



# Expected experience

Changing our view of Data, BIM and Design Make Solutions

Amy Marks  
VP, Enterprise Transformation Practice | Queen of Prefab

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# Amy Marks

VP, Enterprise Transformation Practice, Autodesk  
@Queenofprefab

Thought leader - industrialized construction,  
convergence, sustainability, future of work solutions

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Alumna of Harvard Business School and graduate  
of the University of Florida

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Ambassador of Advancing Prefabrication Conference

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Former Trainer for Mechanical Contractors Association  
of America (MCAA)

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Singapore Govt. Panel of Experts on Construction and  
Productivity



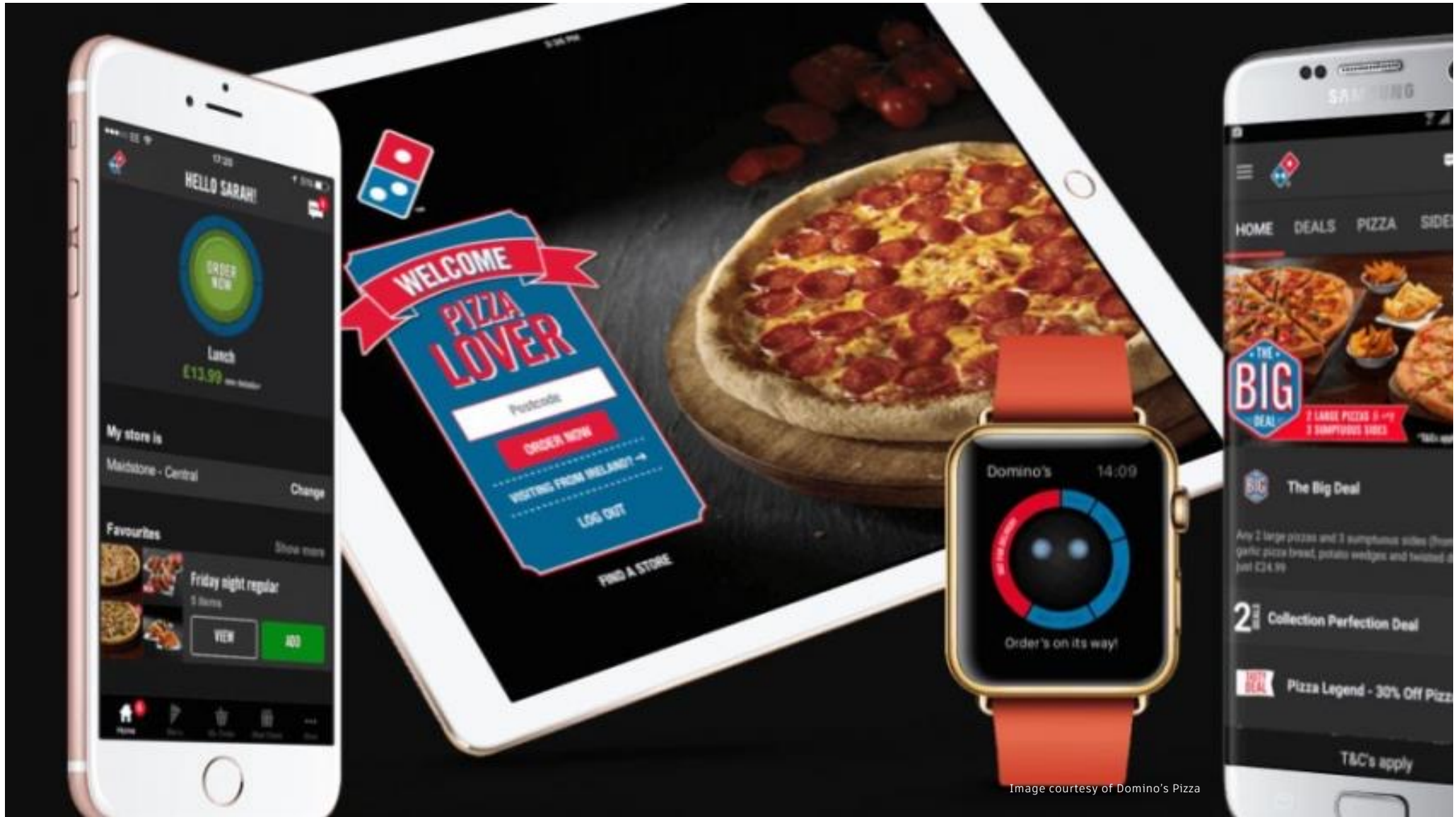
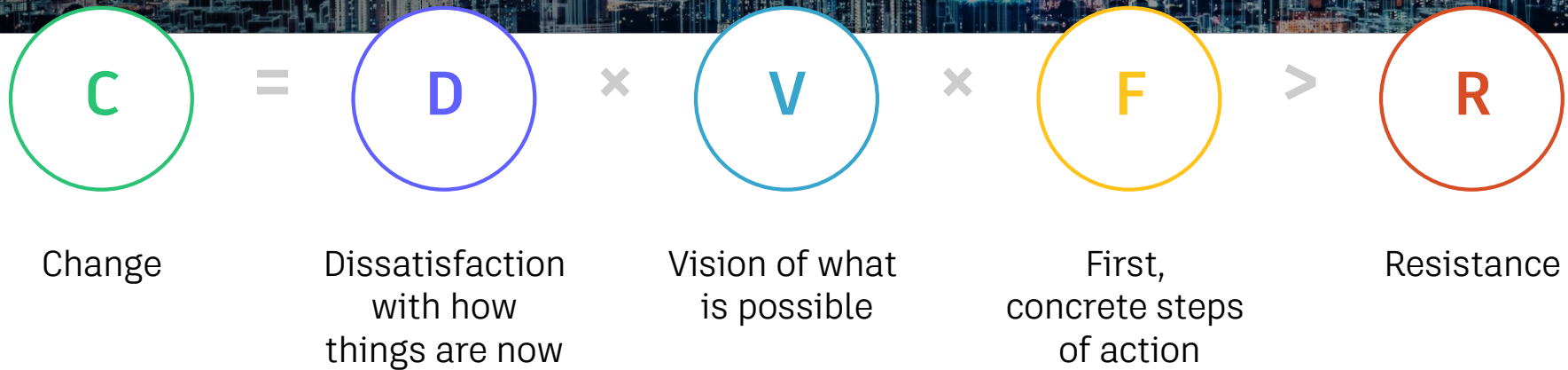


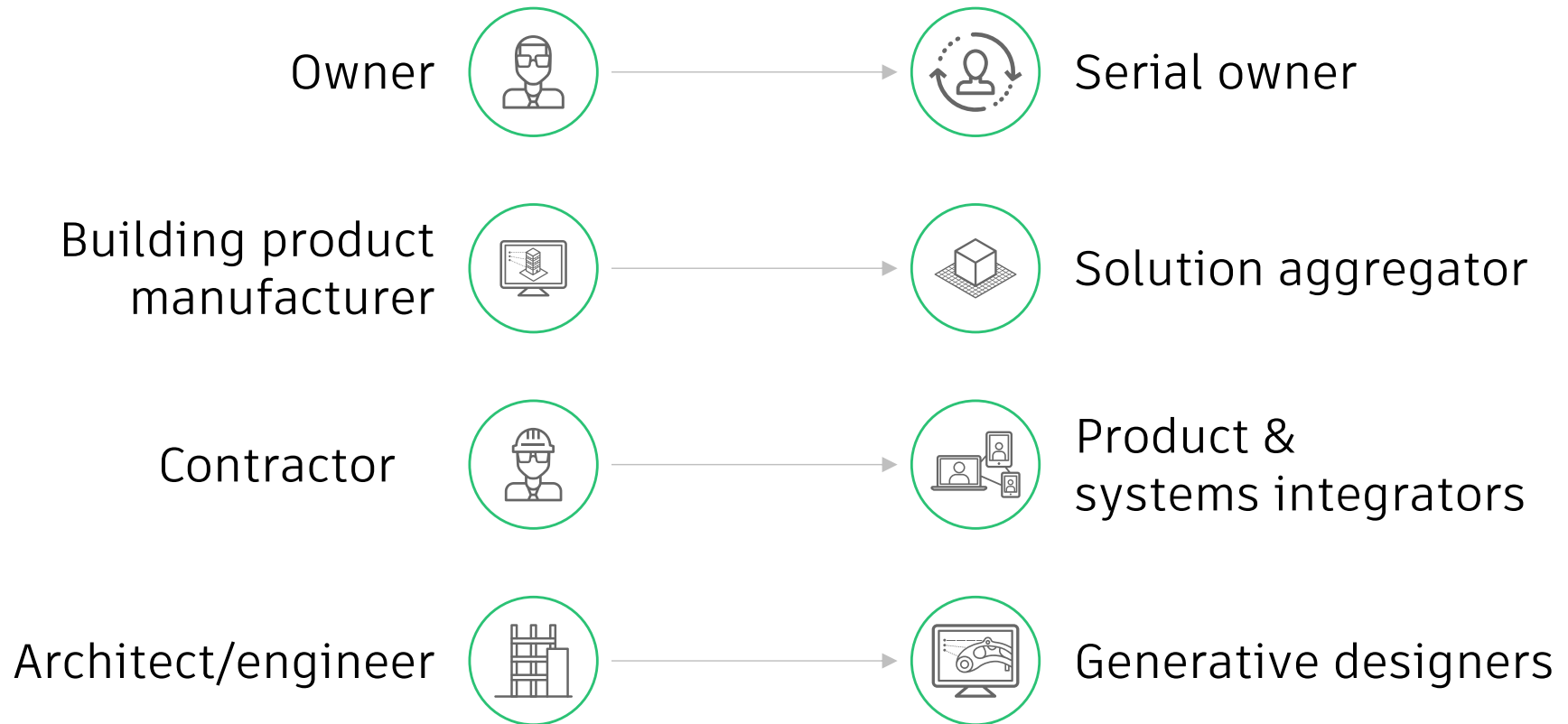
Image courtesy of Domino's Pizza

**What does your  
business want to be  
when it grows up?**

# The formula for change



# Business models are evolving



# Transformation framework



Business strategy for transformation

1

## Foundational

Culture, skills, tools, technology and processes

2

## Productization

Mindset change to drive data reusability

3

## Digitization

Enable automation and connected processes

4

## Connection

Platform thinking, enabled by the cloud

5

## Optimization

Enhanced capabilities (Gen Design, Digital Twins, IC)

