

Total BIM as information infrastructure for industrialised production systems

Traditional vs. Total BIM

Total BIM - new paradigm:

Why → What → How → **Production System** → Behavior → Result



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What is Total BIM?

- "BIM in its totality", "All-in"

Model-based construction / model as a production system

- "Single source of information"

The BIM is legally binding

No traditional drawings ("drawingless")

Production-oriented

Cultural changes / mindset shift...

- Who is the informationen for?

Puts higher demands on software

- User-interface and functionality

- Digital data-driven/-informed process

Leave old, familiar workflows behind!!!

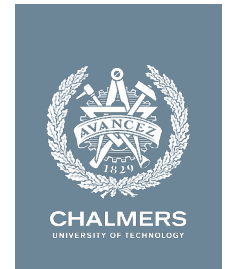


Disney, O., Roupé, M., Johansson, M.
(2024) *Embracing BIM in its totality: a Total BIM case study*

Why?



Research study: Plumbing contractor working time on construction site



Value-adding time
8.3 - 13.2%

Direct assembly work, prefabrication

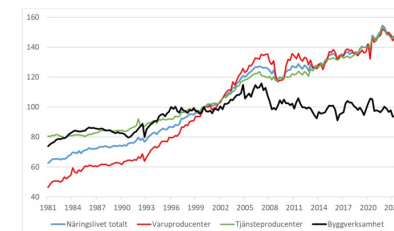
Preparation time
41.7 - 58.9%

Indirect work, carrying, transport of materials and equipment, work planning etc..

"Non-value-adding" time
23.4 – 49%
Fixing errors, idle time, waiting etc.



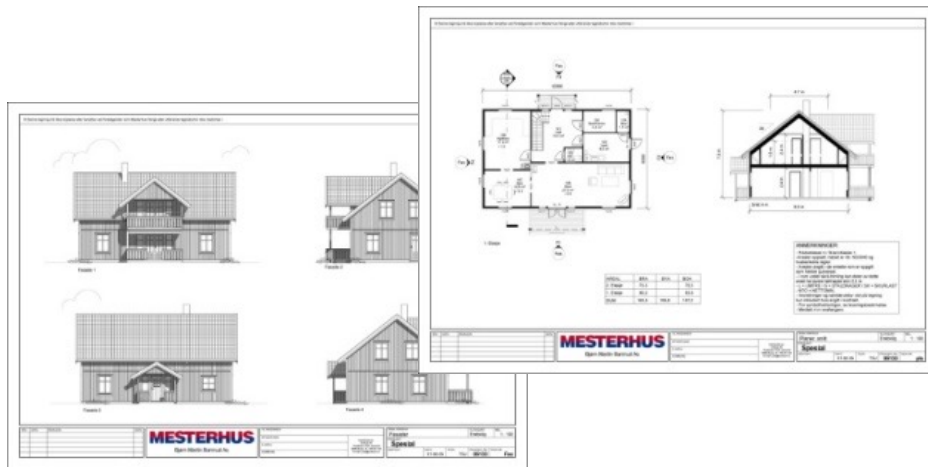
P-E Josephson, L Björkman **Why do work sampling studies in construction? The case of plumbing work in Scandinavia**
- *Engineering, Construction and Architectural*, 2013



Källa: Nationalräkenskaper från SCB. Serier för fördringsvärde och arbetade timmar är säsongsrensade och anges i 2021 års priser. Index 2000:kv1=100.

BIM was supposed to change the construction process...

From drawing-based...



...to model-based
... all information in one place

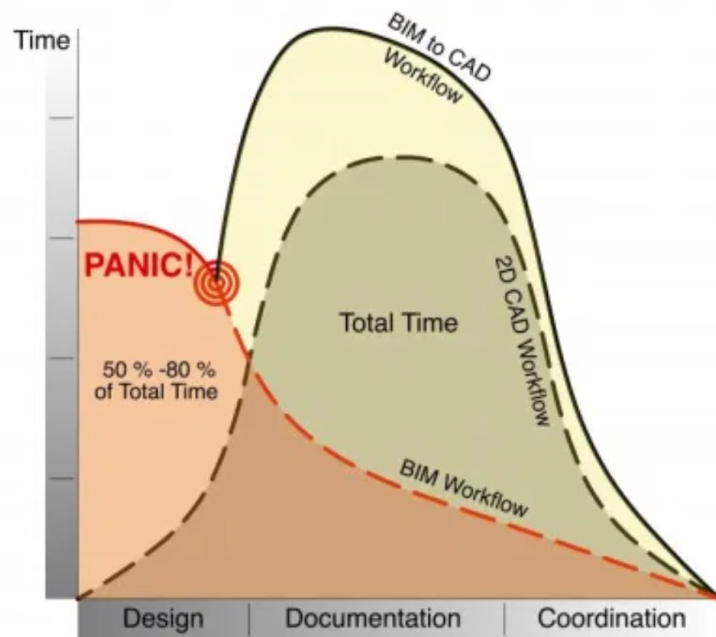
However, still two parallel processes!!!!



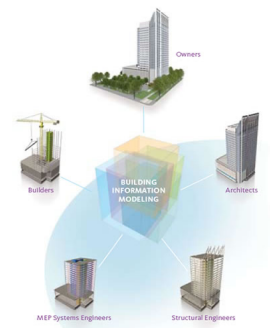
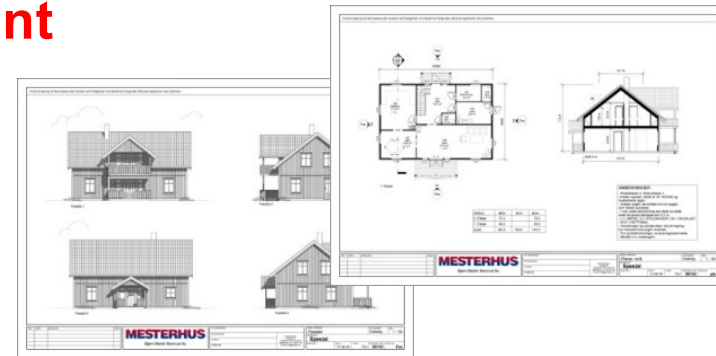
Use at your own risk...

