

# VIRTUAL DESIGN AND CONSTRUCTION: ALIGNING BIM AND LEAN IN PRACTICE

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## 1 BACKGROUND

The advancement of lean thinking and tools and maturity in applying BIM and related concepts and technologies represent two movements that have introduced innovative design and construction practices. Although conceptually independent, research has found clear synergies between the two and they unfortunately provide only partial benefits when applied on their own.

Virtual Design and Construction (VDC) focuses on aligning new technology related to BIM with lean thinking and practices. This paper presents how a general contractor has implemented collaborative lean methods and BIM-related technologies in an integrated way in practice.

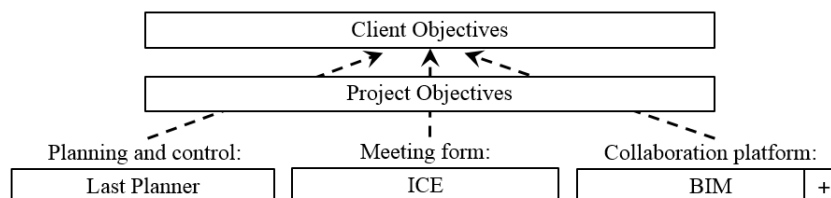
## 2 RESEARCH METHOD AND QUESTIONS

This is a highly empirical paper, where the research methods are observations by the lead author, surveys from project participants and two project case studies. Two research questions are posted:

- What are the observed project benefits from effectively combining new ways of collaboration with digital tools?
- What are critical drivers for this change and barriers against it?

## 3 RESEARCH FINDINGS

- **Main methods:** The lean principle of understanding the end customer's objectives, provide exactly what they need with minimal waste, and aligning this with the objectives of the project team, is essential in VDC. The Last Planner System (LPS) is the main method of mapping both preconstruction and construction activities. Building Information Modelling (BIM) improves coordination and utilization of geometry and information throughout construction projects. Integrated Concurrent Engineering (ICE) is a method for co-located multidisciplinary work sessions with clear objectives, active problem-solving, session facilitator, precisely timed tasks and well-prepared participants. ICE often utilizes modern collaborative tools, such as BIM on touchscreens, in specially designed meeting rooms.



- **Case Studies:** Gjønneshagen, a residential design-build project, used BIM for coordinating design, procurement and production coordination. BIM was brought to the workforce with

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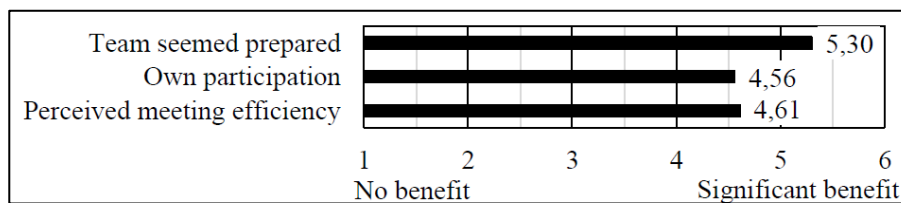
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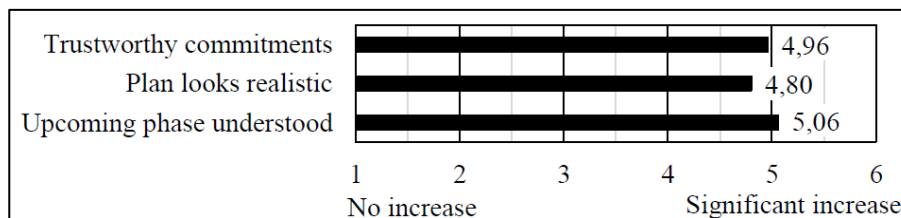
on-site BIM stations and tablets. Last Planner was used both for planning the design process and all construction phases. ICE sessions were implemented for the final design phase. The project was delivered with zero rework on a schedule accelerated from 38 to 32 months. As a continuation of Gjønneshagen, the Tiedemannsbyen project included advancements such as an on-site Big Room, an LOD-system for BIM maturity in the Last Planner design schedule, rebar assembled completely from BIM and a high focus on metrics for Last Planner, BIM and ICE, visible on the Big Room wall. Results are hard to quantify due to the project being ongoing, but the senior design manager claims his original schedule has been compressed with 6 months with VDC methods.



- General regional findings:** Several report of positive project impact since introducing VDC as a terminology. Lean advisors and BIM experts claim they better combine practices and integrate these with project practices. Some surveys show that ICE has a positive impact on how project teams work when meeting (average score of 26 ICE sessions):



Another survey show that Last Planner has positive impact on how well teams feel their schedules are (average score of 143 session participants):



- Drivers for change:** Strong cultural movement for implementation in projects (bottom-up) and support from management (top-down). VDC objectives in regional strategies and regional VDC experts for setting up processes, coaching and following up project teams. New VDC practices tested one project, pivoted (PDCA) before scaling up.
- Barriers against change:** No noteworthy observed, but potential ones are lack of funding, or support, a focus on tools rather than mindset and expecting quick results.

## 4 CONCLUSIONS

- After years of exploring Lean and BIM, the VDC terminology has increased the contractor's ability to explain Lean and BIM for projects, management and clients.
- Several indicators of positive results, but future research should look more into quantifiable results and relations between VDC maturity and project outcomes.

