BIM platform for the acceleration of the twin transition of buildings

Summary

This research work is aligned with the ambitious targets of the EU Green Deal, such as reducing carbon emissions in Europe by 55% until 2030 and being climate-neutral by 2050. The construction industry plays a major role in this decarbonization process, and digitalisation may accelerate the achievement of such important goals.

This thesis aims to tackle green inefficiencies using Building Information Modelling (BIM) methodology, the Twin Transition (Green and Digital), particularly by developing an innovative platform to directly estimate the building's environmental and cost impacts and thereby help decision-makers to account for the full life cycle of the building already in the design phase.

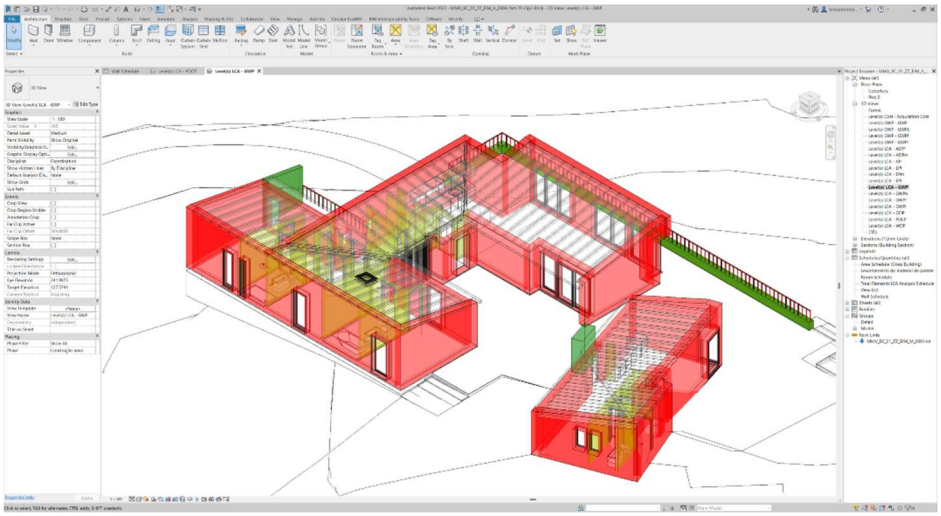
With a Life Cycle approach, traditional and modular construction alternative will also be studied in order to predict the differences in construction time, environmental impacts and global costs. With a circular economy, approach the potential for reuse and recycling will also be analysed and integrated in the platform.

The platform covers the design stages of the projects, providing a visual interface that interacts with the user and shows both quantitative and graphical results of the impacts. The platform will be tested in two case studies of a refurbishment (confirm the potential for disassembly and re assembly) and one of new construction dwelling (comparing traditional methods versus modular construction) to estimate the life cycle impacts and better alternatives. Beyond studying the impacts of a building design, the platform aims to be machine learning and suggest to the designer the construction and materials alternatives with less environmental impacts. It will also be divided per project stage by adapting the Level of Information needed to perform the analysis depending on the stage of the project.

The main results intend to show that the platform is suitable to perform both environmental and economic analysis, and that it can be used in other design projects to anticipate and mitigate the impacts of the construction sector. The case studies can be seen as a proof-of-concept that such an integration in BIM offers results of high relevance when in the search for ways to optimize the life cycle impact of construction and buildings. The results achieved in this PhD thesis aim to show that technology must be taken along the building's design process to meet Climate's targets, reduce the impact of construction on the environment, and accelerate the Twin Transition of buildings and cities.

Keywords

Building Information Modelling (BIM), circular economy, construction, digital transition, Life Cycle Assessment (LCA), sustainability, twin transition.



Tridimentional visualization of Global Warming Impacts in a BIM environment.

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