6

## Circularity

Digital and physical reuse



Vision, Value Drivers & Outcomes



Certainty



Business Growth



(Holistic) sustainability



Schedule



Risk reduction



Safety & Security



Create better products



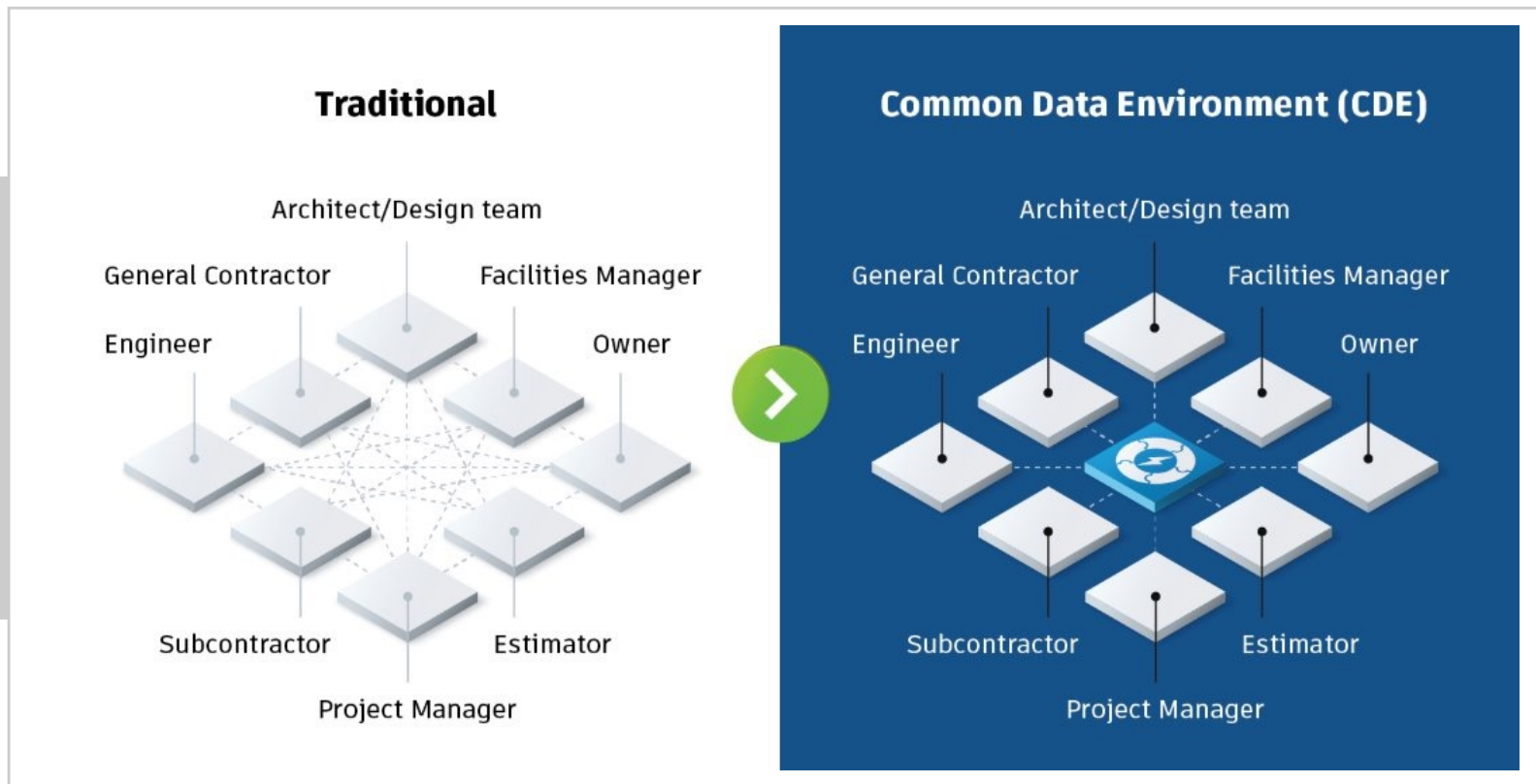
# What if...

- Design-make-operate-inform data is **granular, open and accessible**
- Collaboration is **concurrent** rather than linear
- **Access** to data (the right data) is **seamless**
- Data is **reusable** and improved and informed, **real-time**
- Data **evolves with the lifecycle** of the building or product
- We had a **Modern, Connected** and **Insightful** design environment for AEC-M professionals and owners