BIM was supposed to change the construction process...

Still drawings which are the **contract document**
...so then we have to prioritize these



~30-40% of the time to produce drawings



Use at your own risk...

UK- Research Study: Drawing efforts in a BIM project

*“clients still want good drawings and you have to do a **lot of 2D work to make drawings look nice**”*

41% of time on producing drawings!!!!

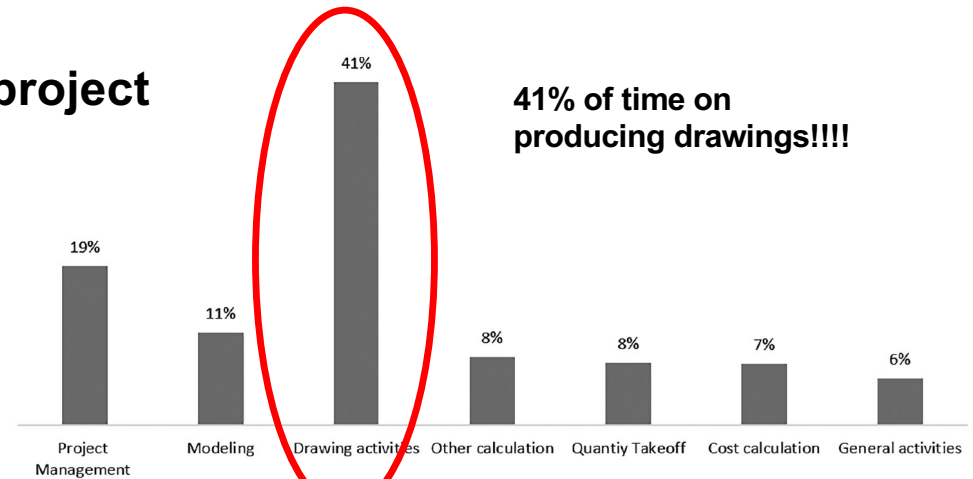


Figure 4. Breakdown of effort per tasks as a % of total effort.

*“until workers on site can use models with tablets during execution of work, **2D drawing production will continue to consume a lot of efforts in BIM.**”*

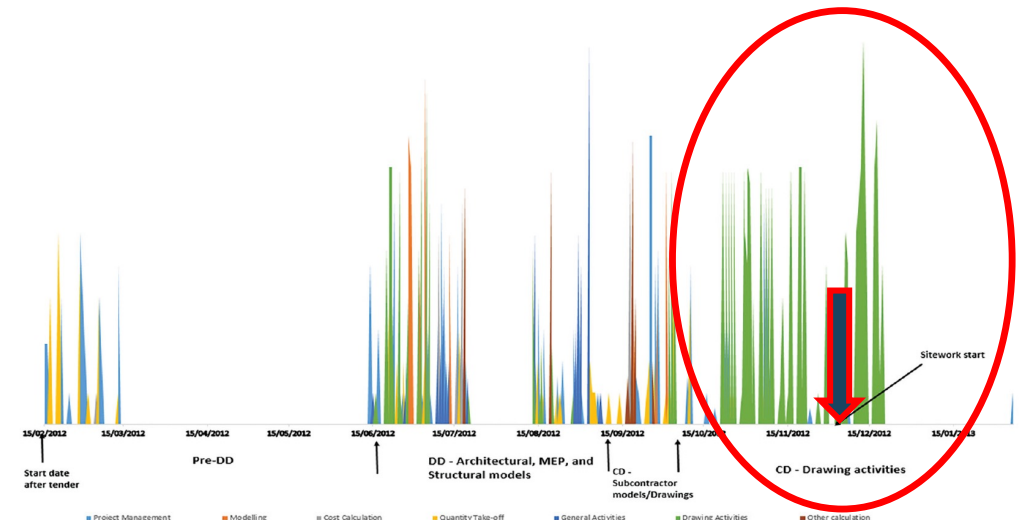
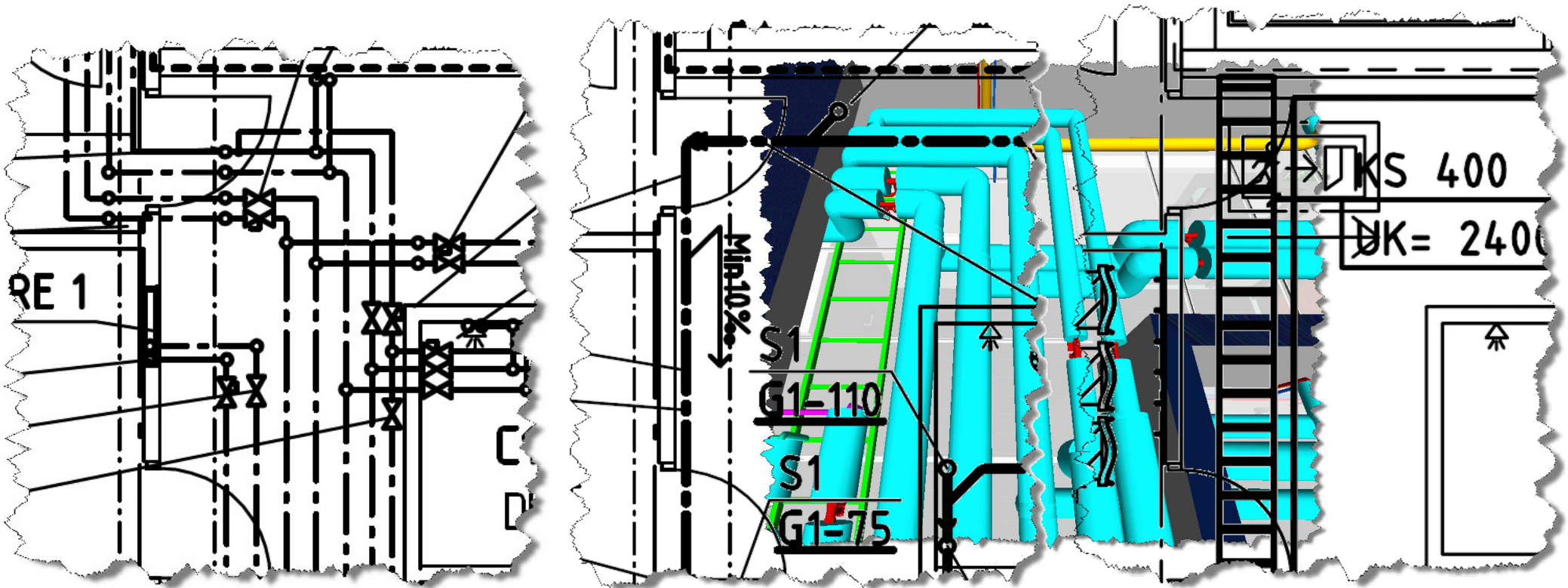


