

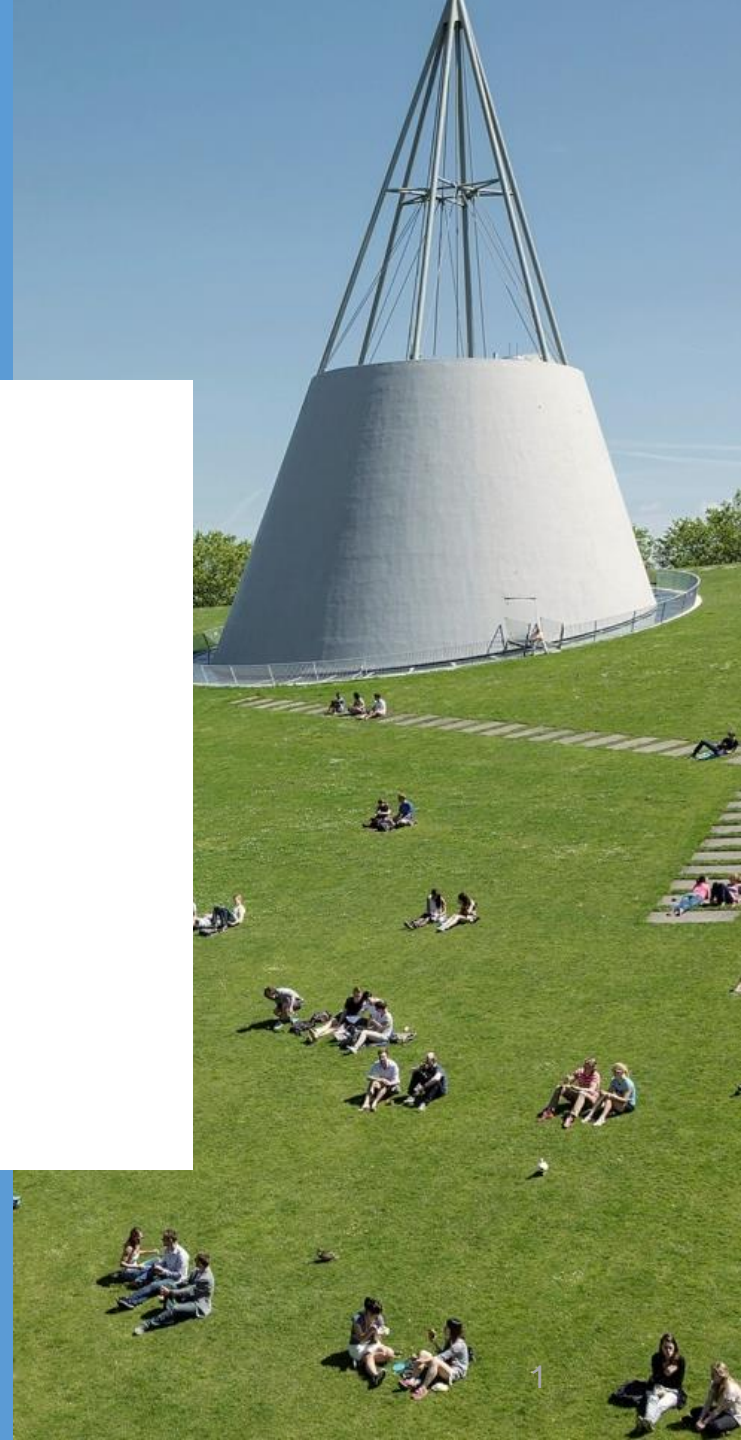
Industrialized Construction: From Houses to Bridges?

MasterClass: Flattening the curve

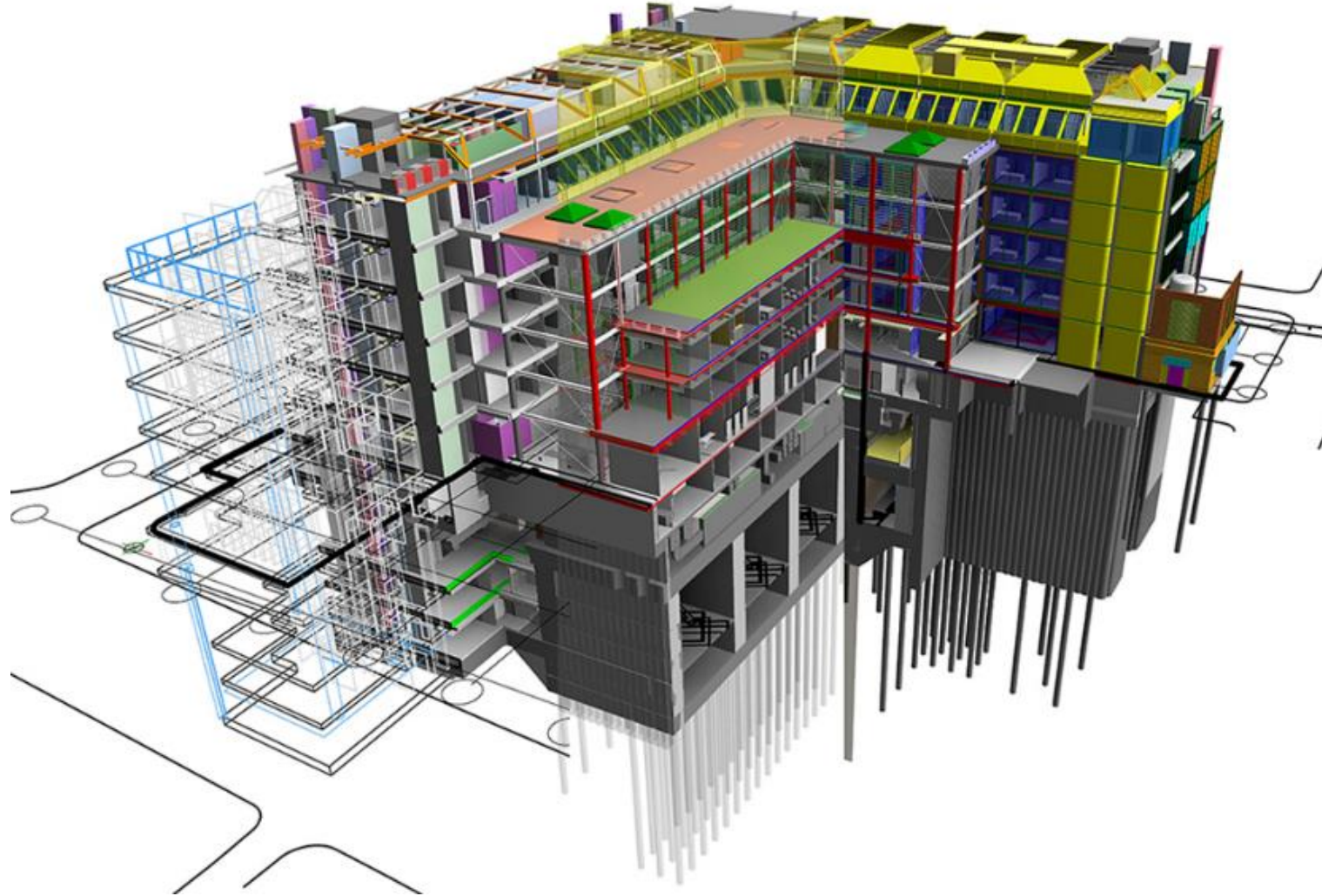
Daniel M. Hall | Assistant Professor

Faculty of Architecture & Built Environment

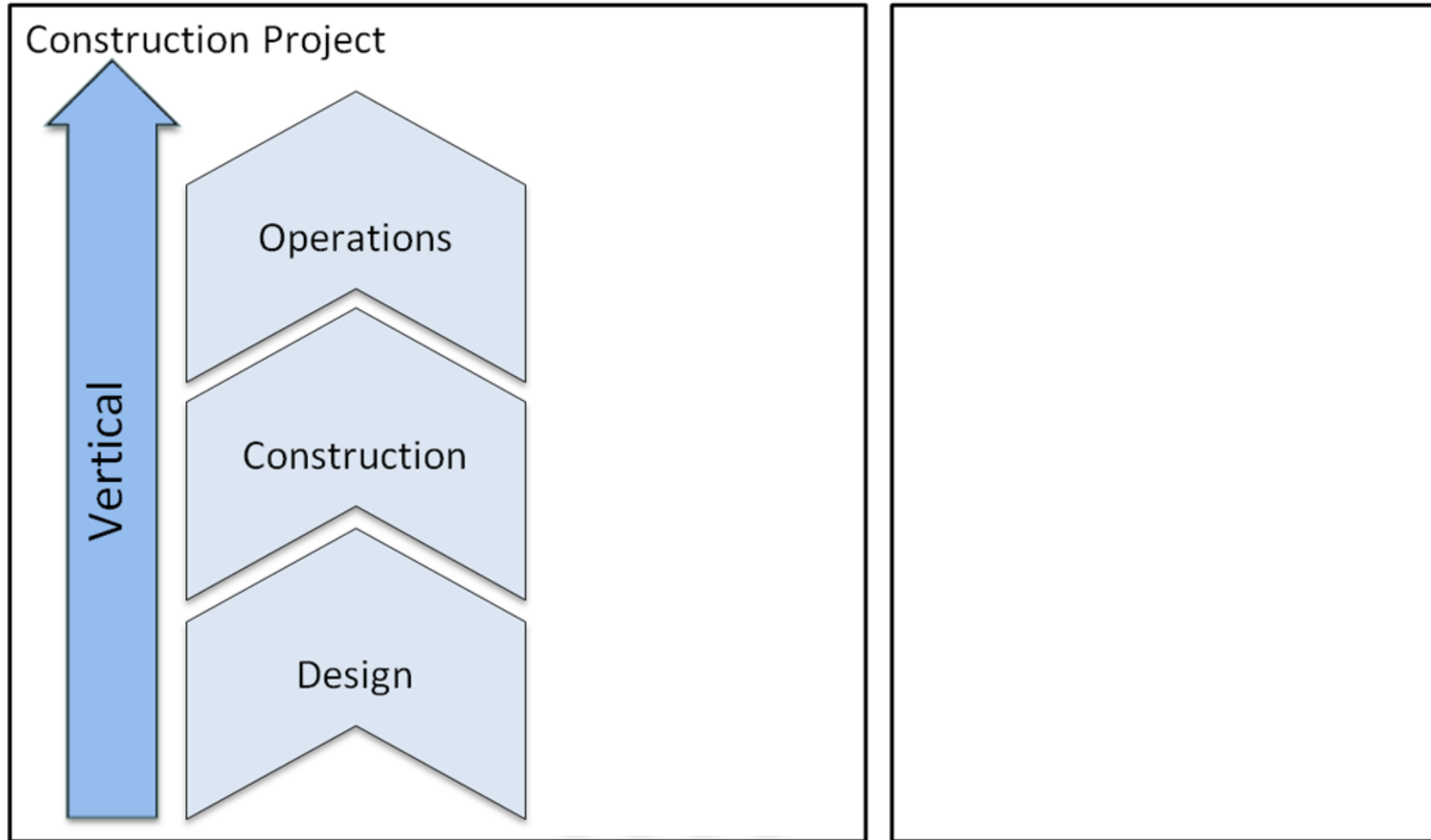
Department of Management in the Built Environment



Wasn't BIM supposed to be the answer to all our problems?



