

UNDERSTANDING THE INTERACTION BETWEEN VIRTUAL DESIGN, CONSTRUCTION AND LEAN CONSTRUCTION

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AGENDA

- Differences between VDC and BIM
- Research Method
- Results
- Conclusion

VDC and BIM

- The literature is ambiguous about the differences between Virtual Design and Construction (VDC) and Building Information Modeling (BIM). As a result, some companies have sold BIM as simply a software platform, setting aside the core of the methodology: collaborative work (Mandujano 2017).
- In this research, we continue define VDC as mentioned by Kunz and Fischer (2011): "The use of integrated multi-disciplinary performance models of design-construction projects to support explicit and public business objectives".
- BIM represents the *form/scope of the product*, which is a crucial but a partial representation of both the total perspective of a project and the information about a project represented in the VDC framework and a POP model (Alarcon et al. 2013).
- In this paper, we continue to define BIM as mentioned by Eastman et al. (2018): "A digital database of a particular building that contains information about its objects".

P-O-P FRAMEWORK

When we reference VDC, we refer to the entire framework method Product, Organization and Process (P-O-P), which has BIM as a part of the product definition (Figure 1).

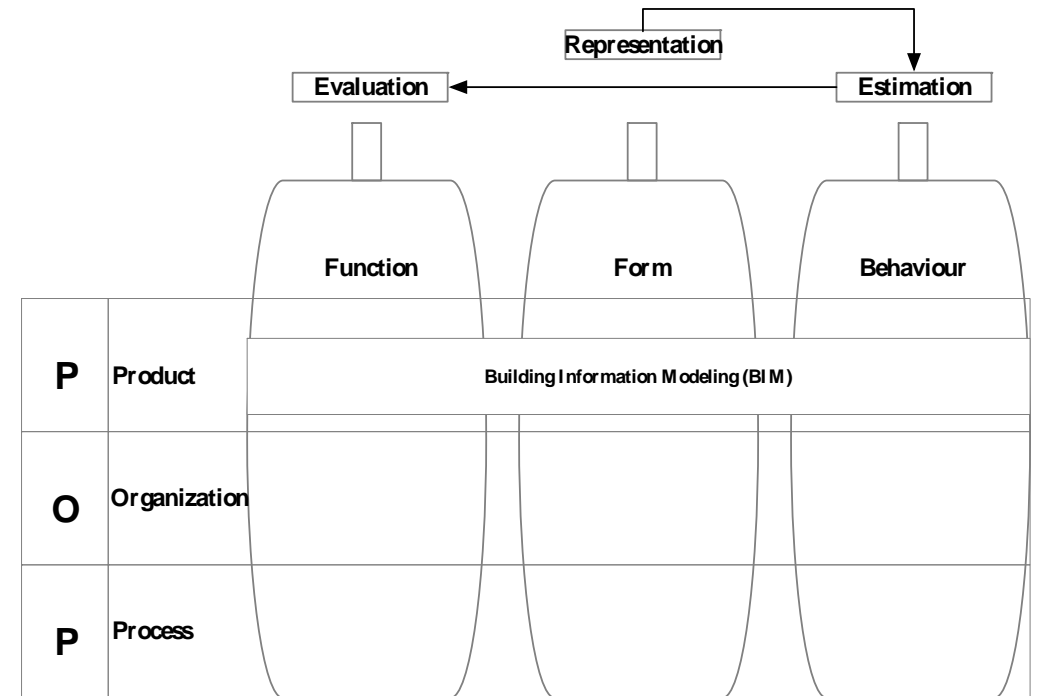


Figure 1. The three components of the P-O-P framework

METHOD

The relevant articles published during the period from 2000 to 2020 were identified through a systematic search of many electronic databases.