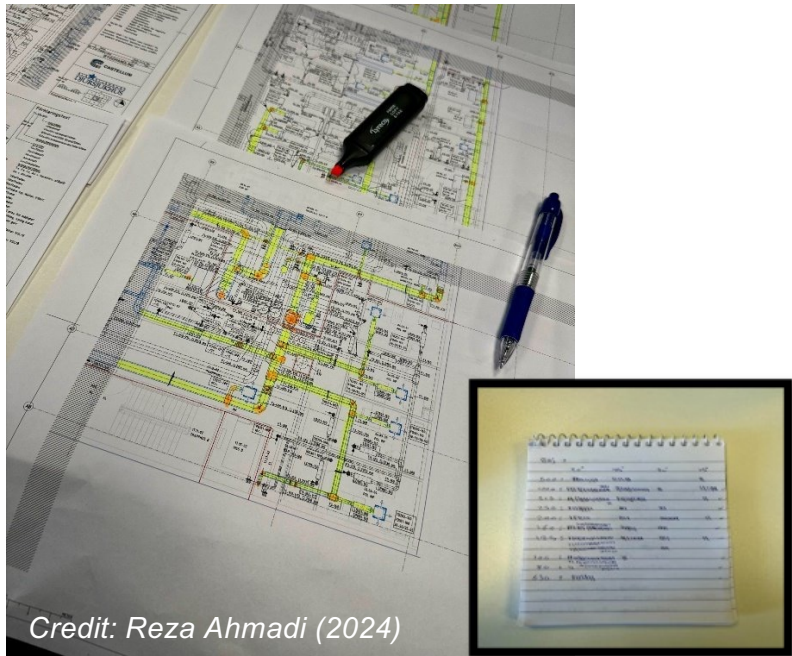
Figure 9. Effort distribution visualization for Project A showing interdependencies among tasks.

Why this focus on “drawingless”??



Still working with drawings on site

- For quantities (tendering / purchasing)
- Measurements



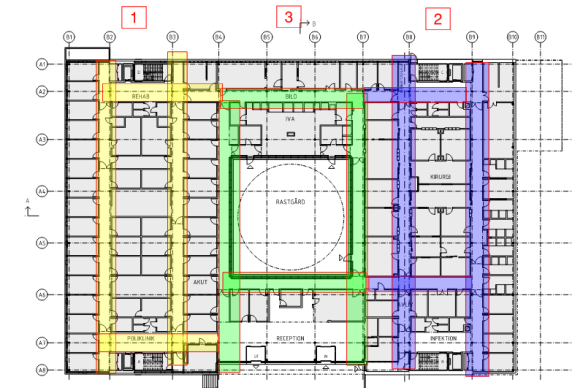
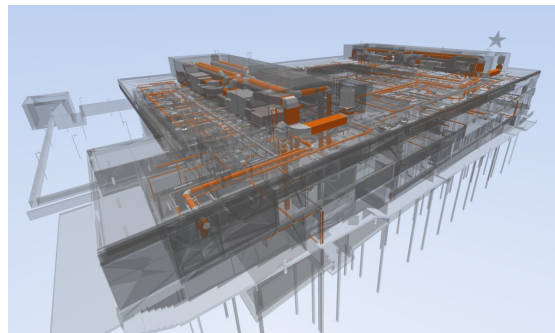
Credit: Reza Ahmadi (2024)



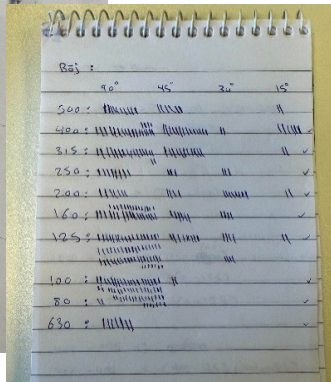
Credit: Reza Ahmadi (2024)