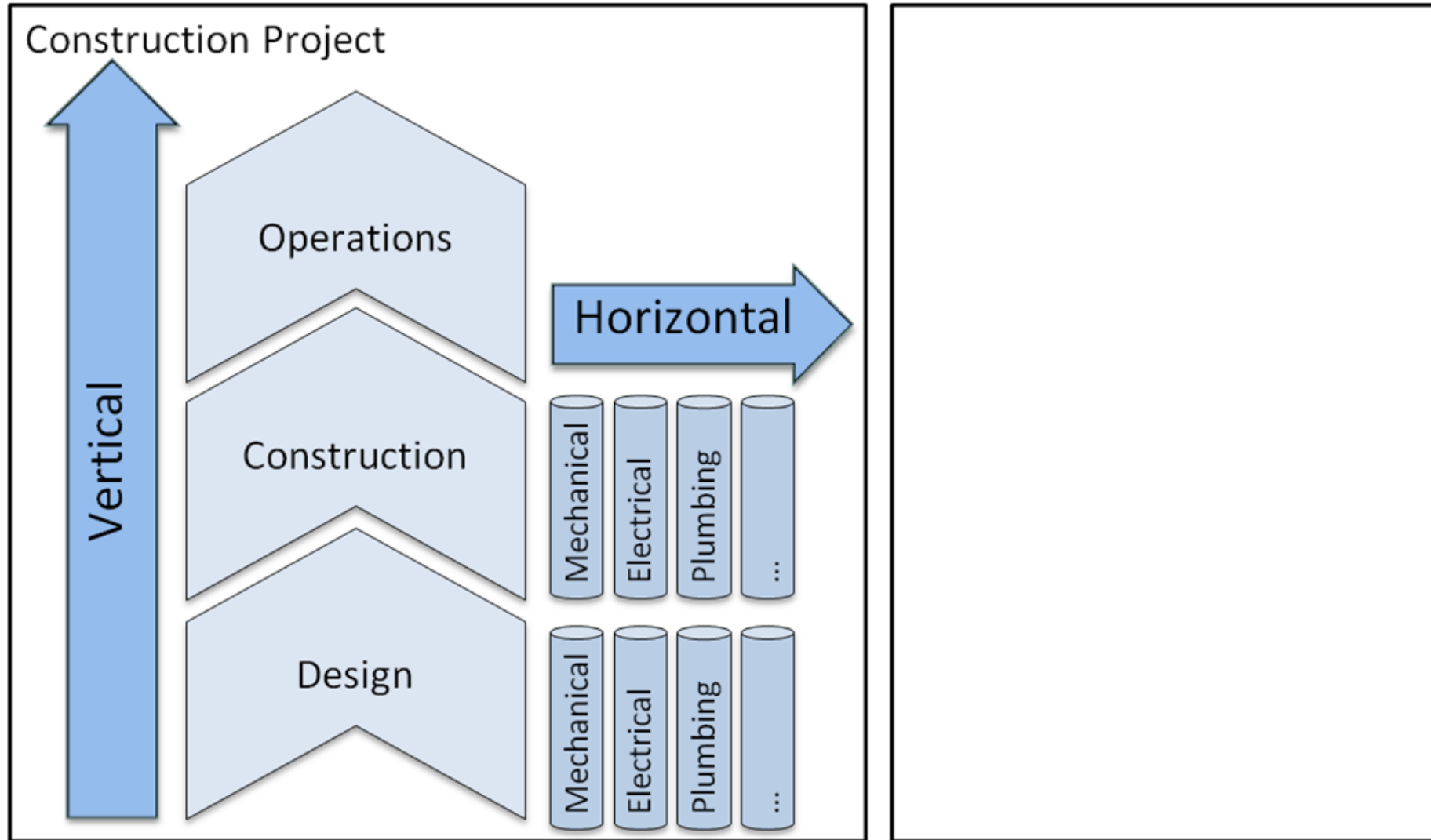
Fragmentation in Built Environment



Fergusson, K. J., & Teicholz, P. M. (1996). Achieving industrial facility quality: Integration is key. *Journal of management in engineering*, 12(1), 49-56.

Hall, D. M., Algiers, A., & Levitt, R. E. (2018). Identifying the role of supply chain integration practices in the adoption of systemic innovations. *Journal of management in engineering*, 34(6), 04018030.

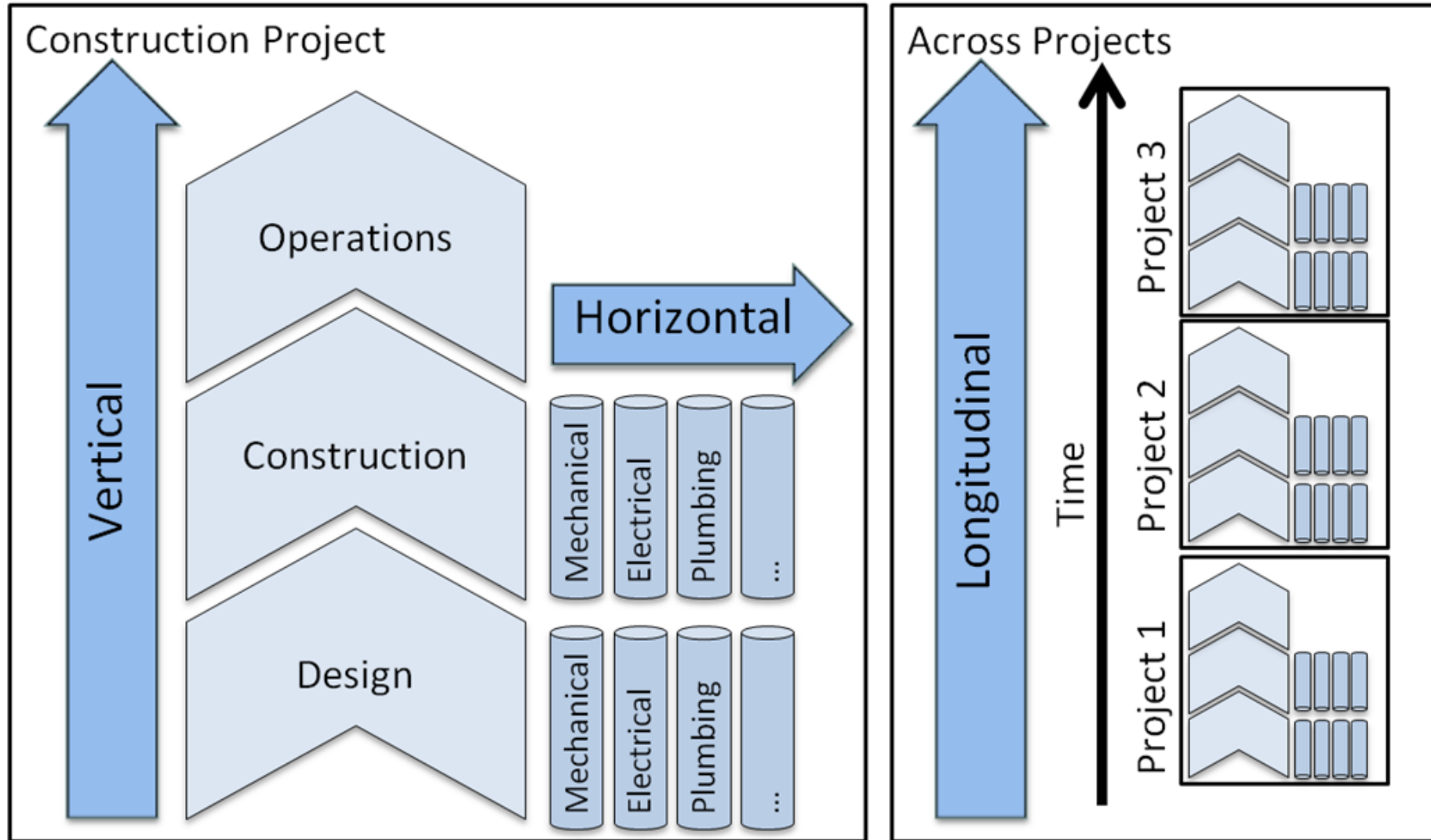
Fragmentation in Built Environment



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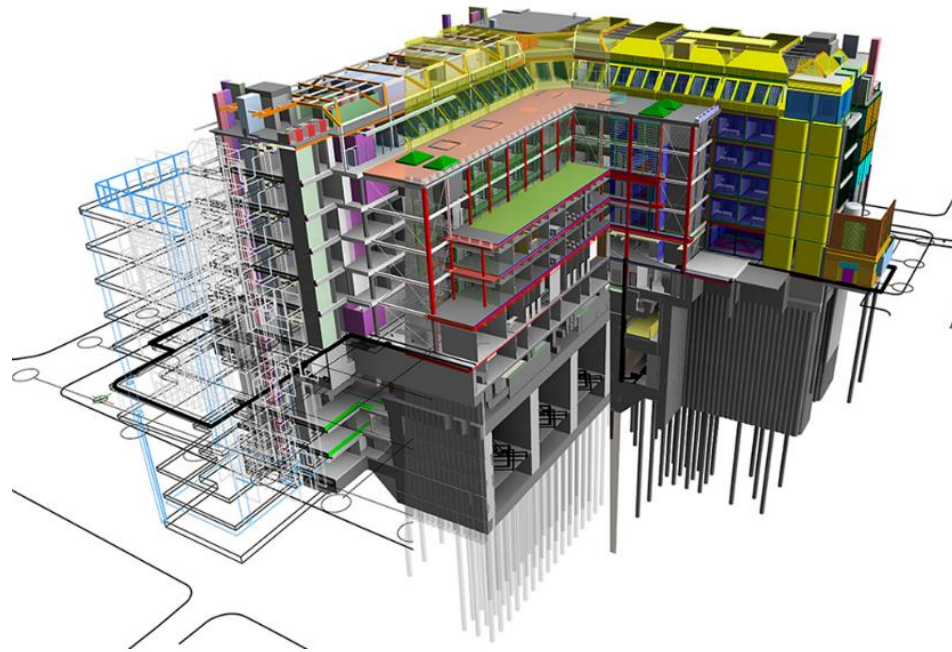
Fragmentation in Built Environment



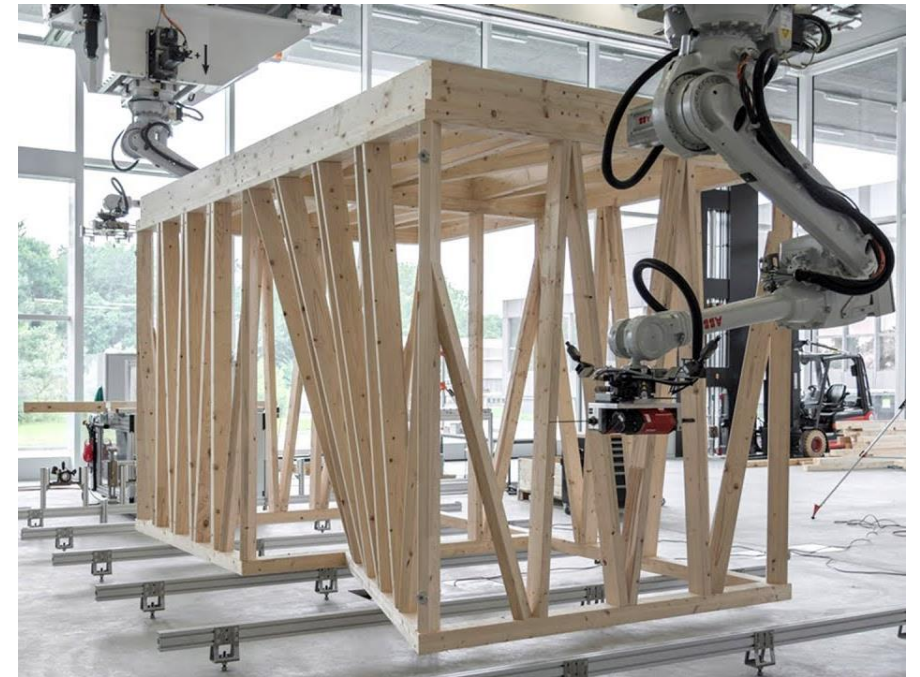
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Shift in Technology: BIM will never be the answer to all our problems



Digitalization



Industrialization

Daniel M. Hall

Insights from 10 years of research on the topic...



