Intervento realizzato da

In consideration of the determination of the Regione Piemonte – Direzione Istruzione, formazione e lavoro No. 218 of 2022, May 3 and s.m.i. which listed the higher institutions authorized to activate PhD positions in the apprenticeship format for the years 2022-2024 in the framework of a specific regional call for proposals (Apprendistato di Alta Formazione e Ricerca - Avviso Pubblico 2022-2026 per l'individuazione e la gestione dell'offerta formativa pubblica approvato con Determinazione 114 del 3/3/2022, modificato con D.D. n. 451 del 17/08/2022 e prorogato con D.D. n. 807 del 24/12/2024)

MANAGEMENT AND PRODUCTION ENGINEERING

Digital Construction Project Management

Company	S.E.C.A.P. SPA [P.iva/CF:04910190018]
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Context of the research activity	Analysis, development, and testing of digital methodologies based on innovative BIM-based methods and AI tools to improve construction-site process management and project management, supporting a smart and sustainable construction site. The research is carried out in collaboration with SECAP S.p.A., which will hire the PhD candidate under a higher apprenticeship contract pursuant to Art. 45 of D. Lgs. 81/2015.
	The research activity aims to develop an integrated methodology that combines BIM and Artificial Intelligence (AI) to enable innovative solutions for project management in the construction sector. The objective is to anticipate risks, cost overruns, and delays, improve the management of construction-site processes, and make operational support accessible also to technical professionals without advanced digital skills. The research is framed along three incremental levels: (1) "baseline" digitalization, where BIM is primarily used for coordination, documentation, and information control, structuring project data and content; (2) "assisted" AI, which builds on this informational foundation to integrate heterogeneous sources (models, documents, planning and as-built data) and supports analysis and reporting, producing summaries and performance indicators; (3) "augmented" AI (human-in-the-loop), where the outputs of the previous level feed a collaborative and traceable decision-making process in which AI generates scenarios and

Objectives	operational priorities in a verifiable manner, while the project manager validates and makes the final decision. The challenge is to turn on-site variability into measurable decision-making capability, without losing accountability, traceability, and control. The research proposes a replicable operational framework that can be adapted to different project contexts, built on the progressive integration of available information: BIM models and parametric modeling, planning and control tools (schedules and actuals), technical documentation, and—when available—digital field data sources. The AI component will be defined and calibrated with the company depending on the projects involved, exploring solutions to: (i) extract and correlate information from heterogeneous sources; (ii) support the prediction of critical issues and the prioritization of interventions (early warning); (iii) enable natural-language interactions and controlled automation (e.g., LLM assistants/agents) for recurring tasks such as analysis, risk assessment, and reporting; (iv) deliver insights through graphical interfaces for decision support (e.g., dashboards) designed for on-site operations. An expected outcome is the definition of indicators to measure company and jobsite resilience, understood as the capability to monitor and manage multiple variables that influence the real outcome of the final built product (time, cost, quality, safety), responding to constraints and unexpected events without degrading performance. These indicators will feed into dynamic, cross-project comparable KPIs, supporting continuous improvement. Within the framework of higher apprenticeship, the PhD candidate's pathway integrates academic training and in-company activities through three progressive steps: (1) building a solid background and defining research questions and requirements through targeted courses, a state-of-the-art review, and alignment with company needs; (2) co-designing and developing the methodology and prototypes, with experimentation on live projects and iterations driven by operational feedback; (3) validating on real cases and consolidating results, measuring impact against operational baselines and formalizing proper KPIs and final scientific evidence.

Skills and competencies for the development of the activity	The candidate shall be less than 30 years old at the moment of the hiring from the company. The skills of the candidate imply competences in: Basics of project and construction management. BIM and interoperability (4D/5D) for site management; familiarity with information workflows, planning and control. Basic AI knowledge (Machine Learning, LLMs) and demonstrable interest in BIM–AI integration for project management and processes, human–machine interaction tool for extended reality. Good English for research and scientific writing.