Exploring the Future: Enhancing Construction with Digital Twins

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WISEST

INTRODUCTION

- Virtual realities and technologies are becoming more of an asset in the construction industry. One construction project can come with a variety of challenges.
- Construction projects can be quite time consuming, cost heavy, and without the proper structuring, disorganized.
- Digital twin is a virtual up-to-date counterpart that replicates all the information and data of its physical twin during the entire lifecycle of an object. [1]
- Digital twins contribute to the safety, cost effectiveness, and achievable nature of intricate, costly, and often hazardous procedures. [3]
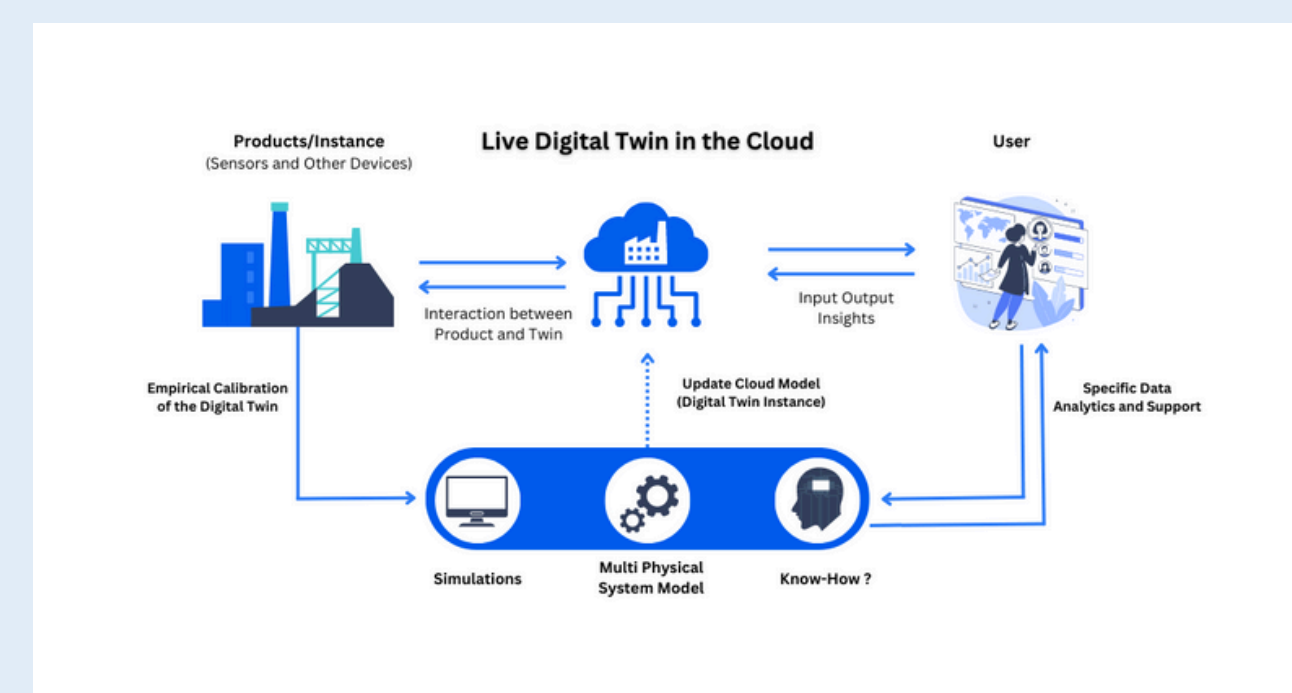
Figure 1. Live Digital Twin in the Cloud

Figure 2. Advancing Digital Twin Technology [6]

BACKGROUND

- As construction projects became larger and more complex, using simpler systems such as a 2D designs with just pen and paper were not efficient.
- Building Information Modeling (BIM) is a powerful process that allows engineers to create and manage digital representations of physical and functional characteristics of structures. [4]
- BIM ≠ Digital Twin. BIM is a methodology used while creating a digital twin. [1]
- Along side with BIM, digital twin technologies can be used to follow the entire lifecycle (before it is built, during, after, and demolition) promoting overall efficiency during construction projects. [3]