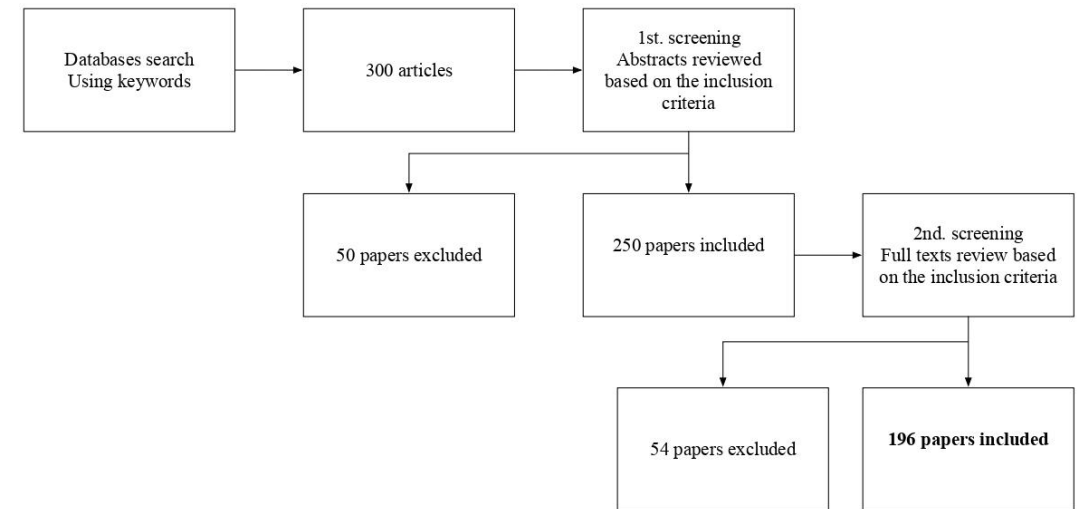


Figure 2. Research Method

RESULTS

After clarifying both concepts, 405 interactions between VDC and Lean were identified. These allow for the development of new VDC implementation strategies and also provide a broader picture that allows for the construction industry to implement more holistic and substantial improvements in every project phase.

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RESULTS

Some results are:

- Co-locating the design and detailing teams such that detailers worked side-by-side, allowed them to construct designs virtually and resolve conflicts and issues immediately, further facilitating highly integrated project Delivery (e.g., Big Room).
- Extended networks that increase collaboration among firms are more effective at implementing models across organizations.
- 4D improves efficiency and safety. It can help identify bottlenecks, improve flow, and verify and validate process information.
- 5D models, which connect 3D models to a database for quantity take-off, support location-based planning and scheduling. These types of models make it easier to visualize quantities and integrate them into schedules and cash flows.

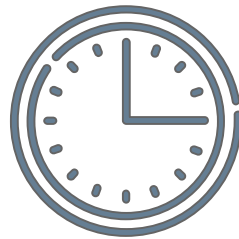
RESULTS

The interactions most mentioned in the literature and practice were:

- *Co-locating Visualization of the Design- Reduce Time (Ad);*
- *Online Communication Product/Process- Reduce Time (Md);*
- *Construction Planning/4D Modeling - Reduce Time (Jd);*
- *Visualization of the Design- Transparency (Ah);*
- *Online Communication Product/Process- Cultivate an Extended Network (Mo)*



The use of "Construction Planning/4D Modeling" improves the "Transparency" and "Reduce Time" in the project. Since the "4D Modeling" enables the visualization of the sequence of the project all issues are identify prior construction. This results in cost and time saving on site because of effective planning.



The use of VDC as a whole becomes more efficient. The "Production of Construction Documents" becomes automatic, this allows to "Reduce Time" when documents are delivered (EEE) and add value to projects.



The use of tools, such as iRoom onsite, plasma screen monitors, iPADS and or Tablet PC's loaded with the latest VDC model, allows for coordination and communication between all stakeholders. This level of visualization is high because it is close to the actual and most updated model version and is available to different levels of the hierarchy especially for onsite workers.

RESULTS

We cannot neglect the negative interactions found “where the use of VDC inhibits implementation of a lean principle (Sacks et al. 2010)”.

- *Production of Construction Documents - Reduce Non-Value Activities (Ba);*
- *Production of Construction Documents - Reduce Time (Bd);*
- *Production of Construction Documents - Simplicity (Be);*
- *Analysis of Design Options - Flexibility (Cf); And*
- *Analysis of Design Options - Standardize (Cg).*

CONCLUSIONS

- Identifying the interrelationship of lean principles with uses and actions performed through VDC provides a broader picture that allows the AEC industry to take a more holistic approach, which can help to obtain substantial improvements in every project phase, by increasing the effectiveness of the methods through a better alignment with relevant lean principles.
- The distinction between BIM and VDC definitions is also an important step in developing a better understanding of the methods and their associated management principles. By making this distinction clear, a significant number of new interactions between Lean Principles and VDC were found in the literature that can help to complete previous studies available in the literature and create new implementation paths in the future.

THANK YOU!

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