# Common Data Environment

Enables a connected project stakeholder ecosystem



# Real time connection

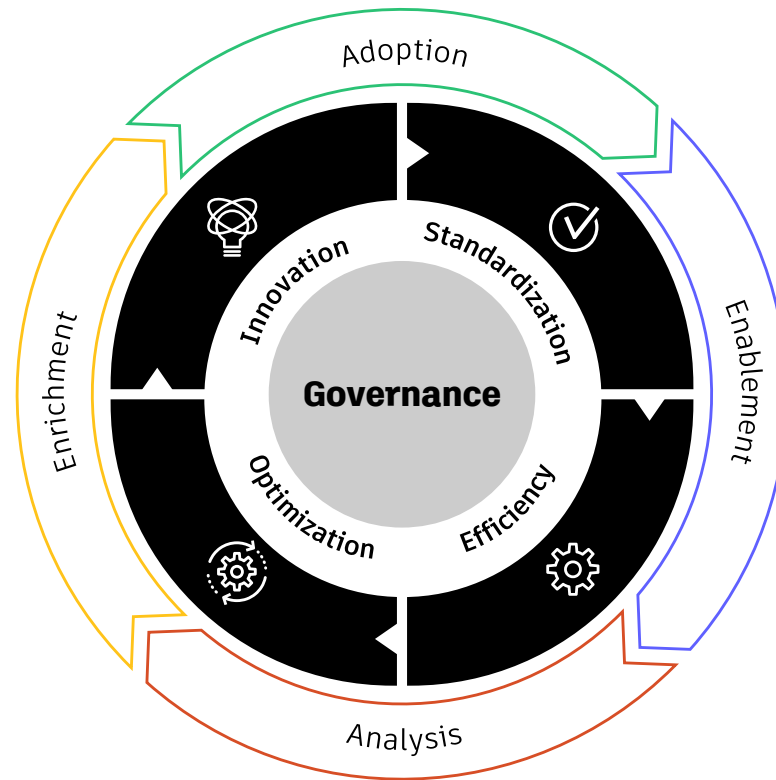


Connected  
teams

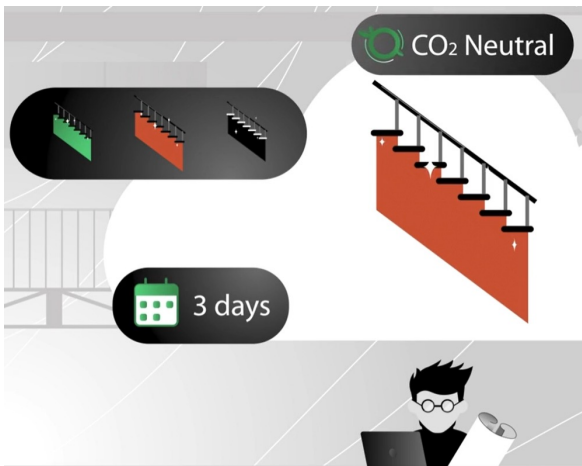
Connected  
processes

Connected  
data

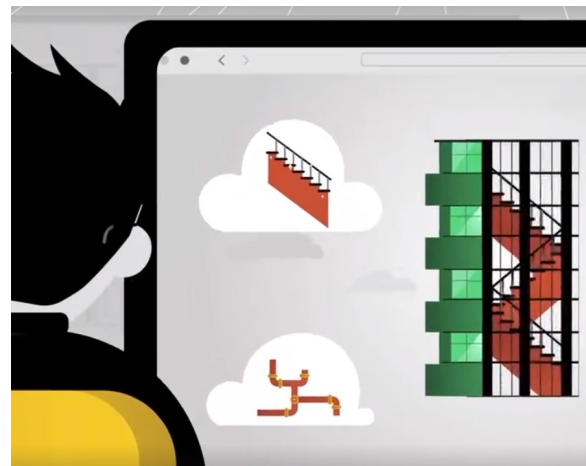
# Data evolution and informed design



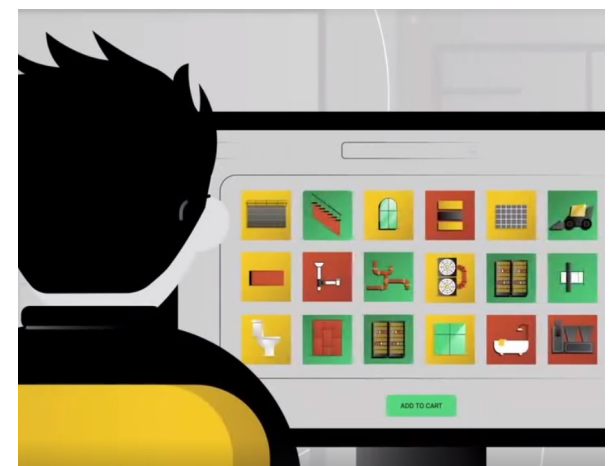
# Product development & design



Product data

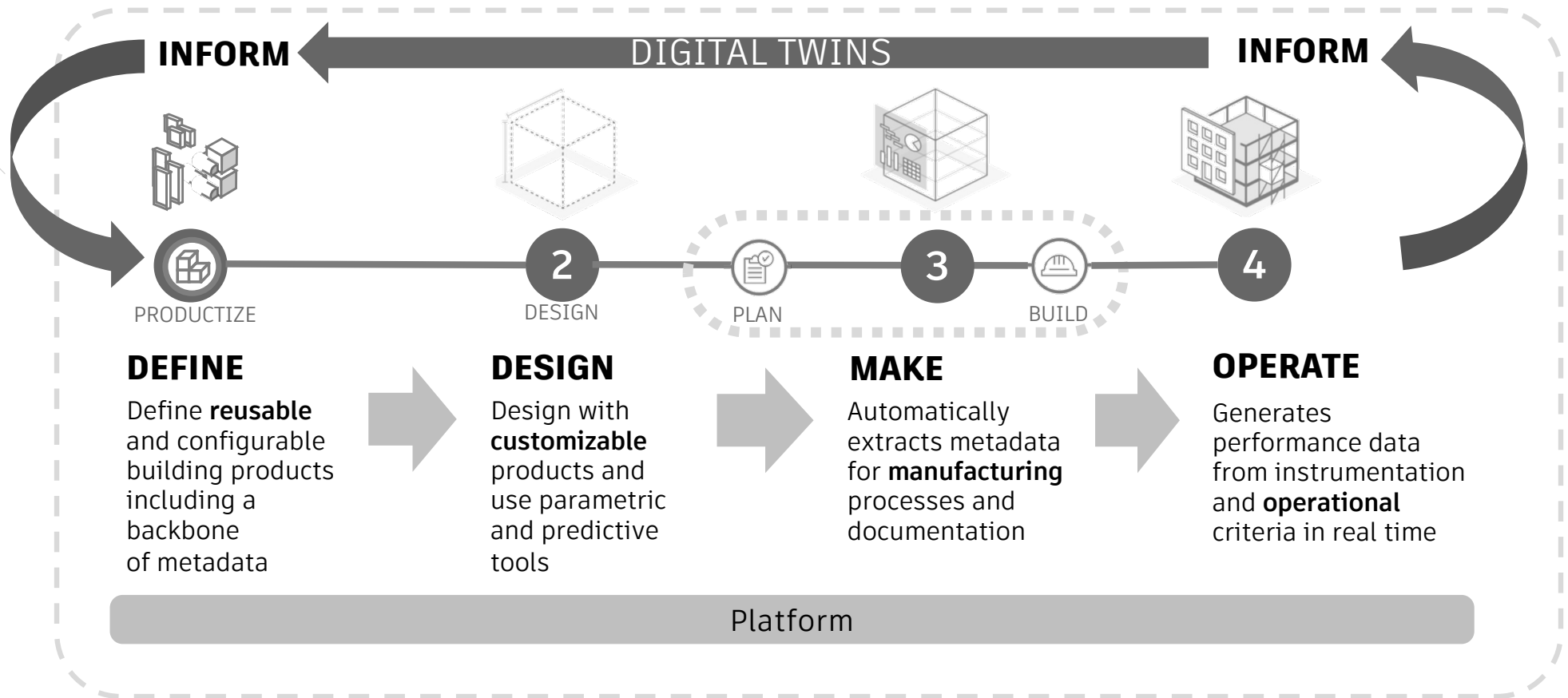


Configure



Reuse

# Informed design



# Manufacturing Informed Design

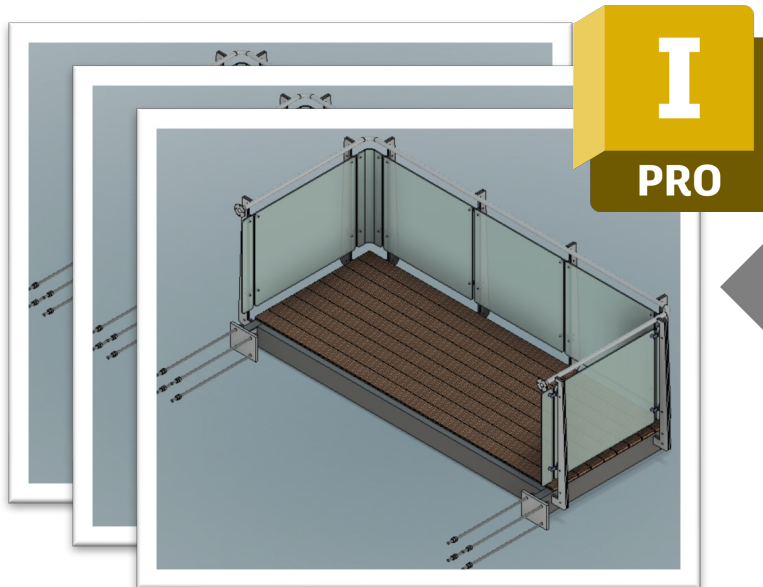
an IC solution to define reusable, customizable, and manufacturable building products; capturing the “make” information



# Connecting design and make

Component-scale data

Defines details to fabricate components



**Execution detail**

Building-scale data

Describes systems of components



**Design intent**







# Industrialized construction

A scalable approach to the built environment that harnesses the power of productized manufacturing and cloud technology to sustainably reinvent the project lifecycle.