Example: Blå Stjärnan

Traditional vs Total BIM-based
Ventilation subcontractor

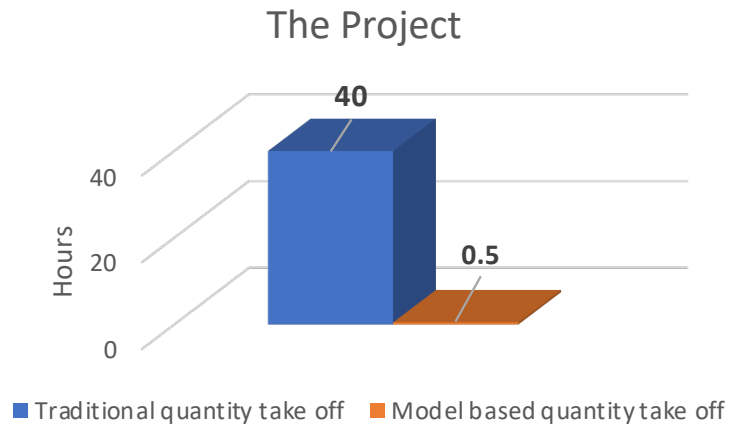


Reza (2023) Total BIM in Swedish Installation Contracting.



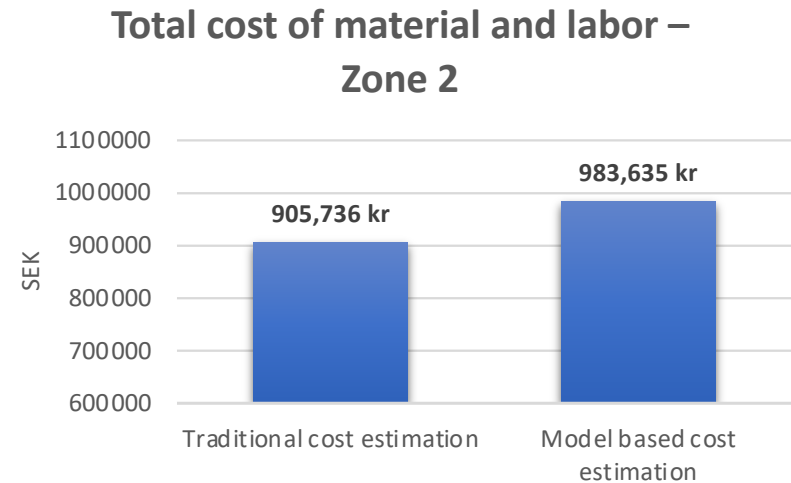
Results

Quantities



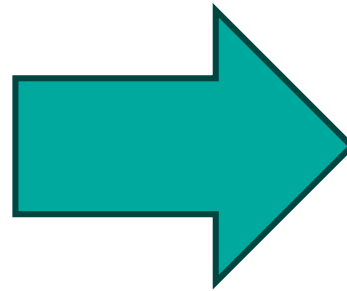
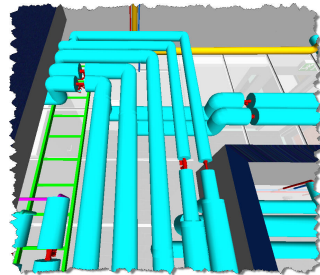
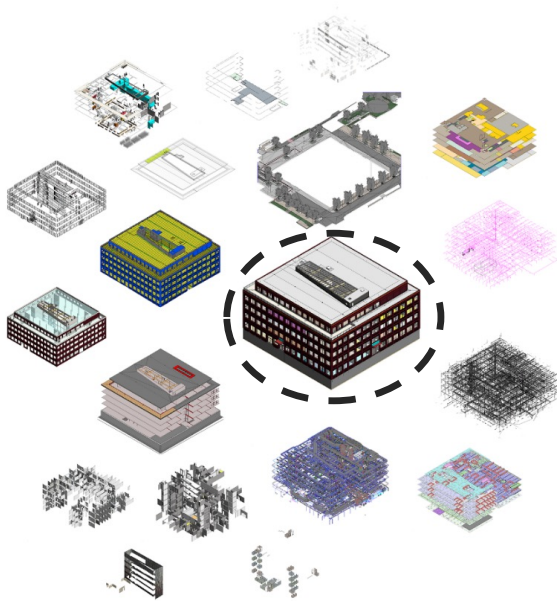
40x faster takeoff!

Bidding/cost-estimation

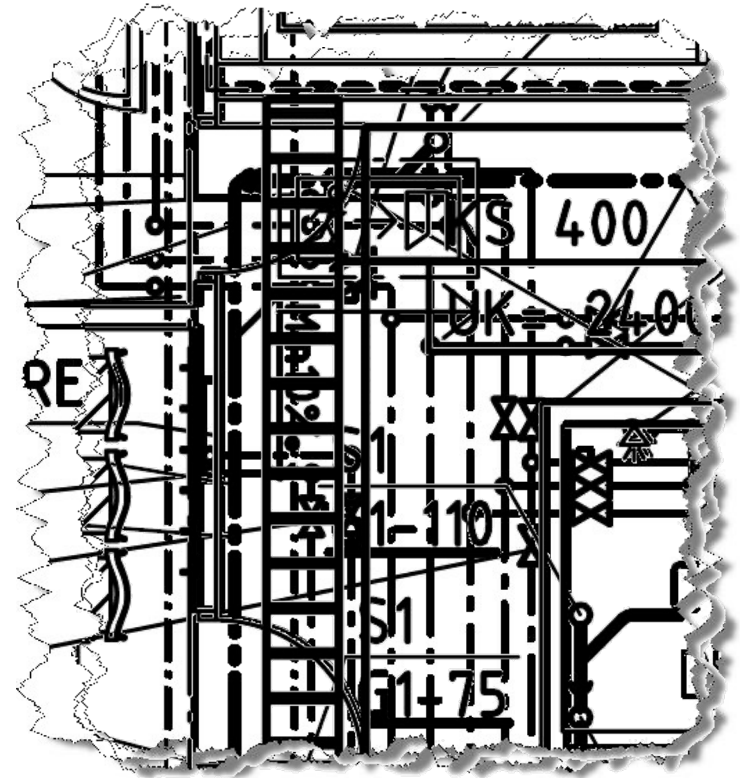


Traditional estimation 8% lower!!!!