Stanford
University



INDUSTRIALIZED
CONSTRUCTION FORUM



Daniel M. Hall

Insights from 10 years of research on the topic...



Stanford
University



ETH zürich



Daniel M. Hall

Insights from 10 years of research on the topic...



Stanford
University



ETH zürich



TU Delft



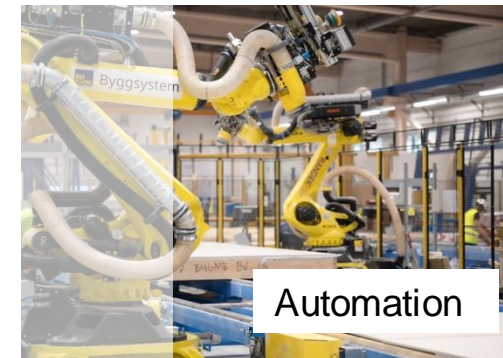
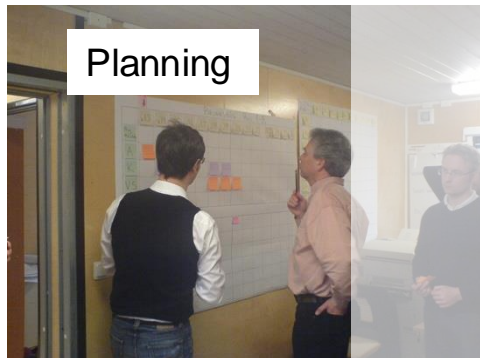
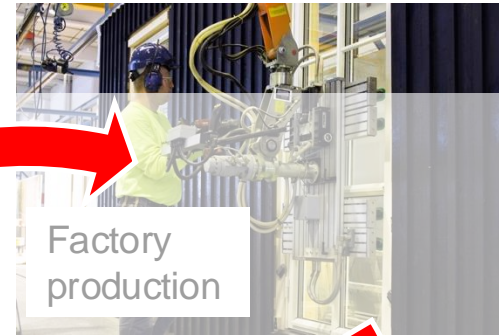
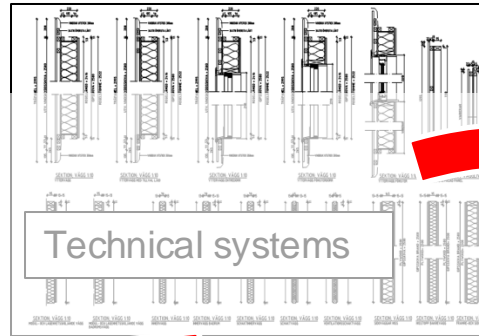
Agenda

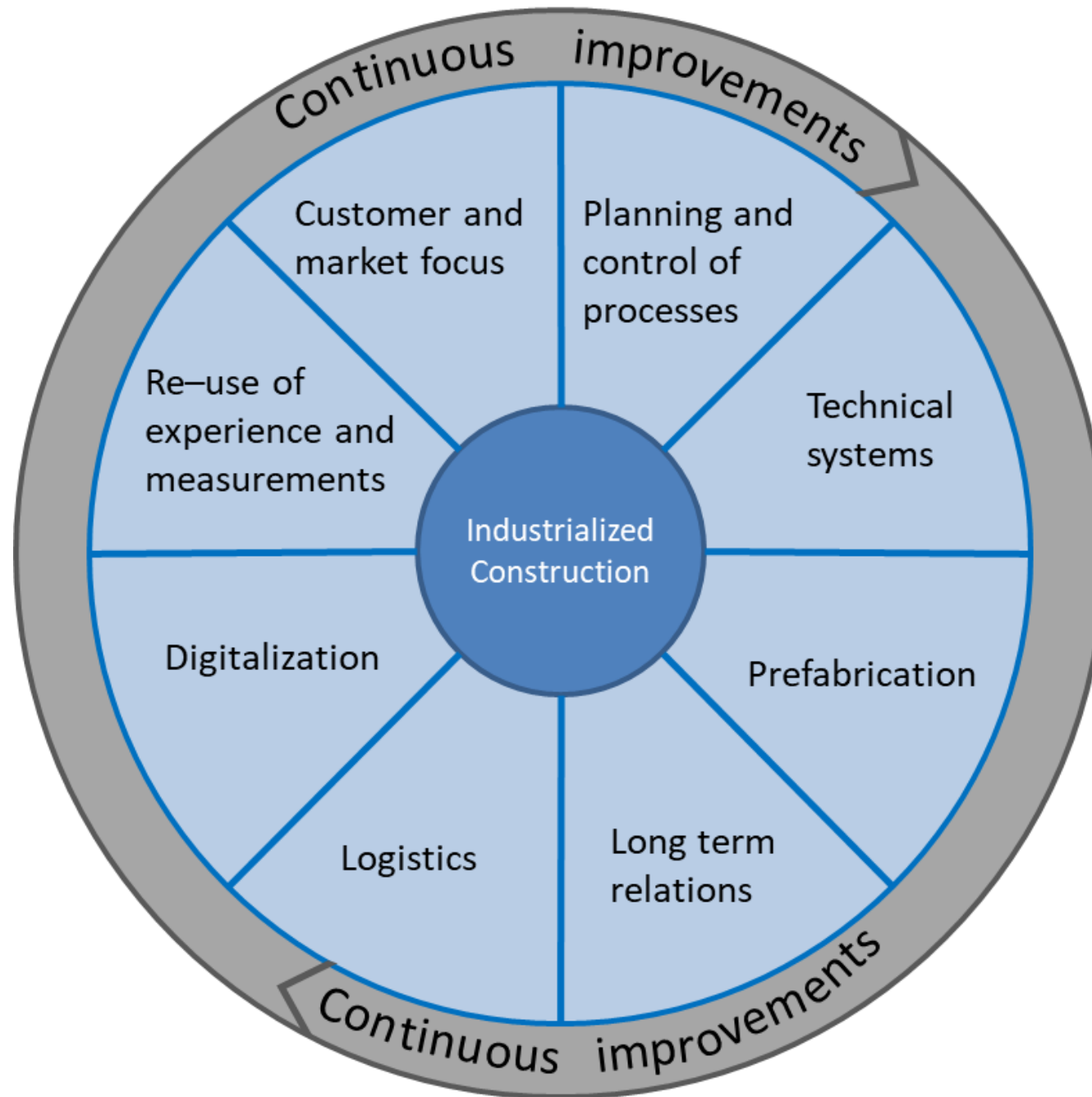
- What is Industrialized Construction?
- Projects, Processes, and Platforms
- Configuration and Mass Customization
- Entrepreneurship and New Business Models
- Towards Circular Industrialized Construction
- From Houses to Bridges?