# INDUSTRIALIZED CONSTRUCTION DESIGN MAKE



Advanced Building Products



Single Trade Assemblies



Multi Trade Assemblies



Volumetric Modular



Robotics & Automation



Additive Manufacturing

**Productization**

**Products**



**Prefabrication Continuum**



**DATA for  
Manufacturing  
and Assembly**



Predictive Manufacturing Tools



BIM & MID



Cloud & Open Platform



Big Data & Analytics

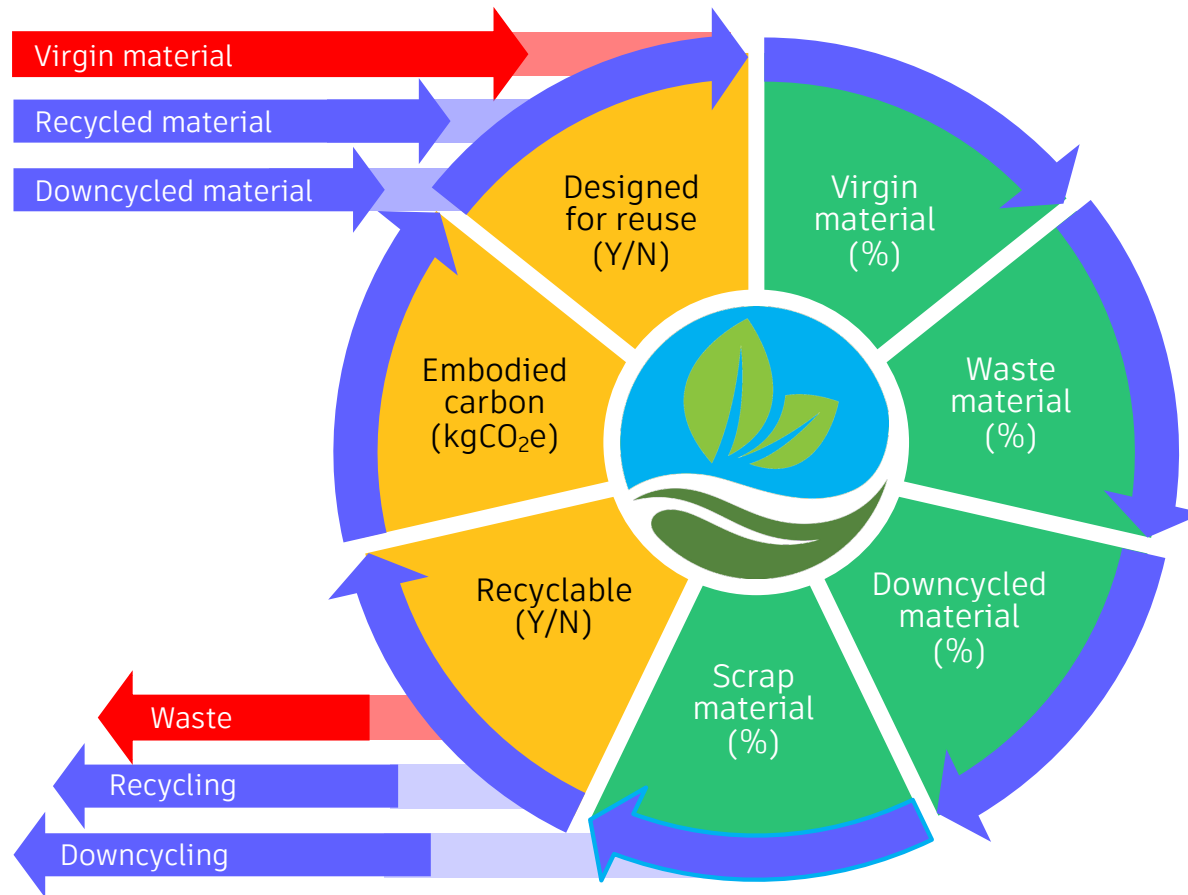


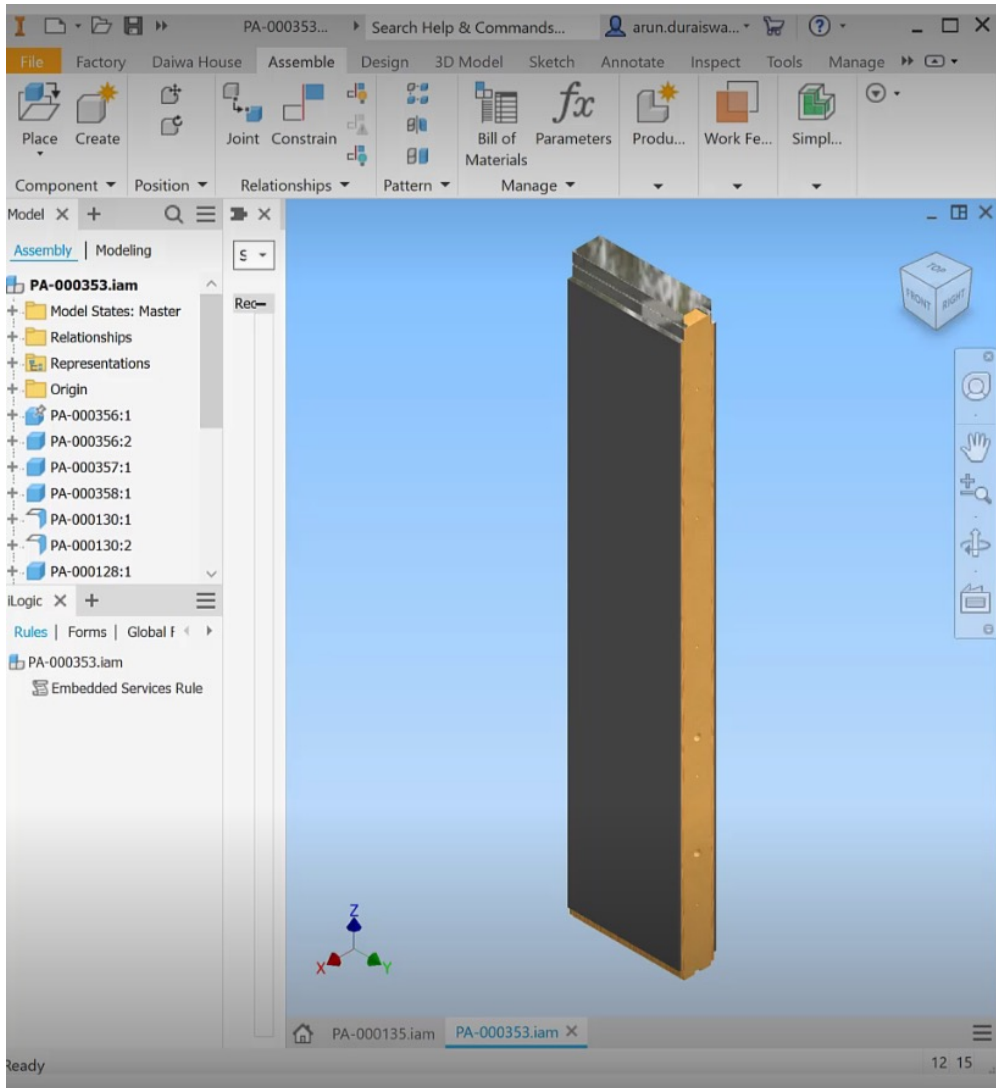
IoT, ML, AI

**PROCESS ENABLERS**

**TECHNOLOGY ENABLERS**

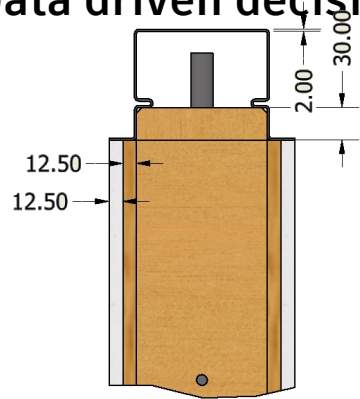
# Material circularity is key to circular economy





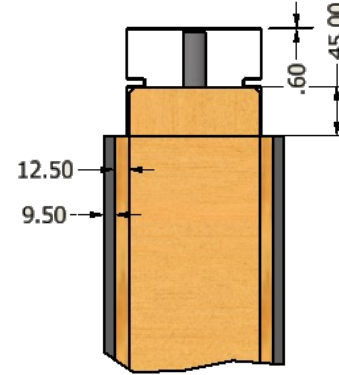
# Embodied Carbon

## Data driven decisions



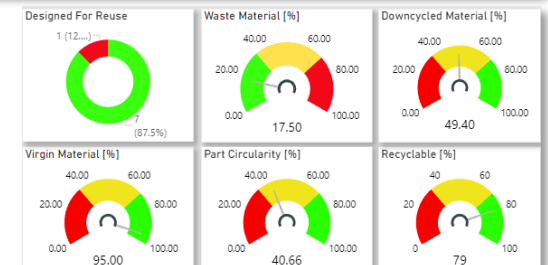
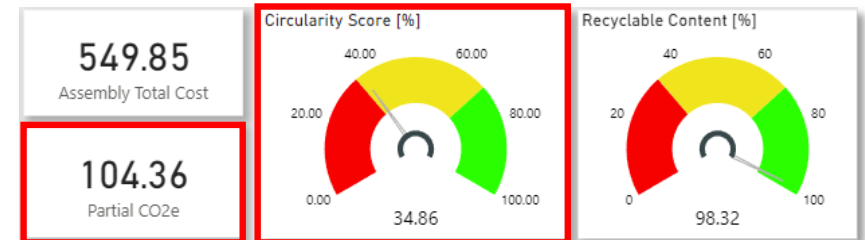
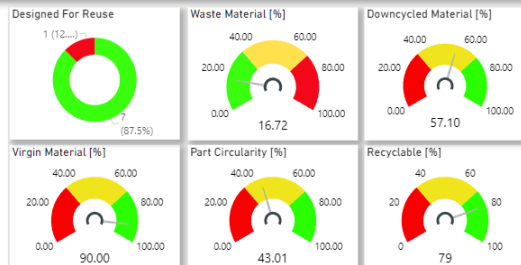
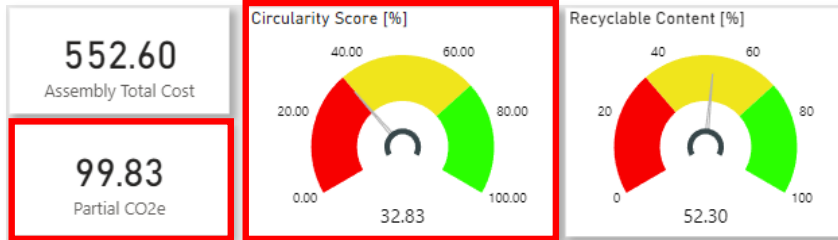
### Baseline Design