Information-loss that costs 40% extra time!!!



40 % extra time
spent on making
the information
worse for
production!

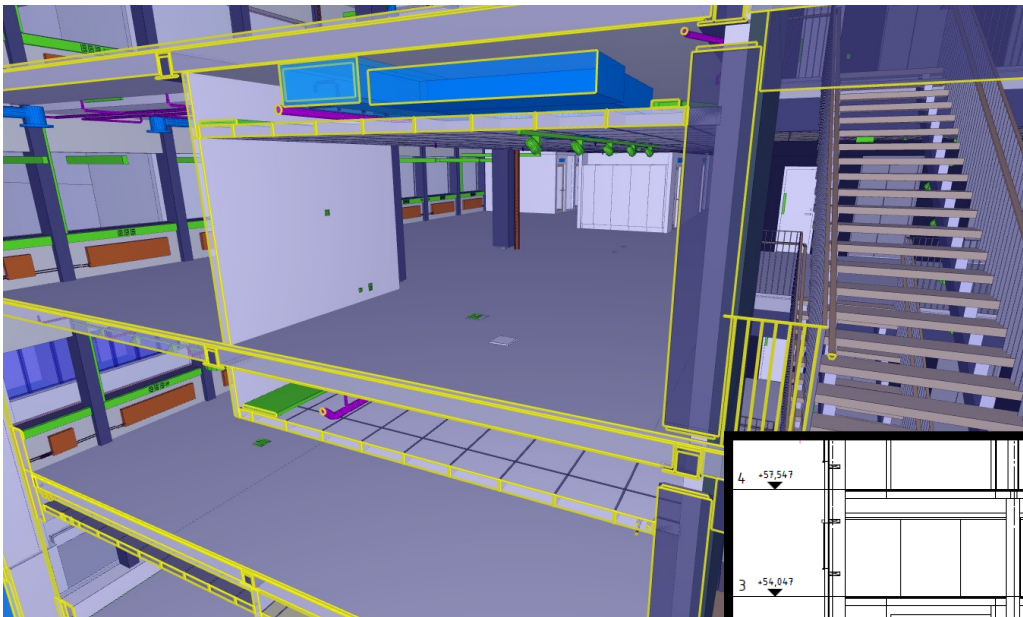


Hybrid BIM



Risk that drawings and BIM do not match

Could you use and trust the BIM on construction site...



Use at your own risk...

Hybrid challenges in other industries



With Hybrid you make two things at the same time!
(complexity, compromises)



New standard contracts (AB27) in sweden provide new conditions and opportunities

Digital model:

Higher status than descriptions and drawings!



New Total BIM process !!!

3 §

Vid motstridiga uppgifter i kontraktshandlingarna gäller följande företrädesordning:

1. kontrakt
2. ändringar i AB 25 som är upptagna i en särskild sammanställning i administrativa föreskrifter
3. AB 25
4. beställningshandling
5. anbudshandling
6. särskilda mät- och ersättningsregler
7. à-prislista eller prissatt mängdförteckning
8. kompletterande föreskrifter för entreprenaden som meddelats innan anbud lämnats
9. administrativa föreskrifter
10. ej prissatt mängdförteckning
11. digital modell
12. beskrivningar
13. ritningar
14. övriga handlingar

Förekommer digital modell i förfrågningsunderlaget så gäller företrädesordningen enligt första stycket p. 11–14 endast om inte annat anges i kontraktshandlingarna.

"2D-project"



"Hybrid BIM"



"Total BIM"



"Safe environment"

**Leave old, familiar
workflows behind!!!**

Data-informed and data-centric process: **All communication through BIM** A data-driven workflow that improves efficiency!

The screenshot displays a BIM software interface with a central 2D floor plan view. The floor plan is divided into colored zones (yellow, orange, green, purple) and populated with numerous circular markers in various colors (green, orange, white). To the left of the floor plan is a sidebar with a list of workflows, each with a small thumbnail and a status indicator (e.g., 'open', 'done'). To the right of the floor plan is a detailed task list under the heading 'StreamBIM Capture'. This list includes categories like 'DE05-Stomme Prefab', 'DE06-Hiss', 'DE07-Glaspazier', 'DE08-EI', and 'DE09-Ventilation'. Each category has a list of tasks with their status (e.g., 'closed', 'open') and a date. Below the task list, there are three small images: a 2D floor plan, a 3D model of a building, and a photograph of a building's exterior. On the far right, there is a panel with workflow details, including 'WORKFLOW: DE09-Ventilation/Förbesiktning', 'LOCATION: Celsius Produktion Plan 05 1203 FÖRRÅD', 'TITLE: S2.3', 'STATUS: Closed', and 'ASSIGNED TO: @DE09'. Below this panel, there are two small images showing a 3D model and a photograph of a building's exterior.

