



PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 40th cycle

PNRR 630 Research Field: DEVELOPMENT OF VIRTUAL MODELLING PROCESSES FOR IMMERSIVE USE IN MANUFACTURING

Monthly net income of PhDscholarship (max 36 months)
€ 1350.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<p>Motivation and objectives of the research in this field</p>	<p>Mission 4, Component 2 "From Research to Business" - Investment 3.3 of the National Recovery and Resilience Plan (PNRR) focuses on the introduction of innovative PhDs that meet the innovation needs of businesses and promote the hiring of researchers by companies: in the field of digital manufacturing, the main objectives of this investment are described below.</p> <p>The necessity of digital innovation and virtual reality (VR) in the manufacturing field, especially for furniture and fittings, is driven by the demand for increased efficiency, customization, and enhanced customer experiences (https://www.dreamy40.polimi.it/case-history/). Immersive digital tools enable designers to create detailed 3D models, allowing for rapid prototyping without physical materials giving designers a virtual space to interact with their creations in a realistic environment. Reduction of time and costs, and fostering of creativity and innovation is evident. Also Modern consumers demand personalized products, and digital innovation allows manufacturers to offer more customization options at lower costs. Digital innovation in manufacturing processes involves advanced equipment like CNC machines, automated cutting, and 3D printing, increasing precision and efficiency</p>



	<p>(https://kpmg.com/it/it/home/media/press-releases/2018/07/la-manifattura-nell-era-digitale.html). VR can plan and simulate production workflows, identify potential bottlenecks, and optimize resource use, leading to reduced waste, lower costs, and faster turnaround times. Global teams can collaborate more effectively through digital platforms and virtual workspaces, allowing real-time design discussions and modifications regardless of physical location. In a globalized market, designers, engineers, and manufacturers can share and work on virtual prototypes in real time. Potential customers can take virtual showroom tours, visualize products in their own spaces through augmented reality (AR), and experience the furniture's look and feel beyond traditional catalogs or online images, significantly enhancing engagement and conversion rates. This approach supports sustainable manufacturing practices by optimizing design and production processes, minimizing material waste, and reducing energy consumption. Virtual prototyping and testing decreases the need for physical samples, further lowering environmental impact. Digital tools facilitate the collection and analysis of vast amounts of data, enabling manufacturers to make informed decisions, predict trends, and respond quickly to market demands. VR can simulate various scenarios, helping businesses prepare for different market conditions and operational challenges.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Sice Previt (https://www.siceprevit.it/) is an Italian company, founded in 1961, operating in the construction sector, both in residential and retail, and in the production of high-end custom-made furniture. The company is a leader in the luxury and fashion segment and operates internationally, with branches in Paris and London. The company is a trusted partner for its clients, supporting them with highly specialized and professional staff throughout the entire project process, where physical prototyping is regarded as a necessary step for implementation verification. The company aims to experiment with adapting its construction methodologies to explore the potential offered by virtual environment construction, initially as a parallel aid to physical</p>



	<p>prototyping. Therefore, the first part of the research will focus on the implementation and evaluation of the time and costs of both prototyping processes concurrently. During this phase, not only the spatial rendering but also the materials chosen for both physical and virtual models will be observed to verify their realism and the level of appreciation by users (https://www.adobe.com/it/creativecloud/3d-ar.html). A second phase will be dedicated to researching suitable tools for virtual utilization, as this process involves both the production process and client experience. This phase will also include detailed studies on the time and costs not only of implementation but also of integrating new processes within the company. This specific and more detailed phase will be developed as a third phase in an international context, within a company equipped with digital and VR tools as part of its business (https://www.spektra.it/soluzioni/prodotti/real%C3%A0-umentata/). The fourth part will focus on identifying the most compatible methodologies for developing collaborative digital environments, where multi-user utilization, annotation, and querying are possible (https://www.nvidia.com/it-it/omniverse/). The parts to be conducted at the company will take place at the Segrate facility in the design department. The parts to be conducted at the university will be developed at the ABC department and in parallel at the LaborA Virtual Reality laboratory. All phases will be accompanied by milestones verified by both parties, with the appointment of a company supervisor in addition to the Politecnico supervisor.</p>
<p>Educational objectives</p>	<p>Train PhD students with advanced skills in the digital sector specialized in Immersive Environment, VR application, AR Visualization applied to manufacturing, including technologies such as Internet of Things (IoT), and industrial automation.</p>
<p>Job opportunities</p>	<p>The profile of the candidate at the end of the process will be related to the one of an Innovator in Virtual Environment applied in processes of manufacturing improving the efficiency, quality, and sustainability of</p>



	productions.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 2 PhD Students
Name of the research directors	Cecilia Maria Bolognesi

Contacts	
Prof.ssa Cecilia Bolognesi email: cecilia.bolognesi@polimi.it	

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	675.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Sice Previt (https://www.siceprevit.it/)
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Additional support:</p> <p>Budget for the research activity (only for positions supported by scholarship): total amount Euro 5503.35 per student In detail: - 1st year Euro 1834.45 - 2nd year Euro 1834.45 - 3rd year Euro 1834.45</p> <p>Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 40th Cycle of ABC-PhD: download is available at link:</p>



<https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-delle-costruzioni-e-ambiente-costruito>

Additional information about ABC department and ABC-PhD programme:

available at link:

<https://www.dabc.polimi.it/>

Desk availability:

The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.