, in which innovation risks being confused with the instruments that serve to produce it. The risk is being unable to provide incremental and significant results that can change the scenario of the relationship between production and design in the contemporary world.

The research contributions presented at the session of the conference "La produzione del progetto – Qualità del progetto e qualità della costruzione. Innovazione tecnologica e ICT per Il processo edilizio" ("The production of the project – Quality of the project and quality of construction. Technological innovation and ICT for the building process") are reassuring testimony for that which research into the technology of architecture is called upon to develop.

In the contemporary world, technique stops being an object chosen by society, but is the setting in which it acts and in which behaviours are determined that transform human action. From being a means, technique tends to become an end, which is to say a complex system interacting at a number of levels with the society that guides its purposes through factors of mediation. The aspect outlined by numerous authors, relating to the social consequences of technology, requires being articulated differently within socio-technical systems, in which human and technological components operate symbiotically towards a generative purpose. In the era of the gradual prevalence of digital technologies, the purposes of the technology of architecture are to be sought within the ability to guide complex systems towards horizons of meanings and towards purposes that supplement new prospects of responsibility and of awareness for the built environment.

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