- 12.5mm Plyboard
- 12.5mm Plasterboard
- 120 x 30mm Batten
- 2mm Sheet Steel



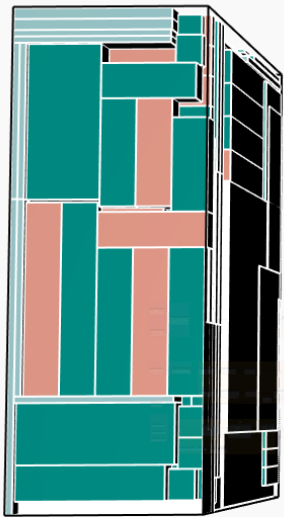
### Optimized Design

- 12.5mm Plyboard
- 9.5mm Fiberboard
- 120 x 40mm Batten
- 0.6mm Sheet Steel



# Embodied Carbon - Transportation

Data driven decisions



**94.73% container used**  
**10% Foundations**  
**61% First Level**  
**24% Second Level**  
**4% Roof**



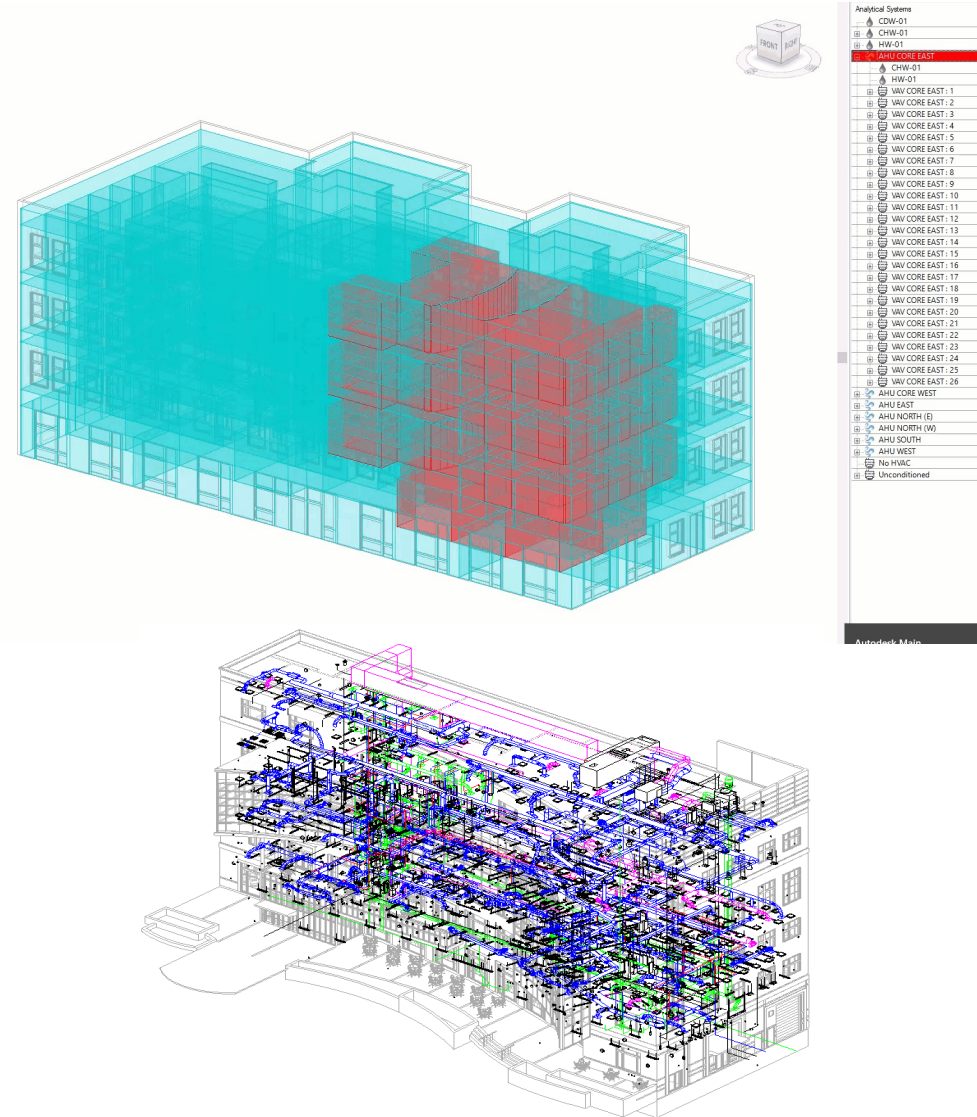
Generative design (Revit + Dynamo) optimize the truck loads to minimize the number of trips

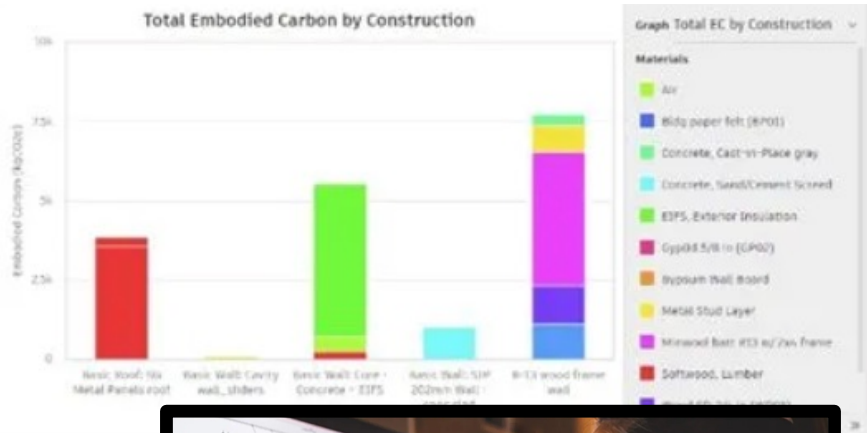
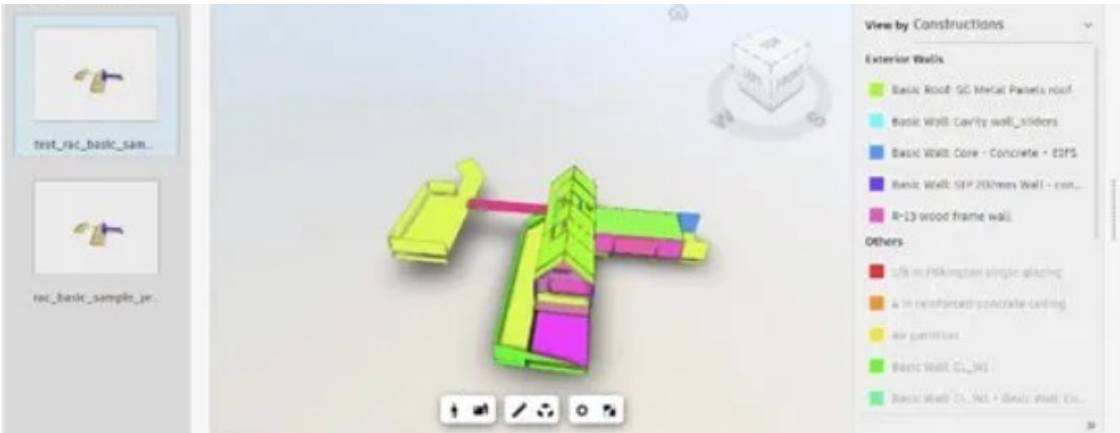
# Energy Models

## Optimizing building systems

Optimize HVAC systems design and modelling

- ⊗ Whole building energy analysis
- ⊗ Early-stage design analysis
- ⊗ Detailed design analysis
- ⊗ Compare cost and performance information across different design options





**Construction Summary**

Construction	Description	Detail Level	Thickness (mm)	Density (kg/m <sup>3</sup> )	Thermal Resist. (m <sup>2</sup> K/W)	Area (m <sup>2</sup> )	Volume (m <sup>3</sup> )	Embodied Carbon (kg/CO2e)	Embodied Carbon (kg/CO2e)	Embodied Carbon (kg/CO2e)
Basic Roof SG Metal Panels ...	Softwood Lumber	Detailed	137.0	495.00	0.0333333	66.53	66.53	1.69	1.69	1.69
	Gypsum Wall Board		12.0	1000.00	0.0164615	66.53	66.53	6.25	6.25	6.25
Basic Wall Cavity wall_slid...		Detailed	260.0	—	—	0.25	0.25	0.25	0.25	0.25
	Metal Stud Layer		20.0	1.20	0.0	0.25	0.25	0.25	0.25	0.25
	Air		20.0	1.20	0.0	0.25	0.25	0.25	0.25	0.25
	Metal Stud Layer		20.0	1.20	0.0	0.25	0.25	0.25	0.25	0.25
Basic Wall Core - Concrete ...		Detailed	254.0	—	—	56.02	56.02	56.02	56.02	56.02
	EPS - Exterior Insulation		40.0	23.00	1.9428571	56.02	56.02	56.02	56.02	56.02
	Concrete, Cast-in-Place gr...		210.0	2300.00	0.007940	56.02	56.02	56.02	56.02	56.02
	Gypsum Wall Board		4.0	1000.00	0.0061538	56.02	56.02	56.02	56.02	56.02
Basic Wall SIP 202mm Wall ...		Detailed	39.0	—	—	134.77	134.77	134.77	134.77	134.77
	Concrete, Sand/Cement Scre...		39.0	2000.00	0.0290325	134.77	134.77	134.77	134.77	134.77
R-13 wood truss wall		Schematic	57.7	—	—	194.21	194.21	194.21	194.21	194.21
	Wood shingle (W501)		17.8	512.84	0.15362	194.21	194.21	194.21	194.21	194.21
	Bitly paper felt (BPOI)		0.0	—	0.03057	194.21	194.21	194.21	194.21	194.21
	Wood S2 3/4 in (W001)		89.0	512.84	0.15701	194.21	194.21	194.21	194.21	194.21
	Mixedwood Batt R13 w/ 2x4 T...		0.0	—	1.8256	194.21	194.21	194.21	194.21	194.21
<b>Constructions Total</b>						<b>422.38</b>	<b>34.49</b>	<b>43362.86</b>	<b>18178.20</b>	<b>18178.20</b>



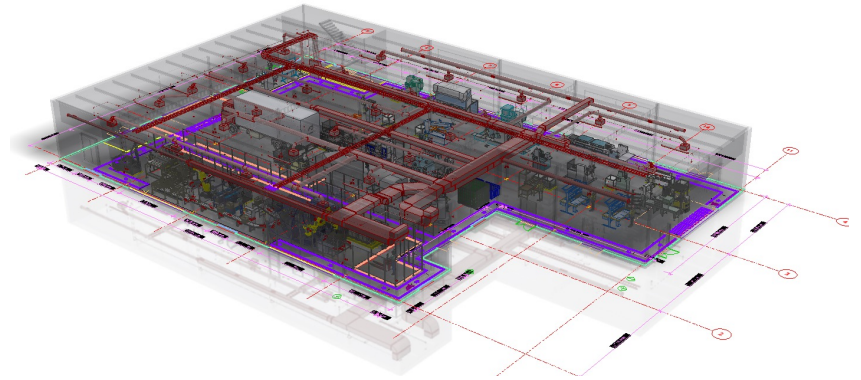
A new dashboard interface allows you to preview and evaluate wall construction to gain insights on the embodied carbon of construction materials.