1. What is Industrialized Construction?

Industrialized Construction vs. Prefabrication

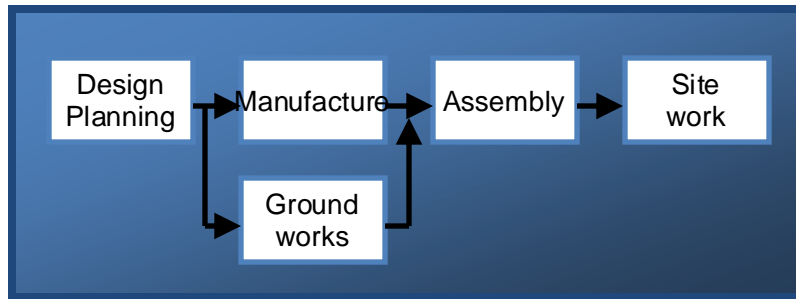






2. Projects, Processes and Platforms

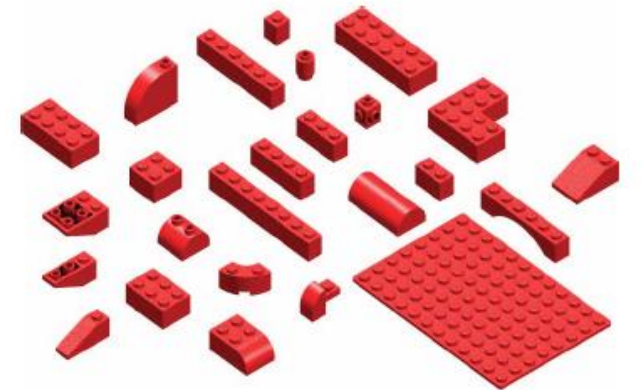
Projects, Processes, and Platforms



Project



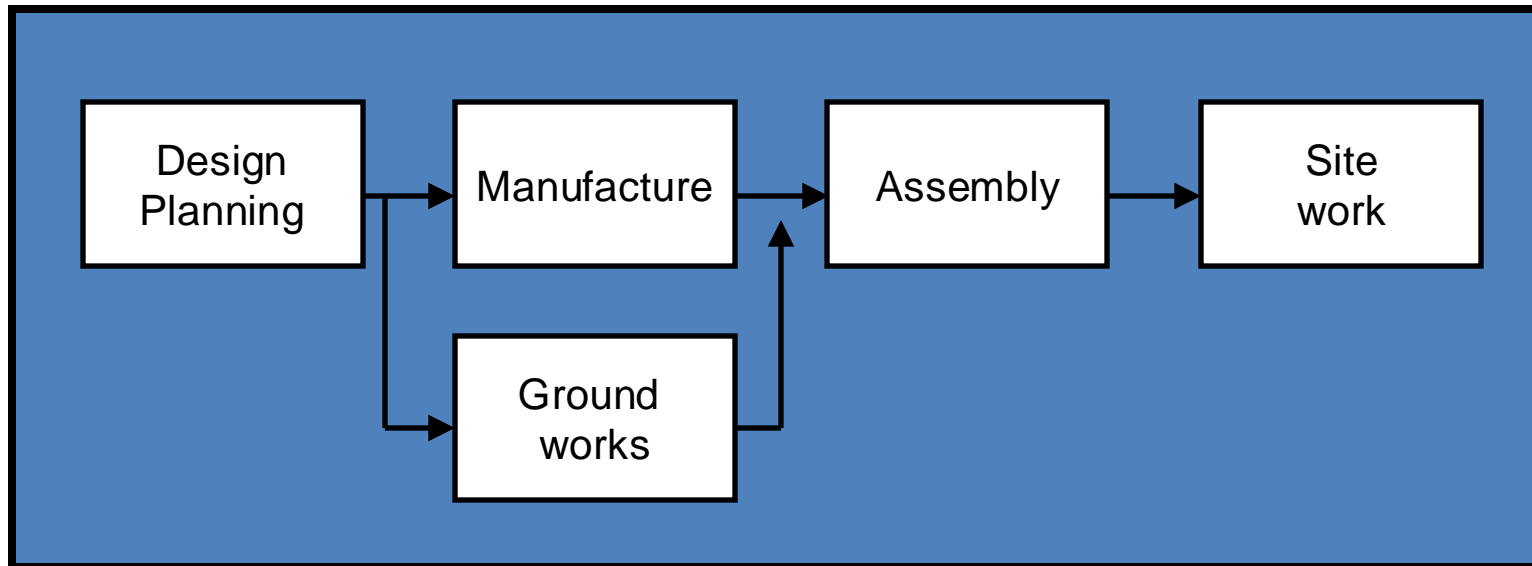
Process



Platform

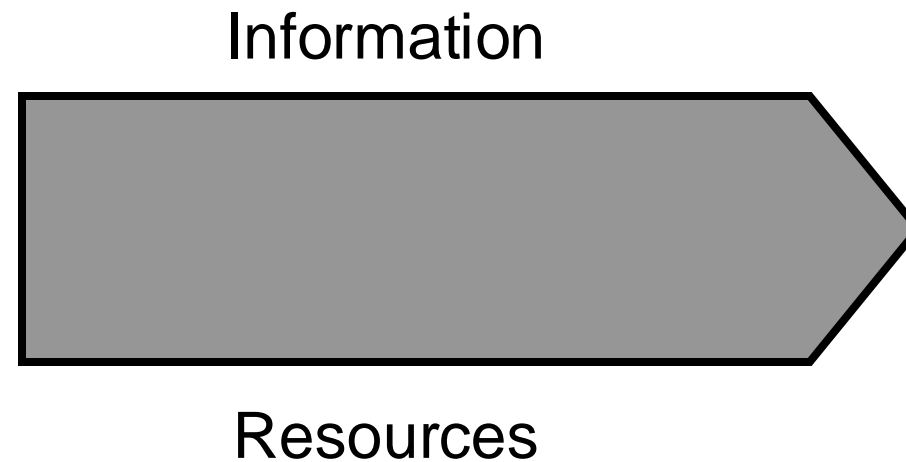
What is a Project?

- A **project** is a series of activities, defined with a starting point and an end point, with a certain amount of resources allocated.
- A **project** exists only once and has its own unique prerequisites.



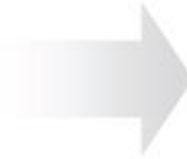
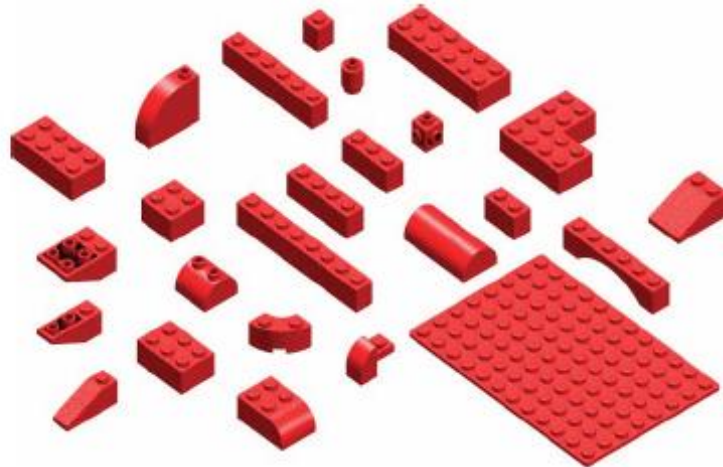
What is a Process?

- A **process** is a continuous flow of activities, that uses information and resources to fulfil its role: to create value for the customers.
- A **process** does not have a clear start and end point in time.



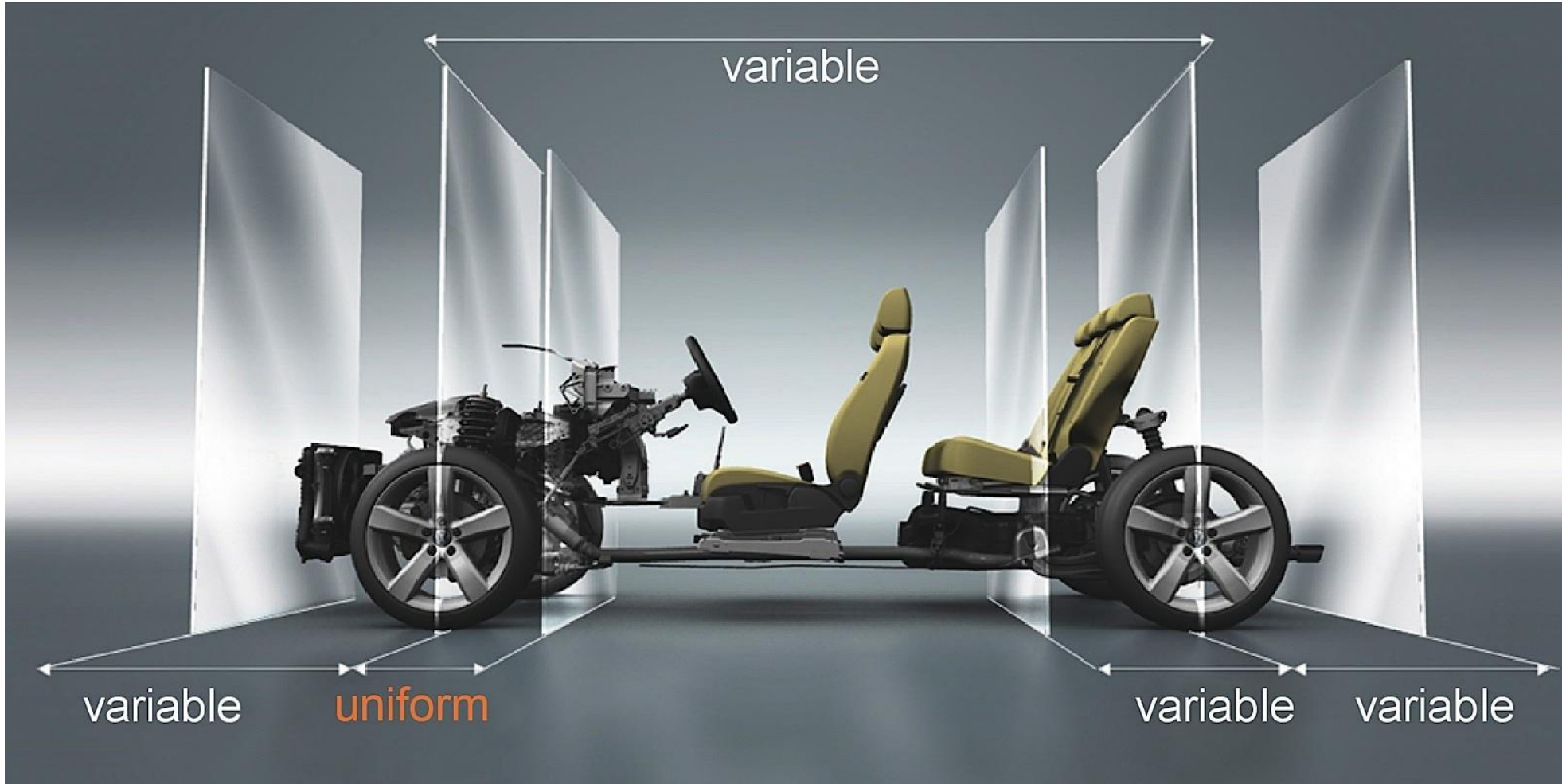
What is a Platform?

- “A **platform** is a set of common components, modules or parts that form a common structure from which a stream of derivative products can be efficiently developed and produced.” (Meyer & Lehnerd, 1997)
- **Platforms** allow multiple products to be built within the same technical framework.



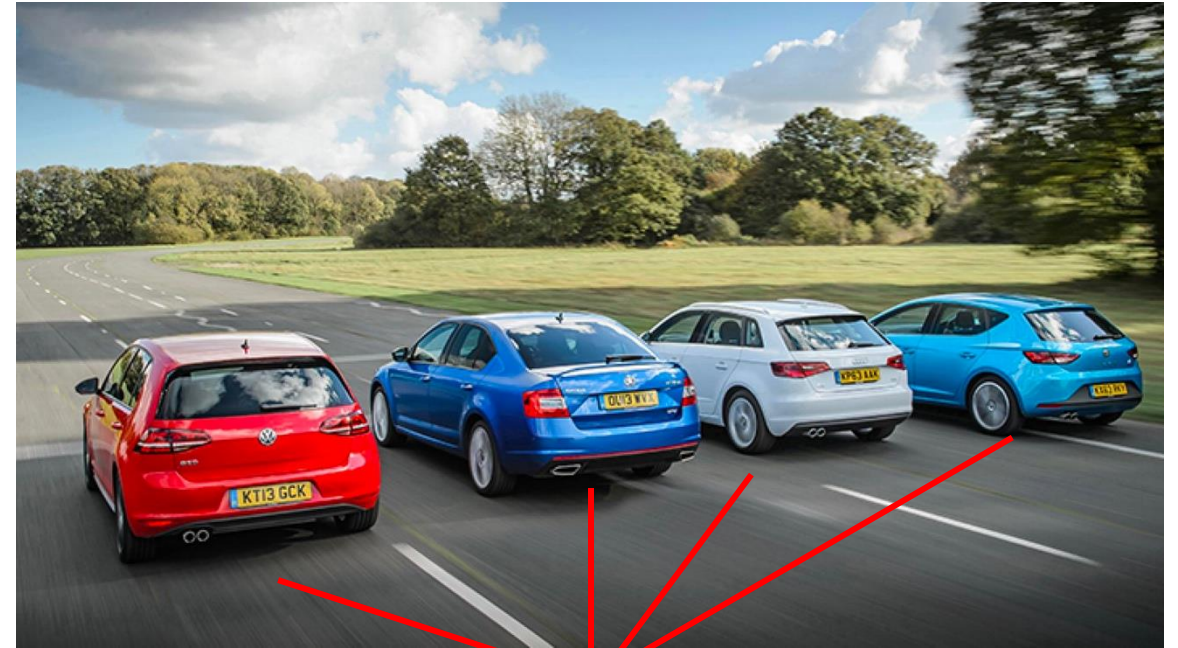
Volkswagen – the MQB Platform

"Modularer Querbaukasten"
"Modular Transverse Toolkit"