Task	Status	Date
#4778 closed Thu 09:38	closed	Thu 09:38
#5208 open Thu 09:38	open	Thu 09:38
#3921 open Thu 08:21	open	Thu 08:21
#4779 closed Thu 07:08	closed	Thu 07:08
#3915 closed Thu 07:08	closed	Thu 07:08
#4252 closed 2019-08-22	closed	2019-08-22
#3916 closed 2019-08-22	closed	2019-08-22
#2929 closed 2019-06-27	closed	2019-06-27
#3411 closed 2019-06-27	closed	2019-06-27
#3410 closed 2019-06-27	closed	2019-06-27
#2933 closed 2019-06-27	closed	2019-06-27
#3413 closed 2019-06-27	closed	2019-06-27

Work preparation and checklists linked to model objects

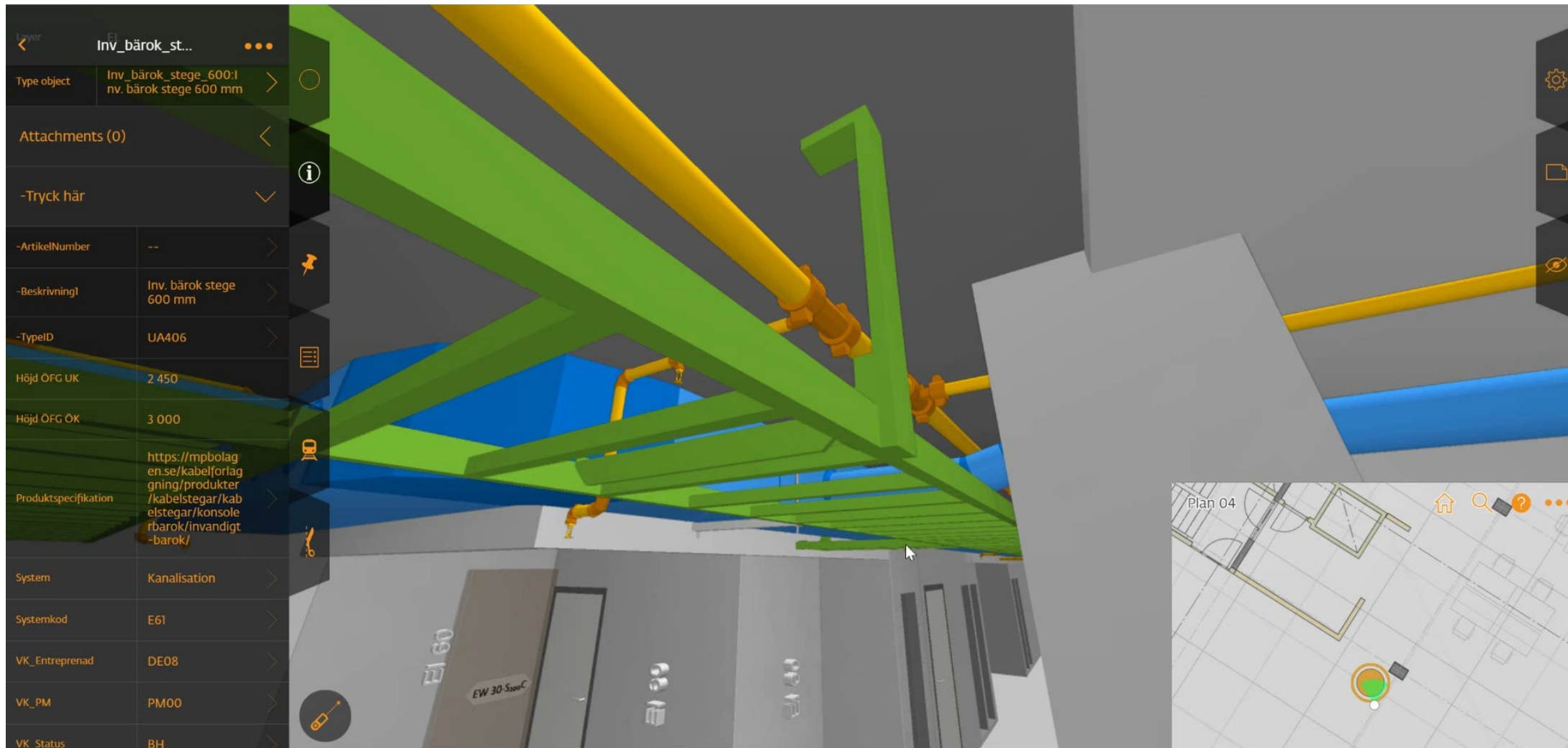
Construction workers can extract Production-Oriented Views themselves!