**Factory Owners receive this...**

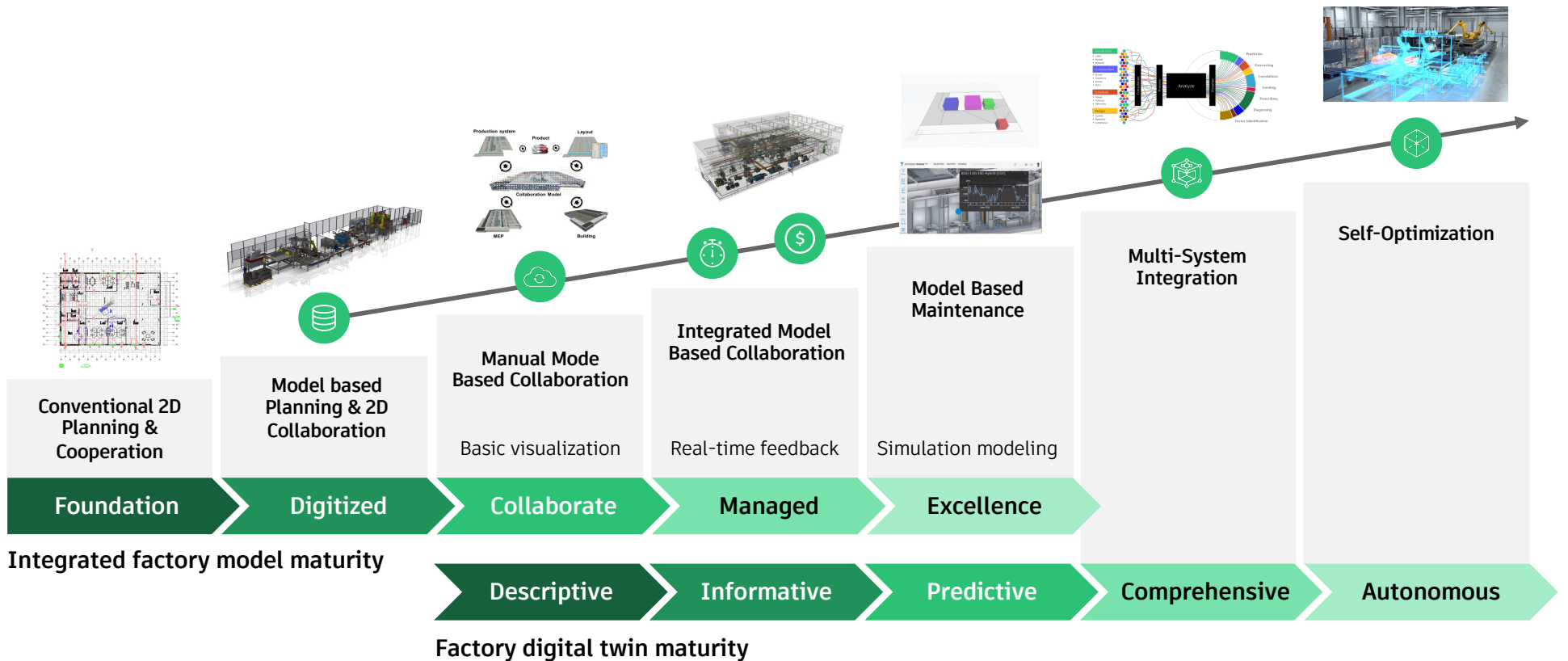


**...when they need this!**



# IFM to factory digital twin

## Maturity model



**No one ring to rule  
them all**



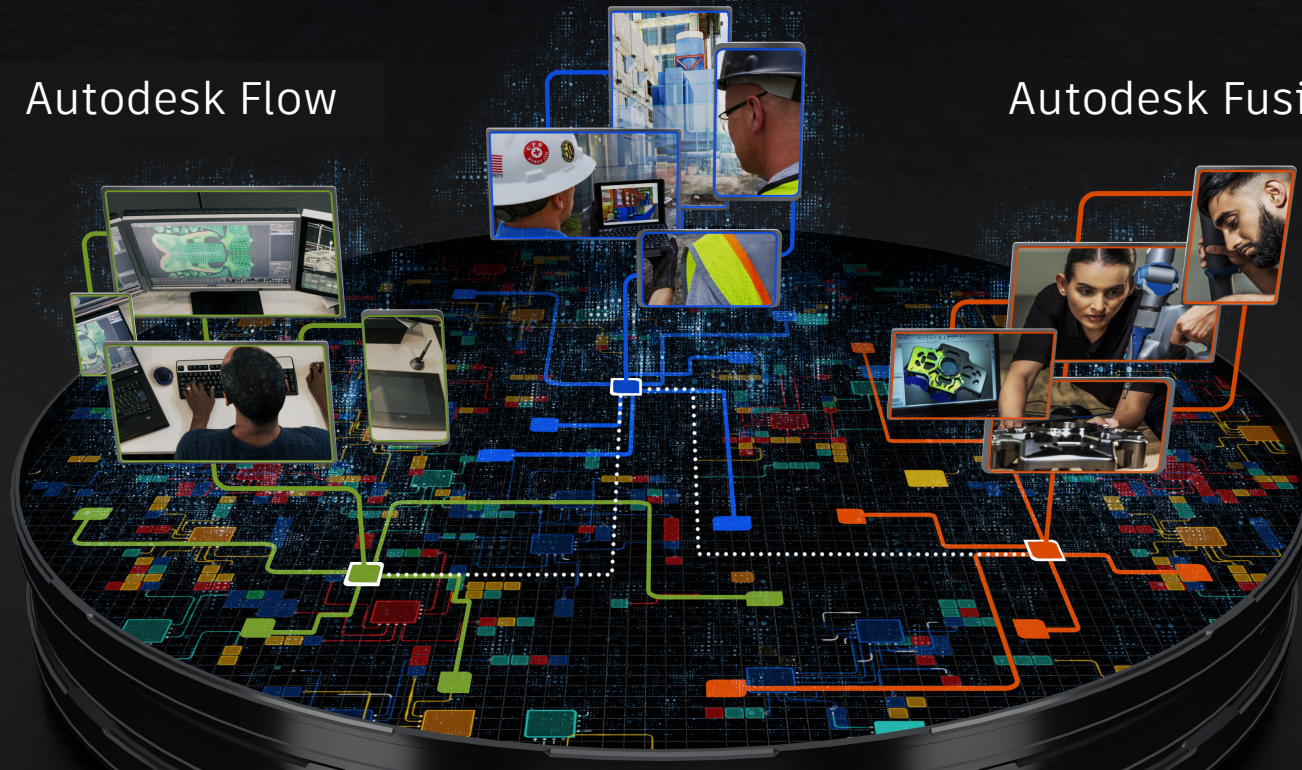
Platform

Image: Unsplash

Autodesk Forma

Autodesk Flow

Autodesk Fusion



Autodesk Platform  
Services

# Growing platform ecosystem



**First concrete steps  
of action**

“I know where I need to go, but I’m not sure the best way to get there”

-Every customer ever

Autodesk  
Customer Success

Current State

Future State





# A framework for outcomes

Executives

## Value driver

A business pressure or aspiration



## Outcome

A measurable change in order to improve business performance



## Solution

A selection of products and services driving specific outcomes and capabilities



## Capability

A combination of skills & tools involved in a critical business process.



## Workflow

The recommended industry process and underpinning technology enabling capabilities



## Product

A specific technology or service that enables a workflow



End Users

# Solutions are complex

## Definition



A selection of products and services driving specific outcomes, capabilities & behaviors



(layers) systems architecture, capabilities, workflows, integrations, interconnections of the platform ecosystem and software products and services



# Solutions enable complex outcomes

## Terms and examples

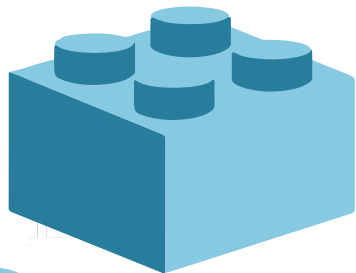
**Software Products** - Revit, Build, Factory Design Utilities, Inventor, Navisworks, AutoCAD, Vault, Pro-Model, etc.

**Workflows** - Model Coordination, Operations Layout, Design Review, Design Visualization...+

**Tools** - APS apps, custom apps, Cintoo

**Solutions** - *Integrated Factory Modeling (IFM)*

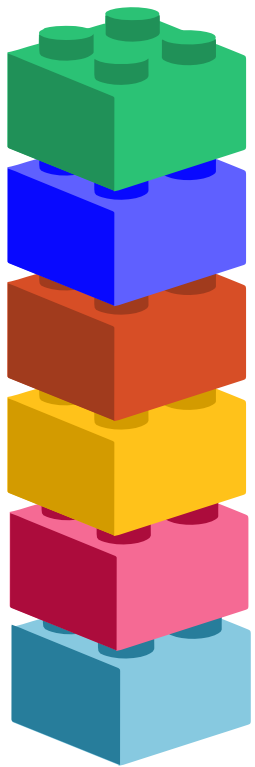
**Solution Sets** - Factory of the Future, Industrialized Construction, ...+



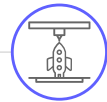
**Integrated  
Factory Modeling**

# Complex solutions

Building blocks that configure to different business outcomes



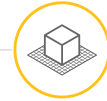
Common data environment (CDE)