Digital Twin

Feedback, optimization, interaction

BIM-BASED MR/AR/VR

Visual inspection function, human-computer interaction

BIM+IoT

Real-time visualization, real-time monotiring

BIM+AI

Decision-making, data-based prediction

Scan-to-BIM

Obtain the current state of the bridge

BIM+Simulation

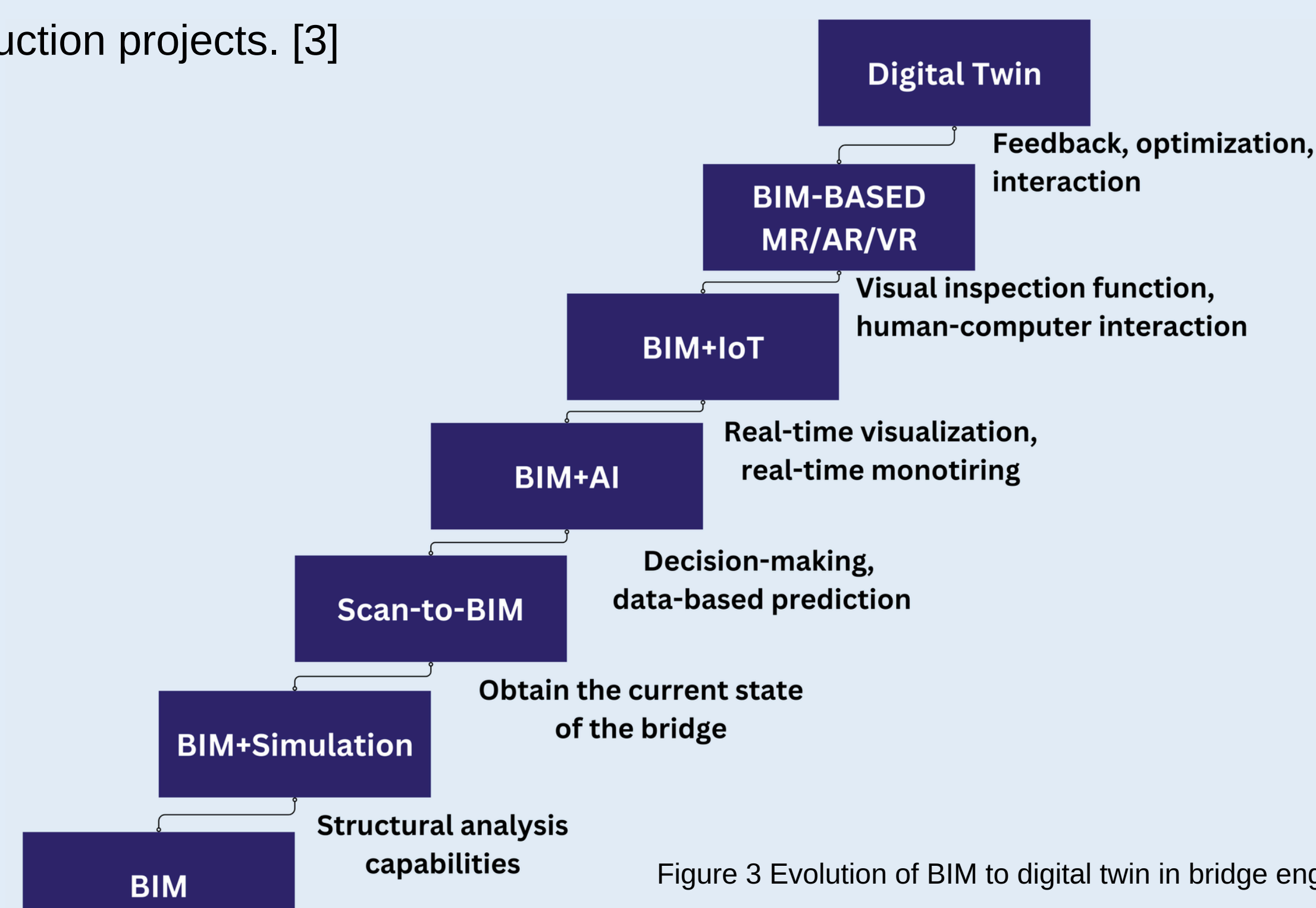Structural analysis capabilities

BIM

Figure 3 Evolution of BIM to digital twin in bridge engineering [9]