Development cost
\$60 billion

Volkswagen – the MQB Platform



SEAT Leon, Skoda Octavia and Volkswagen Golf and Audi A3

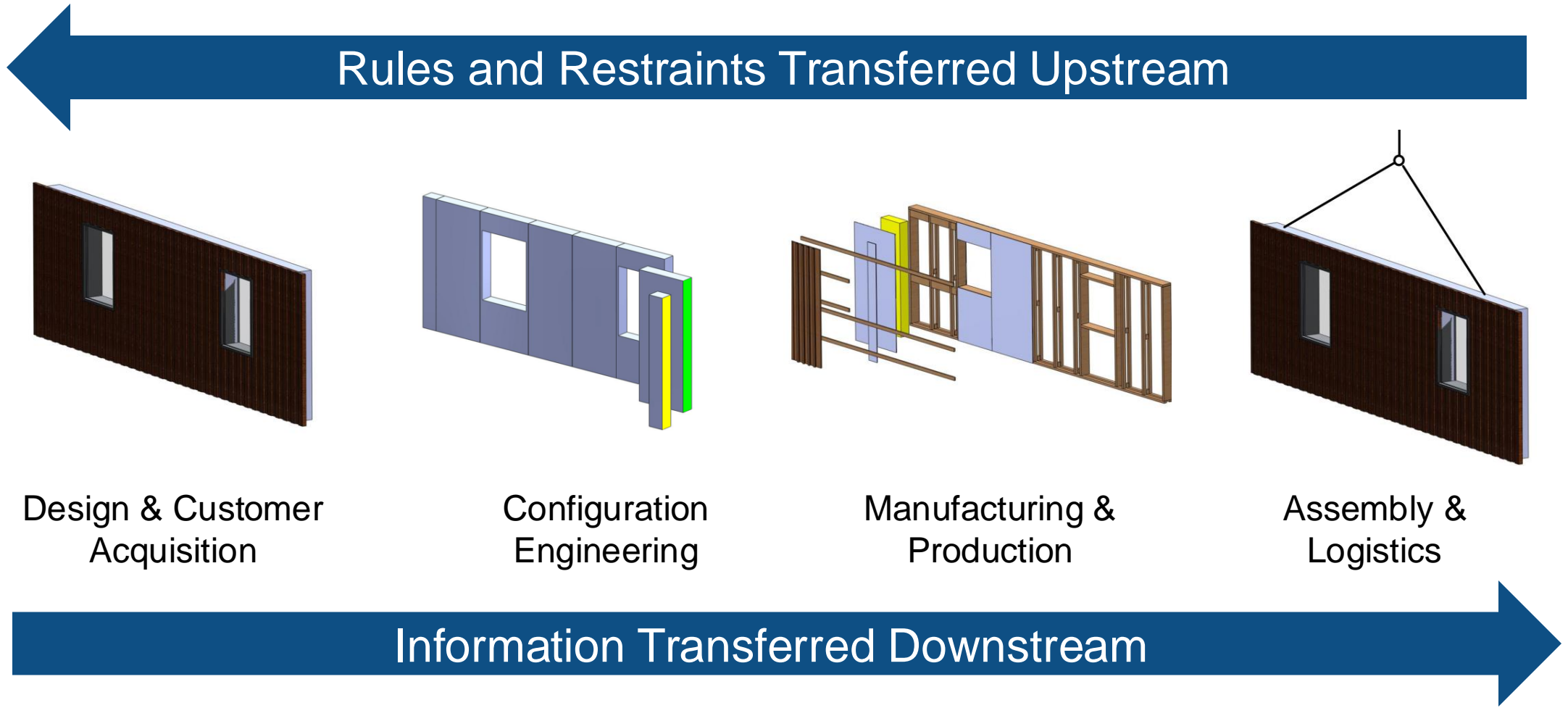
Seat Ibiza Skoda Superb VW Jetta VW T-Roc Audi TT

Seat Arona Skoda Karoq VW Laida VW Tiguan Audi Q2

Seat Ateca Skoda Kodiaq VW Passat VW Touran
VW Polo



Platforms in Industrialized Construction



Platforms in Industrialized Construction

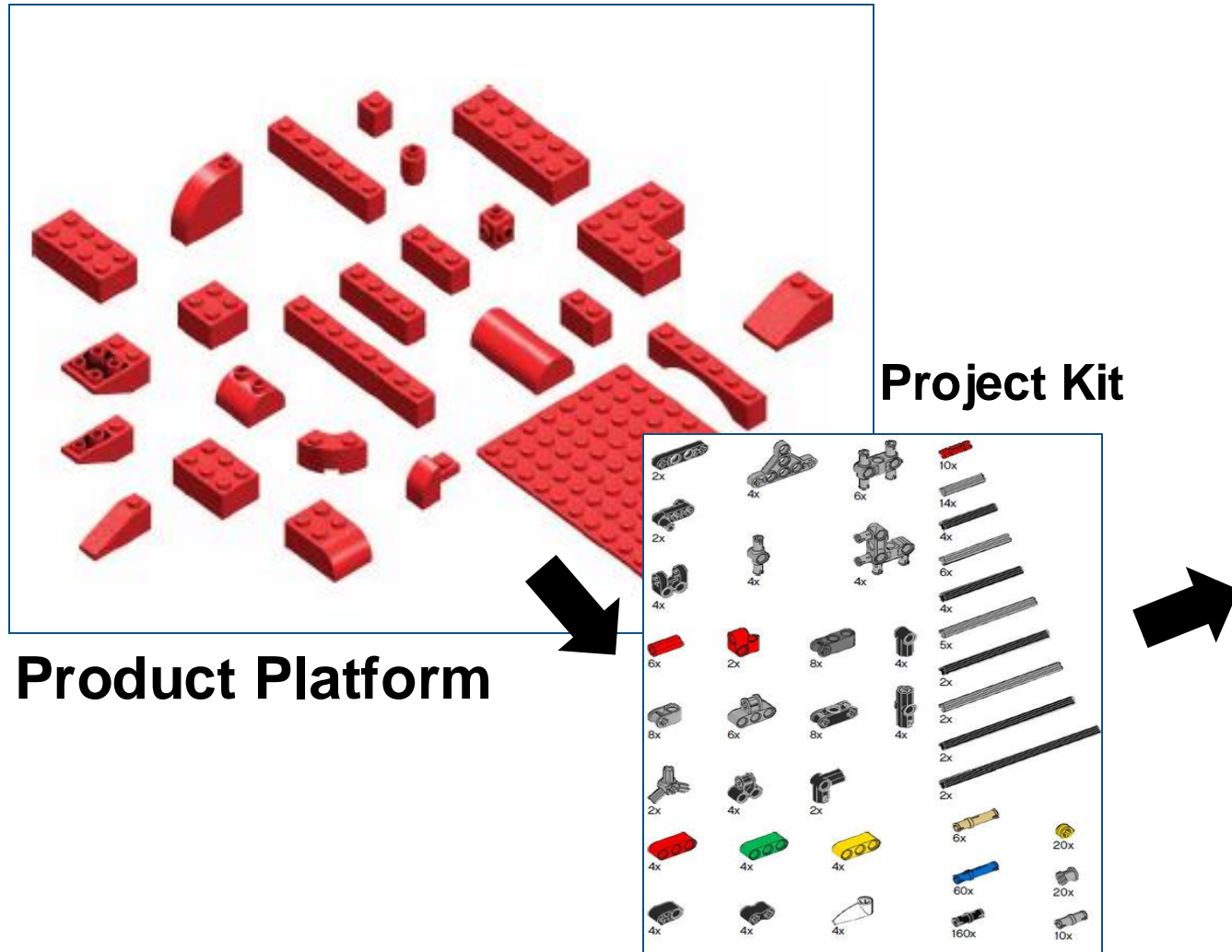


But... customers don't buy platforms...

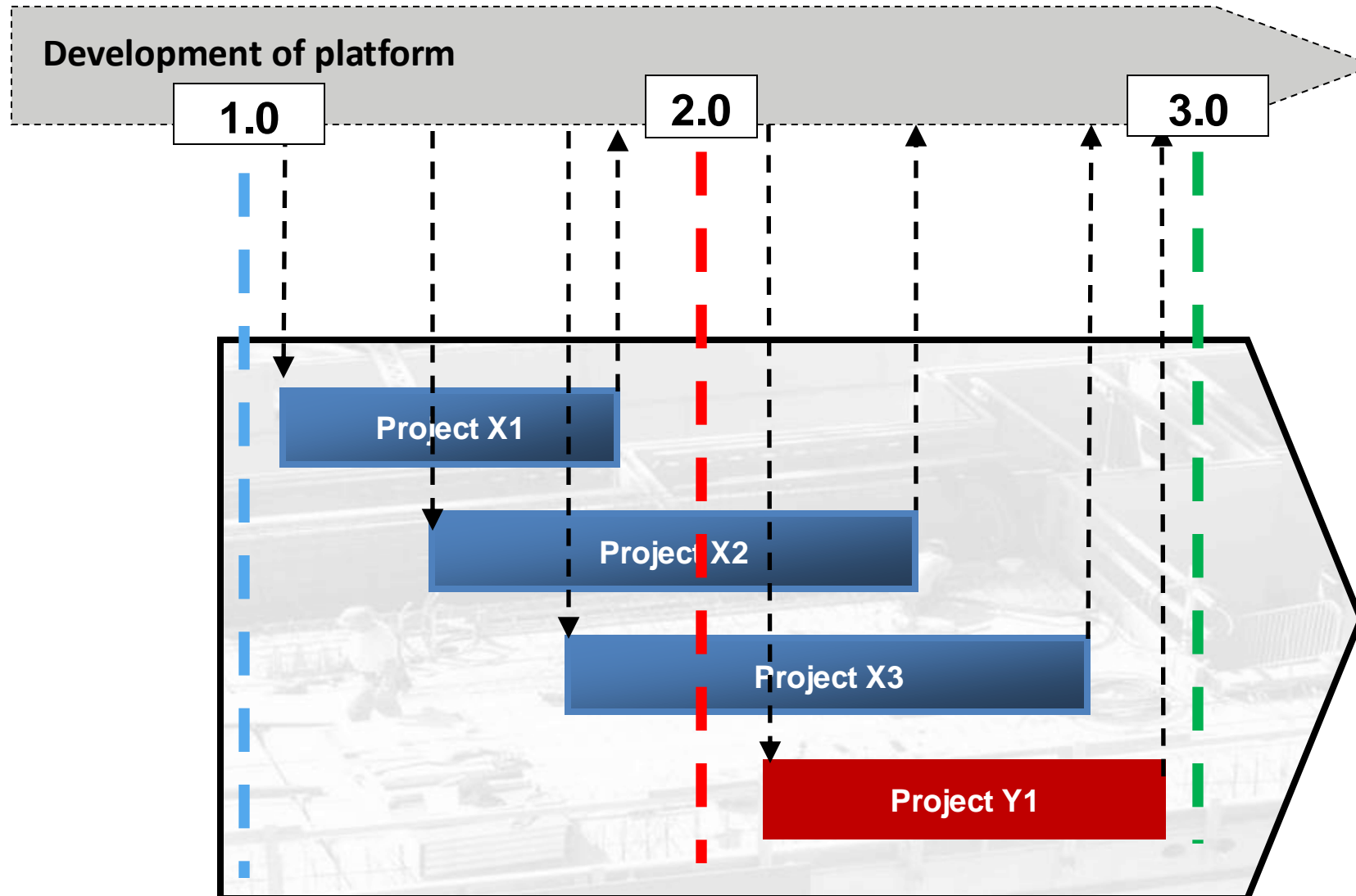
Unique buildings are built using ***projects***, based on solutions from the ***platform***