Product development



Process simulation



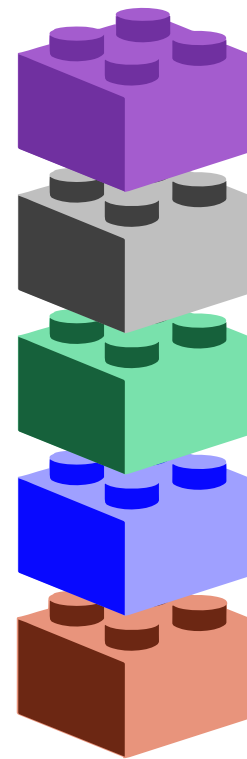
Informed design



Connected construction



Integrated factory modeling



Operations monitoring



Digital twins



Embodied carbon



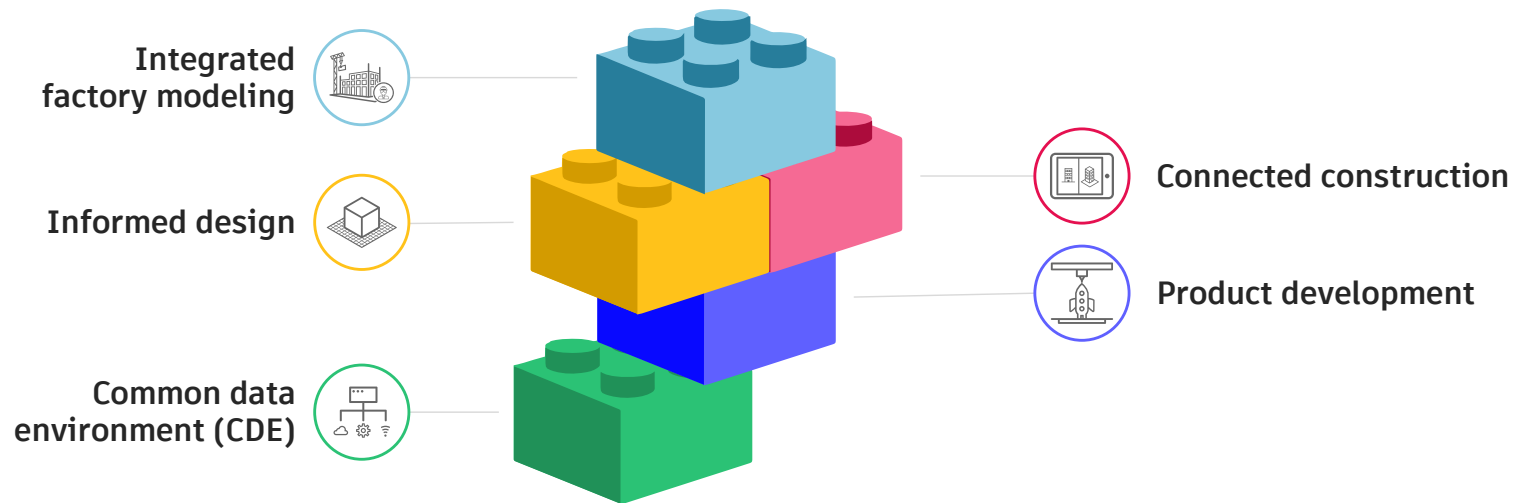
Material circularity



Energy analysis

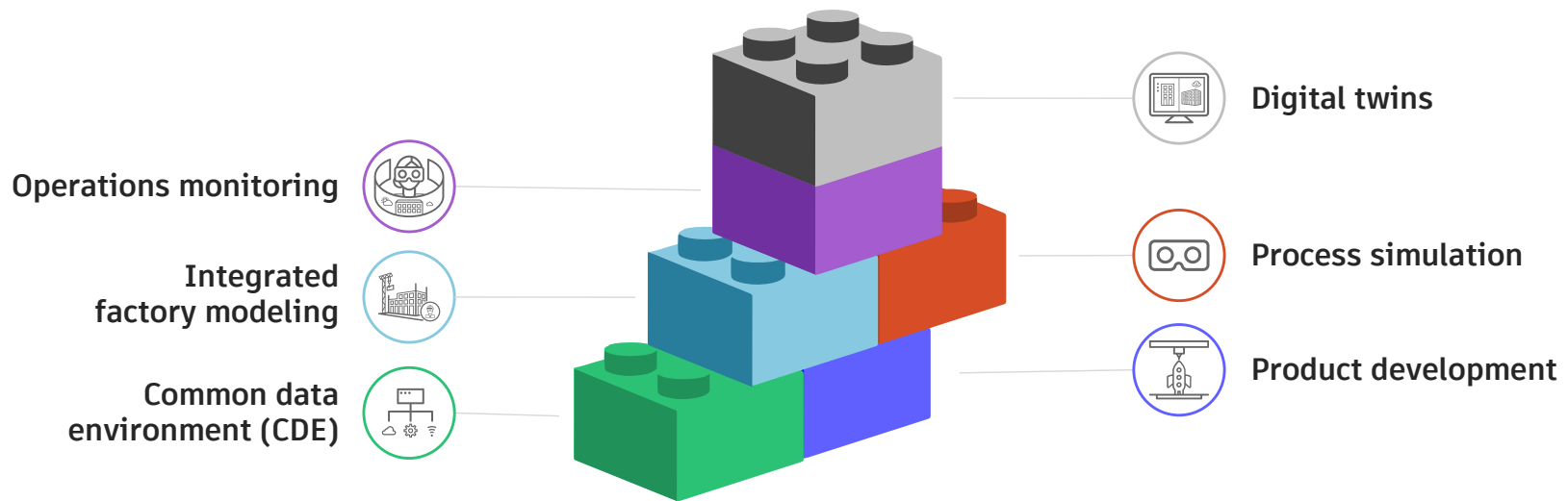
# Industrialized construction

MEP (services) fabricator to product and systems integrator



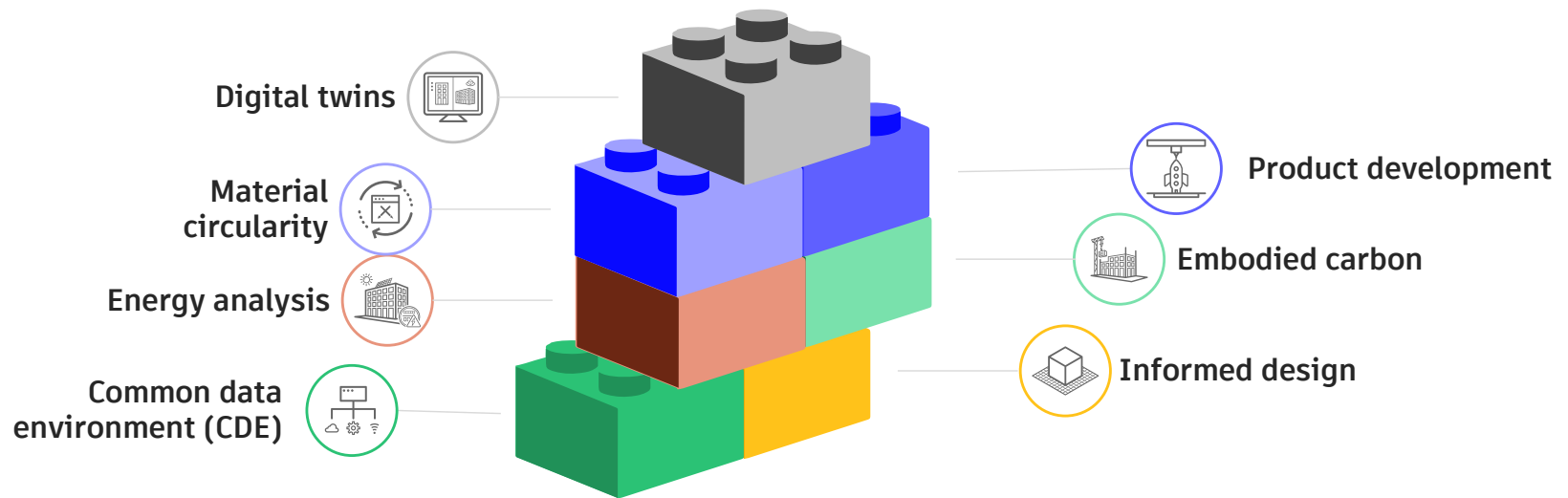
# Factory of the future

Building product manufacturer to solution aggregator



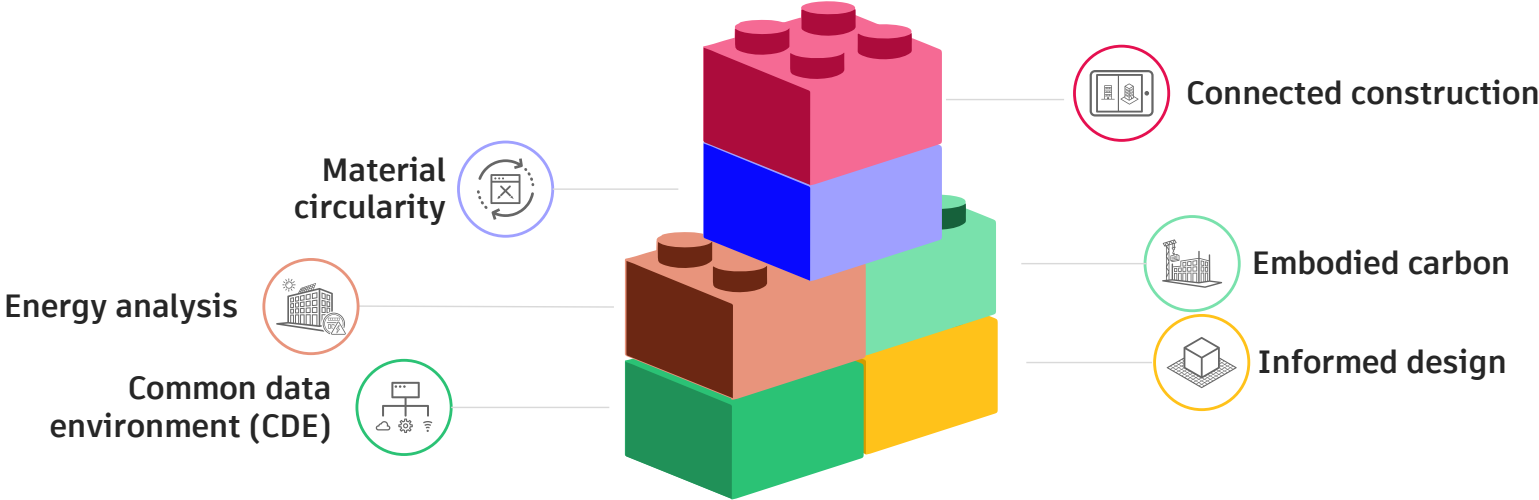
# Predictive operations decisions

Owner to a serial owner



# Outcome driven design

Architect to generative designer





**Some BIG  
announcements**

## Industrialized Construction for the Built Environment

This course explores the megatrends transforming project design, building, and operations and the new business models required to support them.