RESEARCH METHODOLOGY

- 3D modelling is using 3D software to represent objects digitally. The first step of creating a digital twin is building a 3D model. [7]
- Following its development, this model will be linked to the physical components that the digital twin application is going to be constructed around.
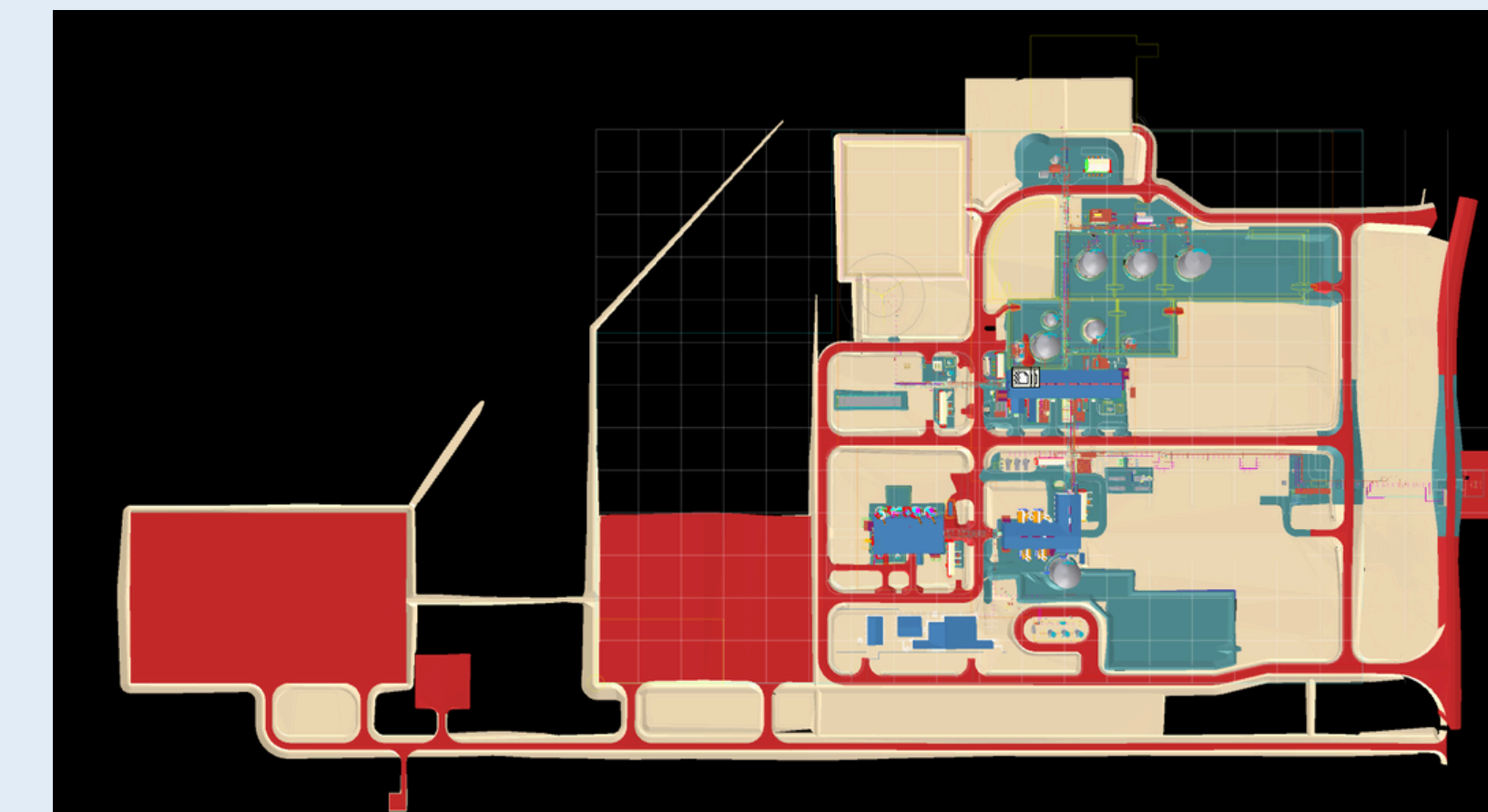
Figure 4. Brion Power Plant 3D Model on Navisworks