Production-oriented: Dynamic filtering of information

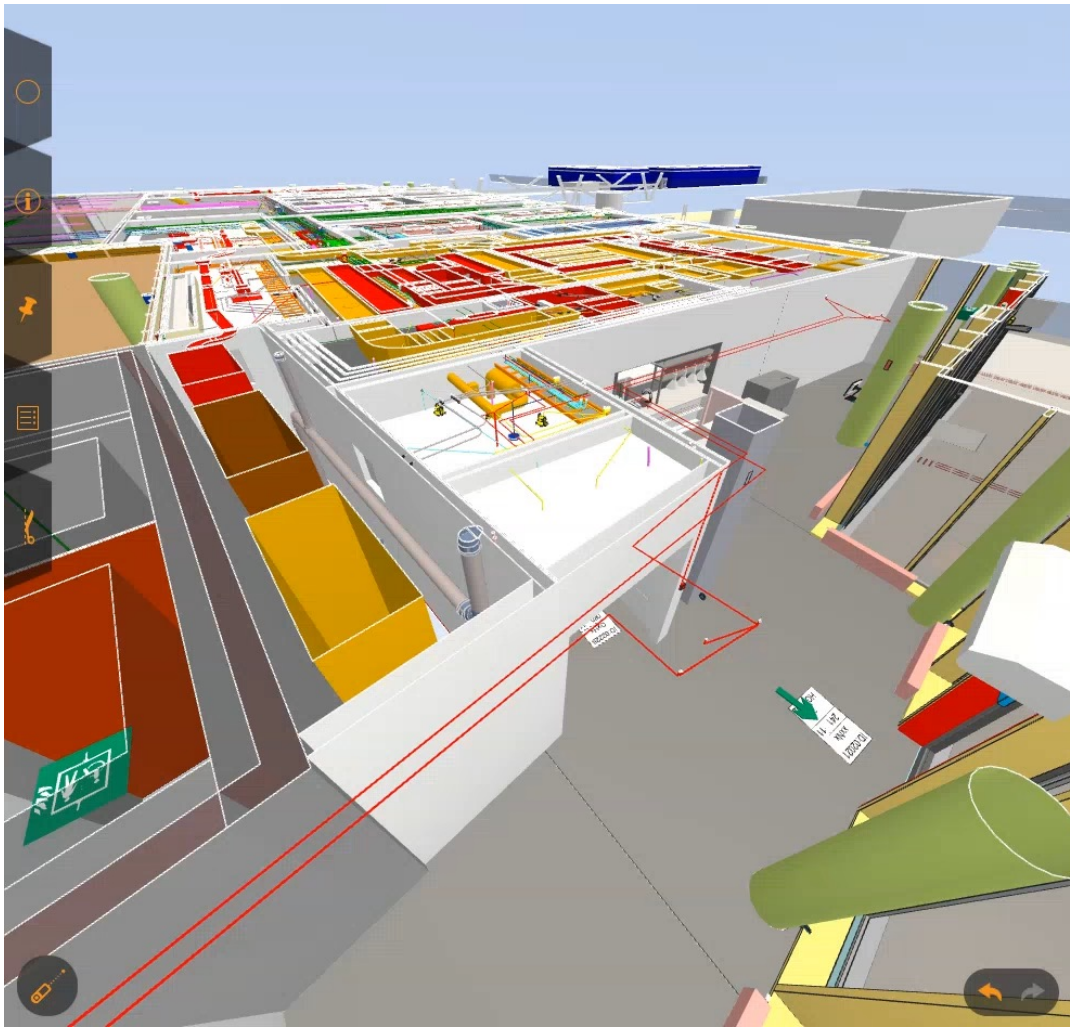
Ask the question: Who is the information for?

What information do they actually need — and how do they want it?



Custom Views:

What information do they actually need — and how do you want it?



Do we get efficiency from a model-based production system?

Value-adding time

8.3 - 13.2%

Direct assembly work, prefabrication

Preparation time

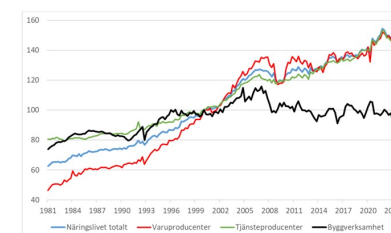
41.7 - 58.9%

Indirect work, carrying, transport of materials and equipment, work planning etc..

"Non-value-adding" time

23.4 - 49%

Fixing errors, idle time, waiting etc.



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Hybrid-BIM



Total BIM



Total BIM

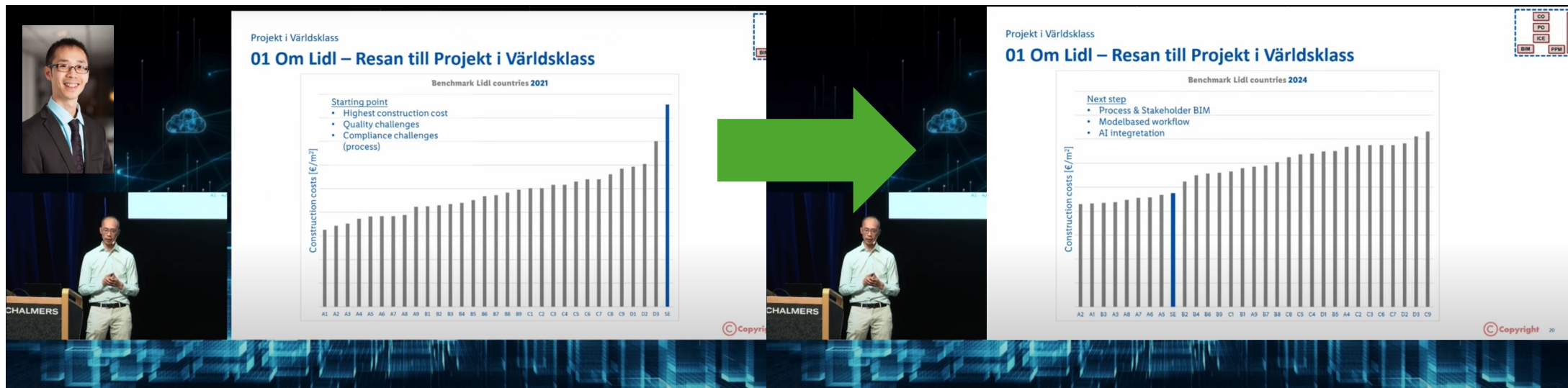


	Hubben (per area)	Celcius (per area)	Lumi (per area)
Design cost	10.4 %	13,6 %	10.3 %
Production cost	82.8 % More cost during production	74.7 % Less cost during production	77.4 % (demolition + recycling) Less cost during production
Reduced cost for installations	-	-8.5%	-28.6 %
Lab area	23 % lab	35 % lab	35 % lab
Production cost		-	- 17.5 % per BTA

Example of efficiency improvement using BIM:

- Lidl reduced construction cost by 46%

From highest construction cost to 9th place



Max Tran, Lidl (Total BIM Dagen 2024)

Problems before:

- High design and production costs
- Errors and quality problems
- Long lead times

Improvements:

- More efficient design and production process
- Better tendering process
- Reduction of change orders
- Prefabricated installation systems

Apply Lidl approach on housing projects



Max Tran

Resona – a Swedish residential property developer

Aim:

Shorter design process and 30% lower total cost

Result:

→ **Shorter design process 18 -> 6 months**

→ **Now: 20% lower cost**

ONE Design Process

18 -> 5,5 months

Design time (- 69 %)

Before

Schematic
Design

Design
Development

Construction
Documentation

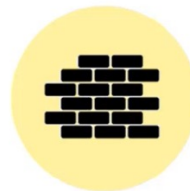
18 months

After

Construction
Documentation
(Master BIM)

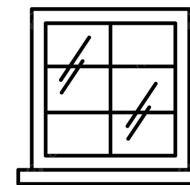
6 months

"Master-BIM" - continuous development



Wall type

27 -> 13 (-52 %)



Window type

360 -> 60

Example of a more efficient process

Traditional vs. model-based installation processes

Value-adding time (8.3–13.2%)

- More prefabrication?
- More efficient assembly/production using BIM on the construction site

Preparation time (41.7–58.9%)

Indirect work, carrying, transport of materials and equipment

- More efficient work planning and installation
- More accurate quantities
- More efficient purchasing
- Fewer questions about installation steps

Non-value-adding time (23.4–49%)

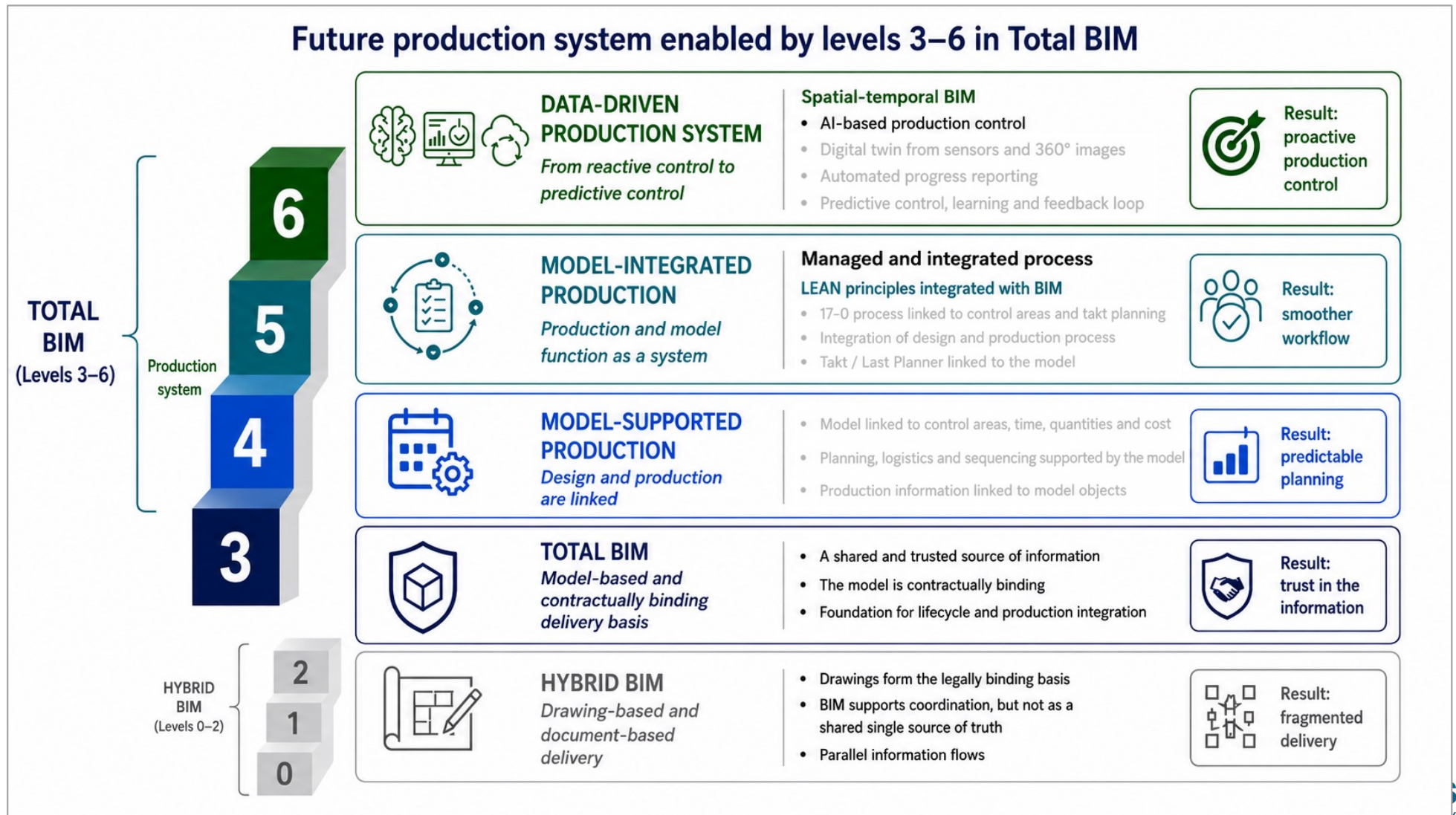
Fixing errors, idle time, waiting, etc.

- Easier to understand and do the work correctly
- Fewer installation mistakes
- All planned deliveries arrive on time
- Accurate material lists
- Avoid paying 3–5× higher price when buying too late

Model-based production system:

- 17-0 process
- Takt-planing
- Logistics

Discussion for tomorrow:





Questions??

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