



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

PNRR 629 PA Research Field: DATA-DRIVEN DECISION-MAKING FOR HEALTHY ASSETS DESIGN, CONSTRUCTION, OPERATION, AND MANAGEMENT

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>The PhD position seeks to explore the integration of advanced data analytics into the lifecycle of built environments, emphasizing human health and well-being at the forefront of architectural and operational considerations. Historically, the architectural domain has primarily focused on structural integrity and aesthetic value. However, since the early 2000s, there has been a significant paradigm shift towards designing buildings that prioritize the health and well-being of their occupants. This evolution reflects a growing recognition of the profound impact that built environments have on human health, leading to the emergence of the "healthy building" concept. This shift has been supported by extensive research and the development of certification protocols, such as the WELL Building Standard. These certifications have begun to overshadow traditional sustainability metrics, highlighting a nuanced understanding that sustainability must encompass human health alongside environmental considerations.</p> <p>In the context of the digital transformation of the construction industry, data-driven decision-making offers unprecedented opportunities to enhance the health and well-being of building occupants. Digital tools and methodologies, such as Building Information Modeling</p>



	<p>(BIM), Internet of Things (IoT) , and advanced data analytics, enable real-time monitoring and optimization of indoor environmental conditions. These technologies facilitate a comprehensive approach to managing the design, construction, and operation of buildings, ensuring that health-centric parameters are continuously met and adapted to changing needs.</p> <p>This research fits the Mission 4 of PNRR, 'Education and Research', including many components and investments, e.g., Component 2 'From research to enterprise' (Invest. 3.3 and 4.1).</p> <p>This PhD project will investigate the potential of integrating data-driven methodologies into the entire lifecycle of buildings, from initial design to ongoing operation and management. The research will focus on identifying key health-related metrics, developing predictive models to anticipate and mitigate health risks, and creating frameworks for continuous improvement of indoor environments. The ultimate goal is to establish a holistic approach to building design and management that places human health and well-being at its core, leveraging the full potential of digital technologies to create healthier, more sustainable built environments.</p> <p>The results of this research will have a major impact on public administration, given that:</p> <ul style="list-style-type: none"> •the Italian State's real estate assets comprise some 43k buildings and land valued at an estimated 62.5 billion euros; •the Agenzia del Demanio has drawn up an industrial plan to manage these assets as a private company would, with the aim of making them eco-sustainable and intelligent.
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>To achieve the research objectives the following methods and techniques will be developed and employed.</p> <p>1. Literature Review and Framework Development</p> <p>The PhD candidate will be guided to conduct a comprehensive review of existing literature to have a theoretical foundation and to identify knowledge gaps.</p>



	<p>theoretical foundation and to identify knowledge gaps.</p> <p>2. Conceptual research framework The PhD candidate will be invited to develop a conceptual framework that integrates health and well-being metrics with data-driven methodologies for building design, construction, and management..</p> <p>3. Data Collection and Analysis The PhD candidate will leverage existing digital tools to envision a Digital Twin for healthy buildings covering the whole lifecycle of a project from design (BIM) to construction and operation (IoT, POEs.). At this step, a development of a sustainable scan-to-BIM and plan-toBIM approach will be focused.</p> <p>4. Predictive Modeling and Simulation The aim is to develop machine learning models to analyse the collected data and predict the impact of various design and operational decisions on occupant health and well-being. This task may require the use of simulation software to model different design and operational scenarios, evaluating their potential effects on indoor environmental quality and occupant health.</p> <p>5. Optimization and Decision-making Framework The PhD candidate will implement multi-objective optimization techniques to balance health, well-being, and sustainability goals. She/he will create a decision support system that integrates predictive models, simulation results, and optimization algorithms to provide actionable insights for stakeholders throughout the building lifecycle.</p> <p>6. Validation and Case Studies The PhD candidate will spend:</p> <ol style="list-style-type: none"> 1. a span of the PhD in a public administration; 2. a period abroad (destination to be defined) to develop the research under the supervision of another mentor and in an international research team.
<p>Educational objectives</p>	<p>This PhD position aims to equip the candidate with advanced knowledge and skills at the intersection of</p>



	<p>health, technology, and built environment. The educational objectives of this position are:</p> <ul style="list-style-type: none"> •To gain foundational Knowledge in Healthy Building Concepts •To acquire proficiency in Data-driven Decision-making •To develop application of Digital Technologies in Construction •To develop the ability to design and conduct rigorous research studies •To learn to collaborate effectively with professionals from various disciplines and develop strong communication skills •To make an intercultural research experience during a period abroad in an international university or research center •To learn the internal process and approaches of Italian Public Administrations during an internship.
Job opportunities	<p>Graduate of this PhD program will be uniquely positioned to lead and innovate at the intersection of health, technology, and the built environment, driving the future of healthy, sustainable, and data-driven building practices.</p>
Composition of the research group	<p>3 Full Professors 4 Associated Professors 2 Assistant Professors 6 PhD Students</p>
Name of the research directors	<p>M. Scaioni, T. Poli, S. Capolongo, F. Re Cecconi</p>

Contacts	
<p>Prof. Fulvio Re Cecconi fulvio.receconi@polimi.it</p>	

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)	to be defined
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

Additional support:

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

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:

<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.