- Navisworks is one of the softwares that is widely used in the construction industry.
- Selection sets are used to divide an enormous project into smaller pieces making it more manageable.
- Selections sets improve collaboration and accuracy as well.
- A selection set is the box and the detailed version of a certain section of a model. For this power plant project, it is a selection of different buildings.

Figure 5. Selection Set "Outside" on Navisworks

Figure 6. Selection Set "Inside" on Navisworks

BIM VS DIGITAL TWIN

- Digital twin is considered the next step after BIM because while BIM focuses on creating a 3D model of a building or infrastructure, a digital twin goes further by creating a real-time virtual representation of the physical asset. [3]

Improved Efficiency

Figure 7. Percentage improvement in project efficiency during project lifecycle [3]

- BIM is still a very useful methodology, and can be used along side digital twin. Collaboration among multidisciplinary context is the cause of it not developing as much in the construction industry compared to other industries, such as manufacturing. [2]
- BIM had made tremendous impacts in the construction industry, and as digital twin is gradually evolving in the construction industry, its potential keeps amplifying. [2]
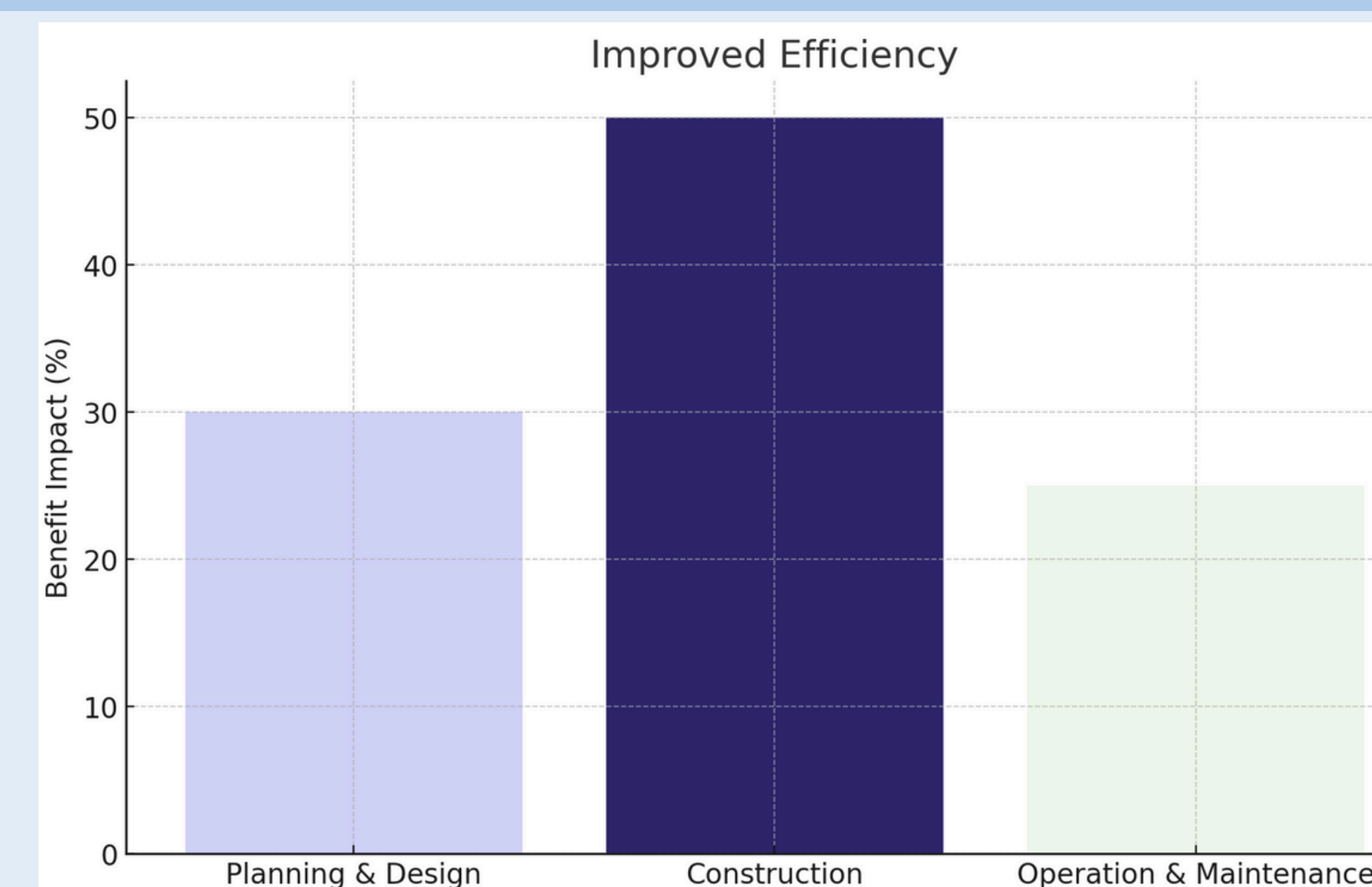
CONCLUSION

