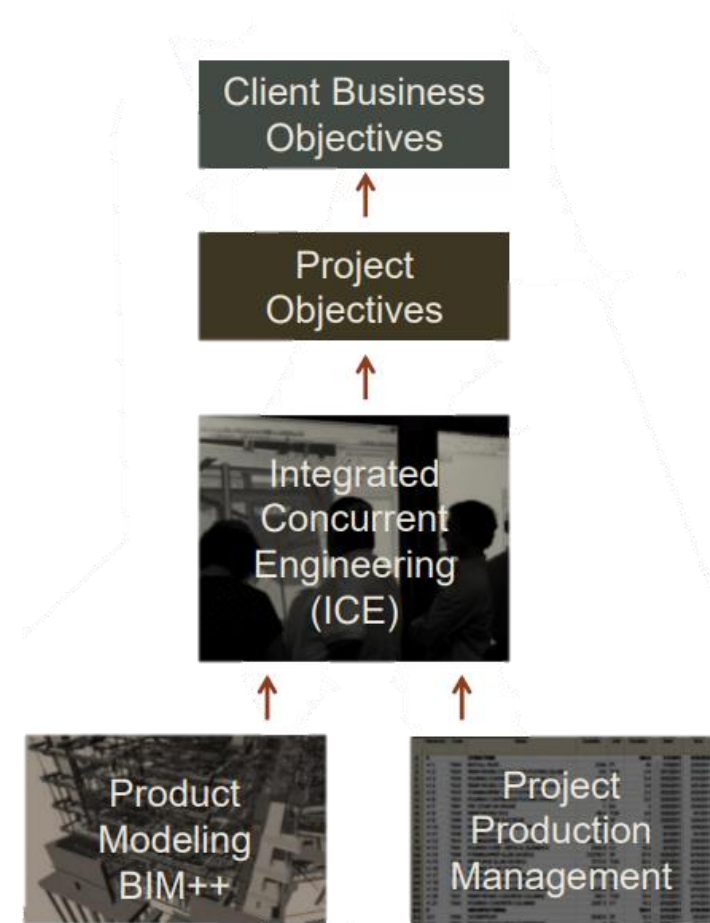# Metrics in VDC projects

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Virtual Design and Construction

- PPM
  - In this case Last Planner

- ICE-sessions

- BIM
  - In this case 3D

- Metrics

Metric	Kunz and Fischer (2009)	Hamzeh and Aridi (2013)	Knotten and Svalestuen (2014)	Fischer et al. (2017)	(Fosse et al. 2017)
Percentage Plan Complete (PPC)	X	X	X	X	X
Tasks Anticipated (TA)		X		X	
Tasks Made Ready (TMR)		X		X	
Root causes			X	X	X
Response latency	X			X	
Decision latency	X				
Evaluation of meetings	X		X		X
Amount of quantity take-off (QTO) done in 3D-model vs drawings			X	X	
How many times the BIM was used to review alternative solutions			X		
QTO from 3D-model vs spent materials			X	X	
Meeting participation	X			X	
Clashes identified using 3D-model/clash trends				X	X
Amount of rework	X			X	
Requests for information (RFIs) on site due to design clashes	X			X	

Research questions

I. How are building processes measured?

II. Which main design phase challenges can be resolved with metrics?

III. Which metrics should be used in future VDC projects?

II. Main design phase challenges

1. Lack of decisions, prerequisites or clarifications

2. Designing with low buildability or low quality

3. "Loops" in the design process with unnecessary rework because of lack of, late or changes in decisions, or unidentified interdependencies

4. Stakeholders are not prepared for meetings

5. Delayed design deliveries which delay construction

6. Minimal understanding of, and respect for other stakeholders needs and/or interdependencies between disciplines

7. Communication through email, and sometimes lacking responses

8. Tasks at meetings are just discussed, not solved

9. Designers prioritizing other projects

10. Hard to make schedules for the building design process

III. Metrics for future VDC projects

Basic metrics for all VDC projects	Suggestions for supplementary metrics
PPC, TA and TMR in meetings [%] (L+I)	Time spent doing QTO [hours] (L)
PPC for each maturity level [%] (L+I)	Cost of design loops [$] (I)
Number of clashes in BIM after reaching each maturity level [#] (L+I)	Construction cost due to design rework or delay [$] (I)
Evaluation of meetings [scale 1-4]	Cost of meetings [$] (I)
Root causes [#] (L+I)	Cost of solutions vs budgeted cost [$] (I)
Decision latency [hours] and stickiness [#] (L+I)	Correlation between decision stickiness and number and impact of design loops [%] (I)
	Amount of rework per discipline [hours] (L+I)