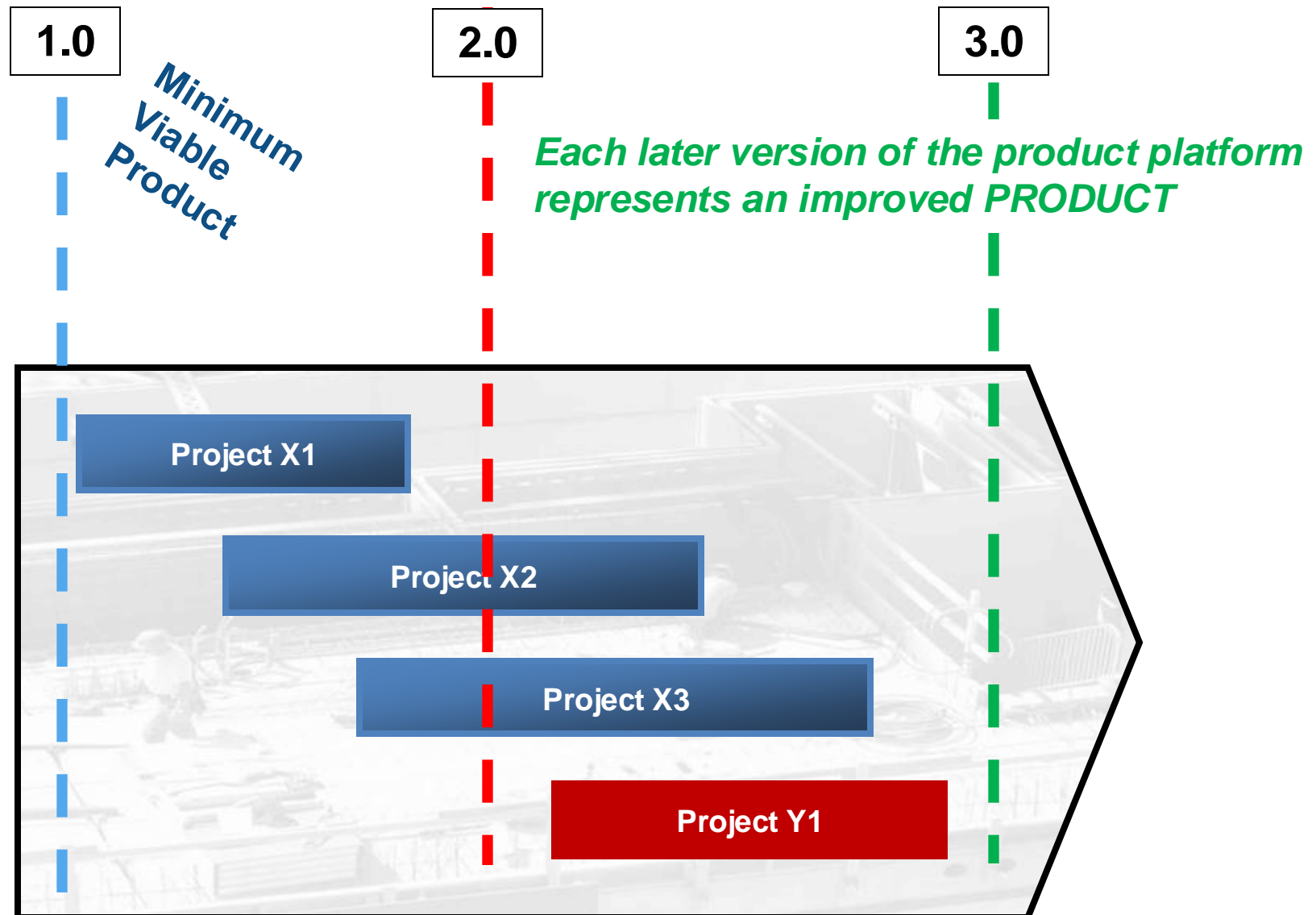
(Adapted from Malmgren et al. 2011)



Projects



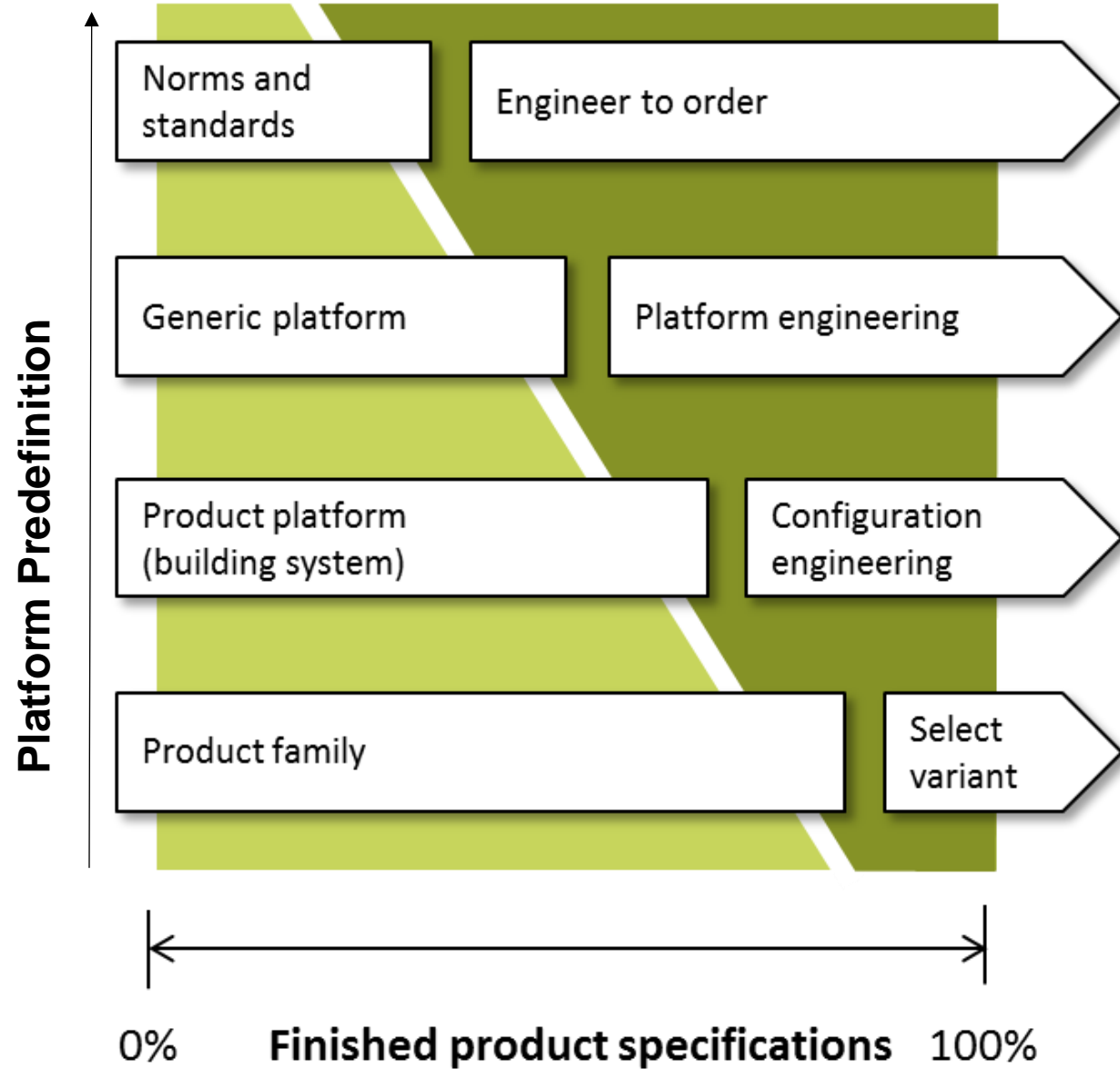
The projects are part of a continuous process



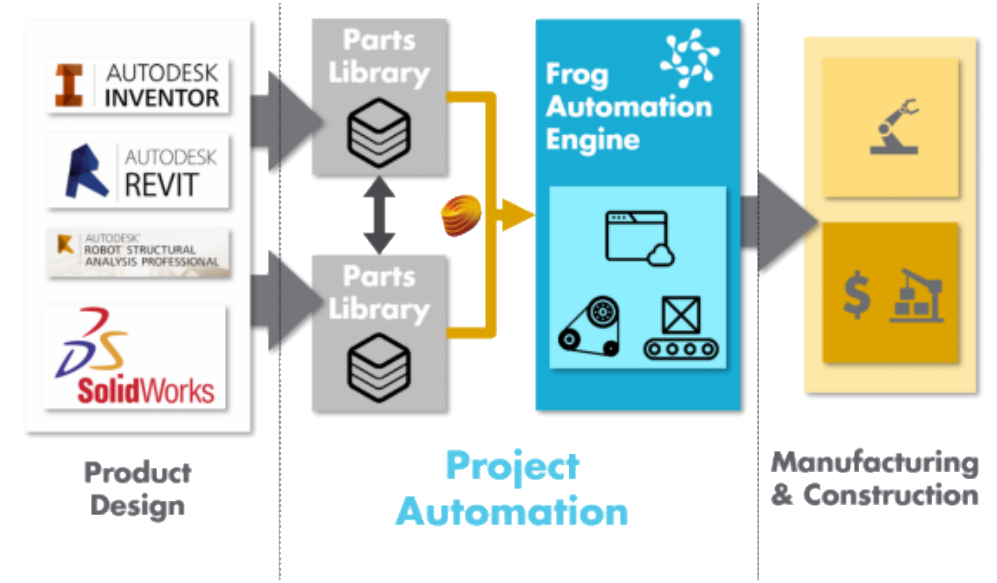
The projects are part of a continuous process