- Digital twins have revolutionized the construction industry by providing a comprehensive, real-time view of projects.
- They facilitate improved collaboration, enhanced safety, and significant cost savings.
- By integrating digital twins with advanced BIM and 3D modeling tools, the construction industry can achieve greater efficiency and precision.
- As technology continues to evolve, the use of digital twins is expected to become even more integral to successful construction project management, driving further innovation and improvement in the field.
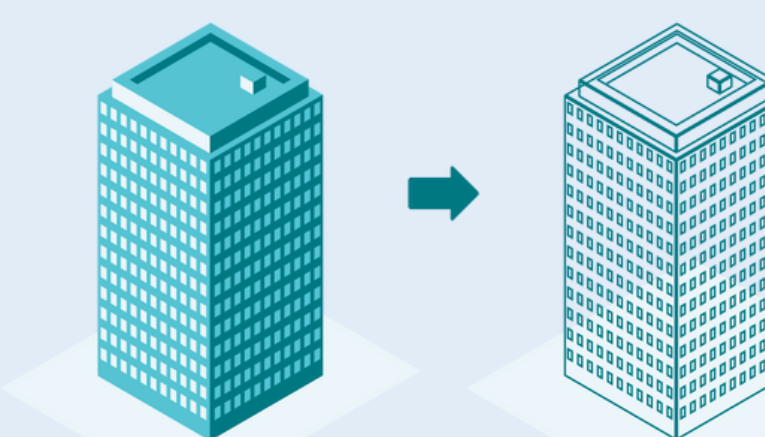
Figure 8. Digital Twin [8]

Figure 9. Brion Power Plant 3D Model on Navisworks®

Further Studies:

- **Improving and easing utilization of current software**
- **Improving the capacity of extracting information and promoting collaboration between disciplines**

CITATIONS

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