32. BIM and AI for Automated Construction Scheduling: A Preliminary Integrated Framework

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The evolution of geomatic technologies and digital modelling has consolidated Building Information Modelling (BIM) as an information system for organising data useful for construction process management. Yet the potential of its geometric and semantic information remains underexploited in support of planning, since construction scheduling still relies predominantly on traditional, manual procedures and individual experience, which can prove inadequate for contemporary project complexity and limits the support offered to decision-making. To address this, the study proposes an integrated methodological framework combining BIM and Artificial Intelligence (AI) to automate the generation, prediction and optimisation of construction schedules, evolving site planning towards a fully data-driven approach. The methodology develops through three phases. First, a Generative AI application extracts geometric and semantic data from the BIM model, translating its elements into construction activities and producing a structured dataset that integrates geometric attributes with real operational variables such as labour productivity, equipment availability, execution constraints and activity dependencies. This dataset is then used to train the eXtreme Gradient Boosting (XGBoost) algorithm, which captures complex, nonlinear relationships among project variables and estimates activity durations with high accuracy (R^2 = 0.955, MAE = 0.132, RMSE = 0.858). The resulting durations feed a Genetic Algorithm (GA) that identifies the most efficient sequence and resource allocation while respecting dependencies and site limitations, compressing the overall project duration through the parallel execution of compatible activities. Validated on a reference digital model, the framework demonstrates the potential of BIM and AI to support consistent, data-driven construction planning.