3. Configuration and Mass Customization

Design entry point for customization

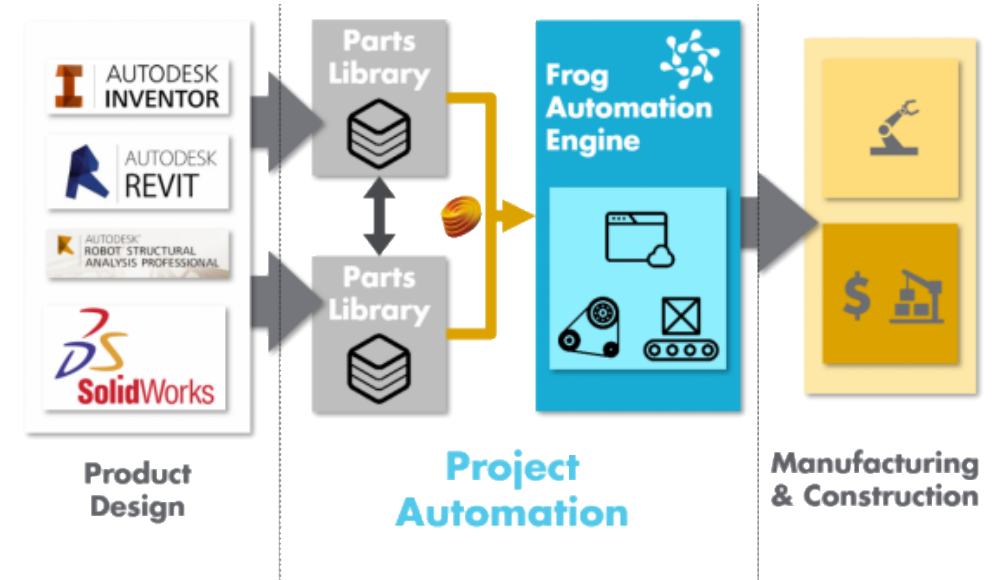
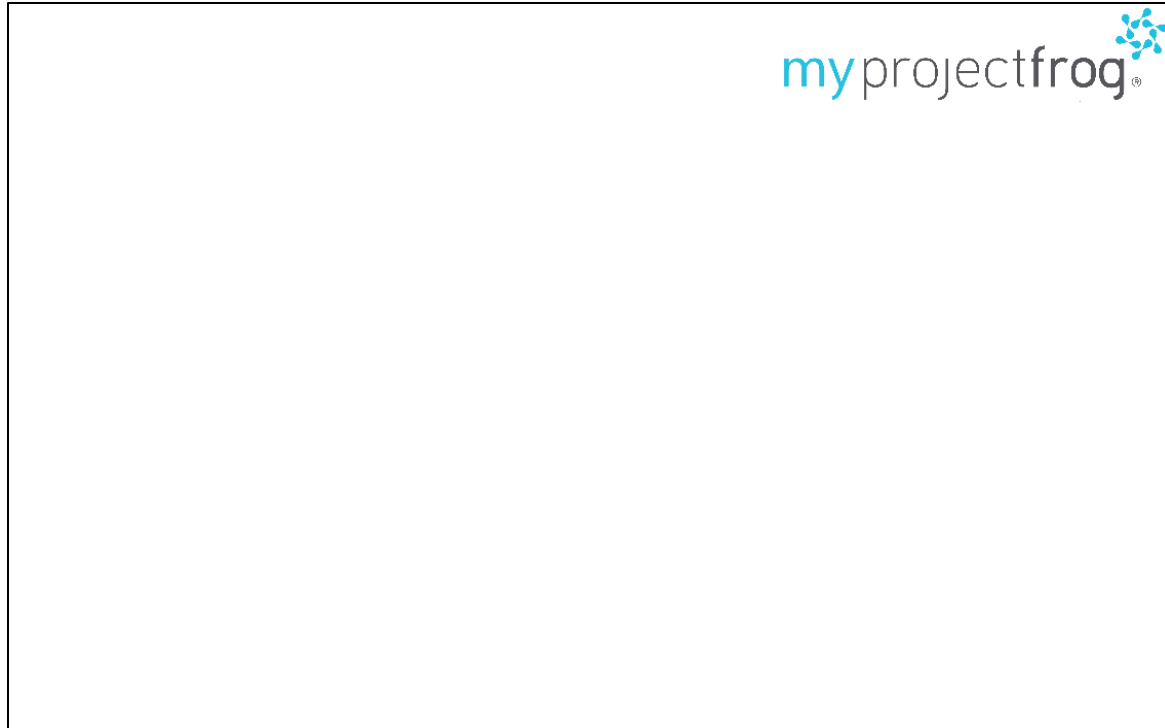


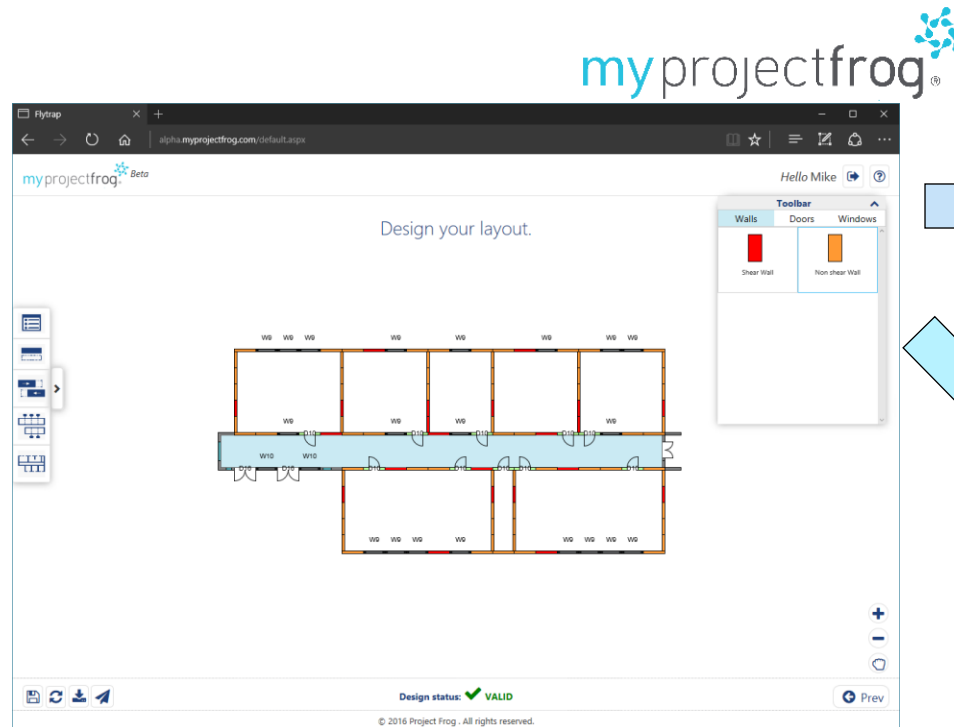
Digital Configurators



(images courtesy projectfrog.com)

Digital Configurators





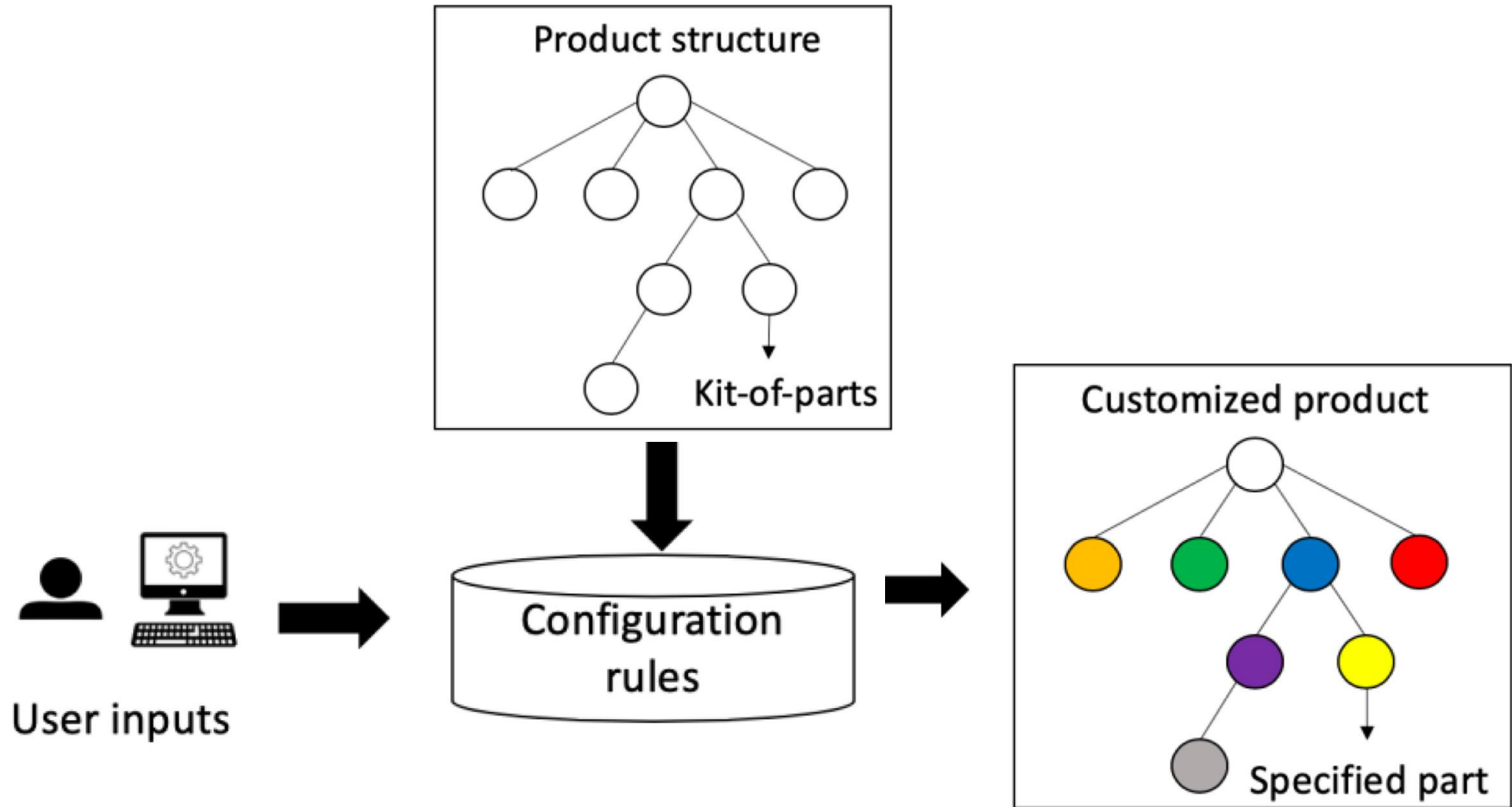
Manufacturing

Bill of Materials
Component Model (LOD 400)
Shop Drawings

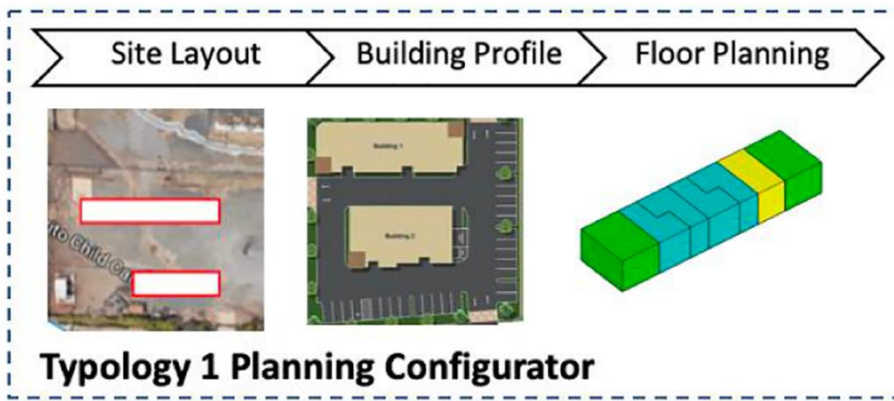
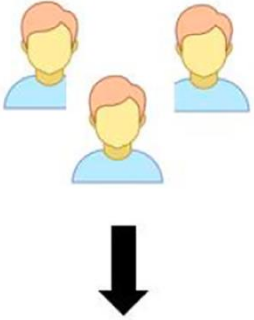
Permit & Construction

Structural Calculations
Architectural Drawings
Structural Drawings

Digital Configurators: The link between platforms & mass customization!



Clients, Planners, Architects

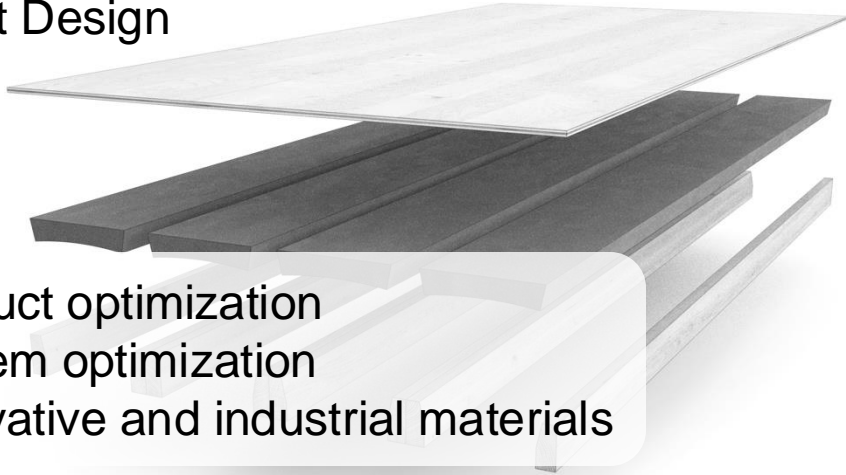


4. Circular Industrialized Construction

Opportunities in Resource Efficiency and Circularity for IC

Product Design

rematter



- Product optimization
- System optimization
- Innovative and industrial materials

Logistics and Assembly

au ar



- Site and equipment efficiency
- Transportation efficiency
- On-site and near-site manufacturing

Manufacturing + Supply Chain

VOLUMETRIC BUILDING COMPANIES



- Precision, perpetuity, synergy in manufacturing
- Lean production
- Inventory monitoring and tracking

Performance and Lifecycle

TU Delft



- Operational energy efficiency
- Non-intrusive refurbishment
- Product flexibility
- Product-as-a-service



BRIDGE THE GAP



How to Bridge the Gap The platform Our mission Partners

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COMING SOON

Your guide to off-site construction systems and technical installations

Bridge the Gap is a non-profit organization that aims to support a faster transition to sustainable and circular construction methods. Soon, users can find, compare, and select the best off-site products on the European market in just one place! We will do the same for technical installations that support net-zero.

[Register as a supplier](#)

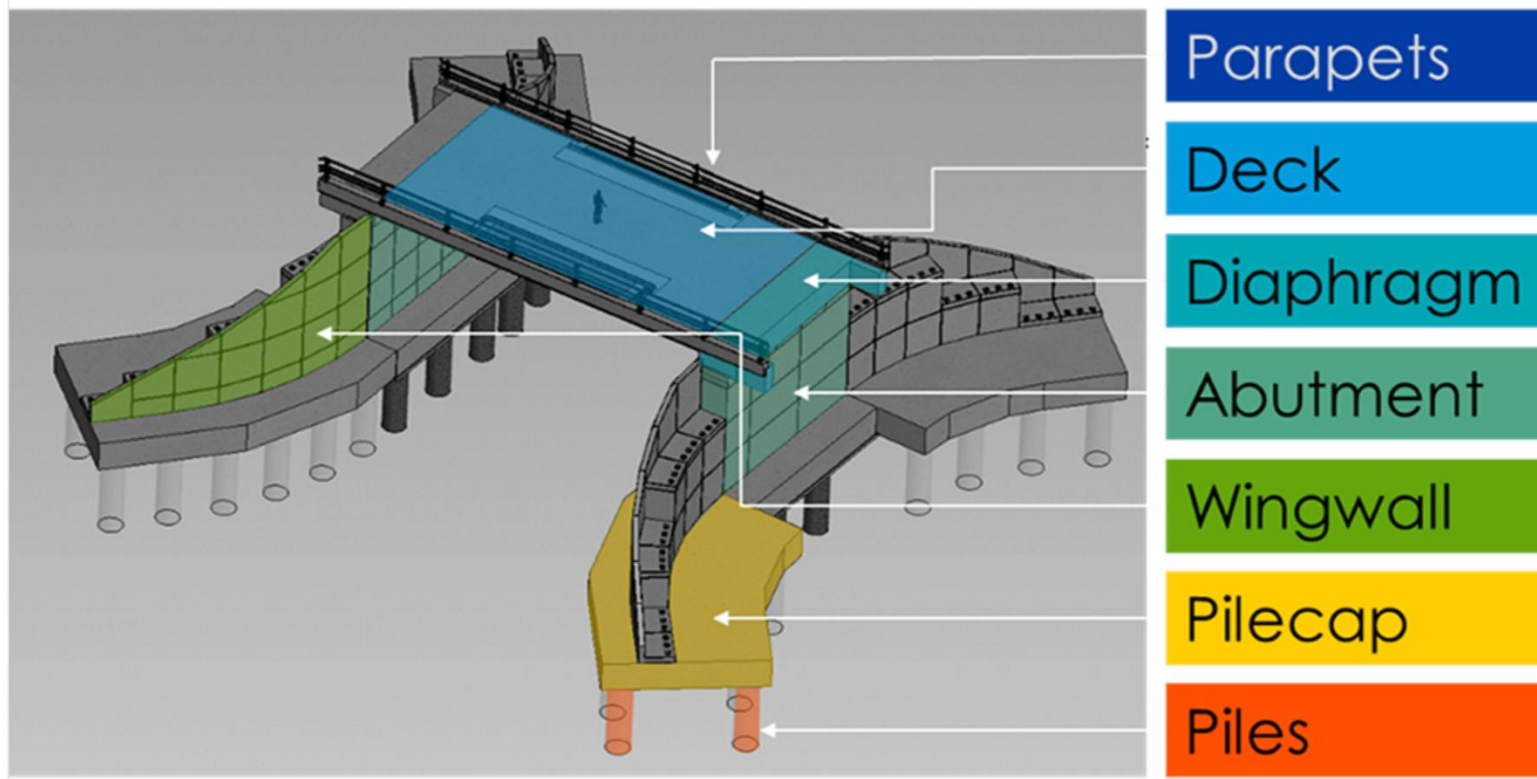
www.bridgethegap.info



5. From Houses to Bridges?

Can we apply this to infrastructure?

LAING O'ROURKE



“Our innovative approach is underpinned by a **digital bridge configurator** and an **engineered kit of parts** that has been developed, tested and refined by our technology and innovation team, working in collaboration with industry and academic partners.

It has the ability to save weeks off a programme, not only that, but our solution requires less resources, and produces a smaller carbon footprint.”

Can we apply this to infrastructure?

LAING O'ROURKE



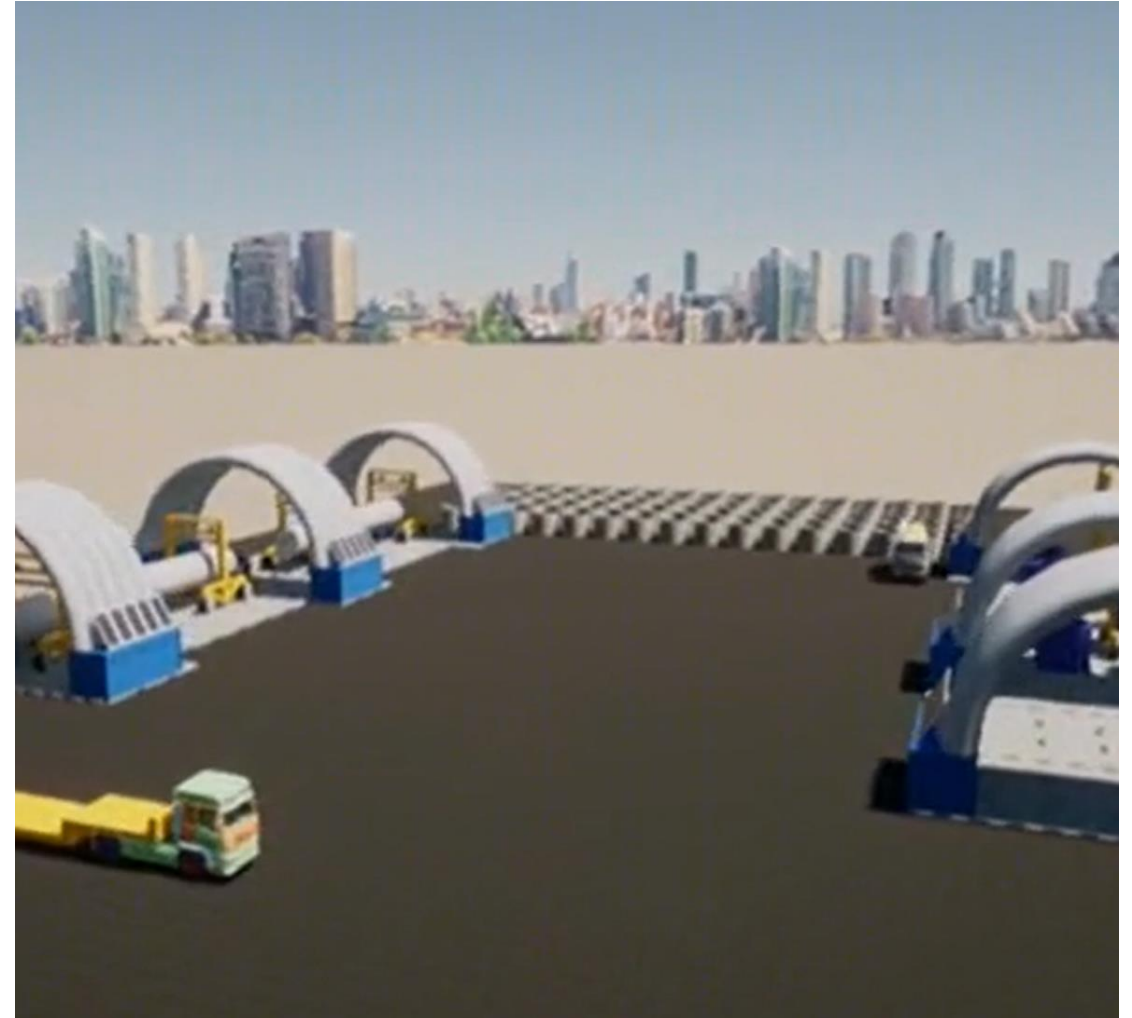
“Our innovative approach is underpinned by a **digital bridge configurator** and an **engineered kit of parts** that has been developed, tested and refined by our technology and innovation team, working in collaboration with industry and academic partners.

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Rethink the Factory Model?



Smart Mobile Factory for Infrastructure Projects



Slide from Tom Brouwer Master Thesis?

Thank You!
Questions?

D.M.Hall@tudelft.nl