### Introduction to Industrialized Construction

This module introduces the megatrends shaping Industrialized Construction for the built environment lifecycle.

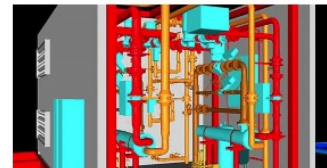
➔ Download updated module assets



### Productization, DfMA, and Sustainability

See how the shift towards productization is necessary for Industrialized Construction to reduce waste and scale construction more sustainably.

➔ Download updated module assets



### Rise of MEP Assembly

Learn about MEP innovation in prefab processes and an integrated multi-trade approach to applied manufacturing techniques.

➔ Download module assets



### Applying the Transformation Framework

Explore the transformation framework's six stages and its resulting outcomes, strategy, and final state.

➔ Download updated module assets



### Convergence of Technology, Process, and Business Models

Learn how convergence promotes multidisciplinary collaboration by creating value through digital and physical strategies.

➔ Download module assets



### Machine Learning, AI, and Advanced Construction Technologies

Learn how a data-driven approach brings context to digital and physical strategies to support advanced building methodologies.

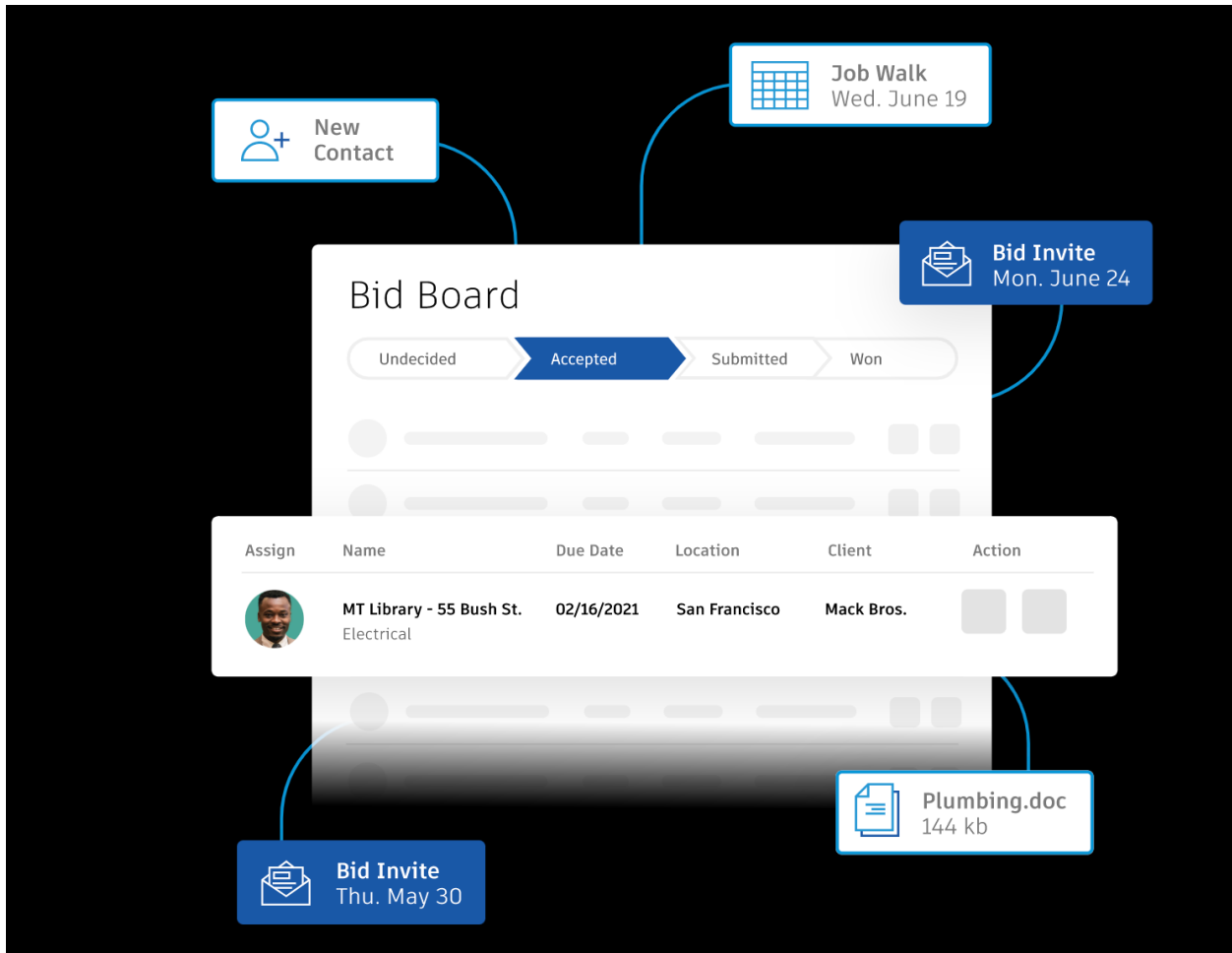
➔ Download module assets





### Future of Work in Industrialized Construction

Explore the interdisciplinary skills and roles required to support future integration of automation, robotics, and productization.

➔ Download module assets



The screenshot displays the 'Bid Board' interface. At the top, there is a progress bar with four stages: 'Undecided', 'Accepted' (highlighted in blue), 'Submitted', and 'Won'. Below this, a table lists bid items. A callout box labeled 'New Contact' points to a person icon. Another callout labeled 'Job Walk Wed. June 19' points to a calendar icon. A callout labeled 'Bid Invite Mon. June 24' points to an envelope icon. A callout labeled 'Plumbing.doc 144 kb' points to a document icon. A callout labeled 'Bid Invite Thu. May 30' points to another envelope icon.

Assign	Name	Due Date	Location	Client	Action
	MT Library - 55 Bush St. Electrical	02/16/2021	San Francisco	Mack Bros.	

### Bid Board Pro

See where everything stands—and win more bids.

### TradeTapp

Accurately qualify more subs in less time and mitigate risk.

### BCPro

Win more work by finding subcontractors on the largest precon network.

# Building connected



**BUILDINGCONNECTED**  
AN AUTODESK COMPANY

## Division industrialized construction products

- Bathroom pods
- Prefab MEP Underground /structural deck assemblies
- Single-trade electrical assemblies
- Process piping assembly/skids
- Modular mezzanines
- Structural insulated panels
- Pre-finished drywall shapes/assemblies
- Prefab kitchens
- Prefab elevators
- Prefab electrical rooms/skids/panels
- Prefab plenum & duct work assemblies
- Prefab balconies
- Panelized exterior skin
- Modular closets/casework
- Multi-trade MEP distribution racks/risers
- Prefab operating room ceilings
- Prefab EV charging station
- Pump skid
- Prefab structural steel assemblies
- Prefab floor/roof cassettes
- Pre-assembled MEP support systems
- Medical headwalls
- Single-trade plumbing assemblies
- Prefab stairs
- Pre-assembled concrete block-out systems
- Prefab interior wall systems

## Division industrialized construction building types

- Modular/prefab multi-story housing
- Modular/prefab student housing
- Modular/prefab edge data centers
- Modular/prefab central utility plant
- Modular/prefab food processing
- Modular/prefab hotel rooms
- Modular/prefab hospital rooms
- Modular/prefab data centers
- Modular/prefab clean rooms
- Modular/prefab disaster relief buildings
- Modular/prefab office buildings
- Modular tertiary medical building (MRI/Proton/etc.)
- Modular cable landing stations
- Modular cryptocurrency units
- Modular/prefab guard shack
- Modular/prefab educational buildings
- Modular/prefab healthcare clinics
- Modular/prefab hardened/secure/SCIF buildings
- Modular/prefab pharmaceutical processing
- Temporary modular/prefab buildings

## Division industrialized construction services

- Multi-trade prefab design & engineering
- Plumbing prefab design & engineering
- Precast design & engineering
- Industrialized construction maturity assessment
- Electrical prefab design & engineering
- Process piping prefab design & engineering
- Mass engineered timber/wood design & engineering
- Industrialized construction education
- Mechanical prefab design & engineering
- Structural prefab design & engineering
- IC/DfMA architecture/design
- HVAC Prefab design & engineering
- Concrete 3D printing design & engineering
- DfMA Consulting

# Industrialized Construction Maturity Assessment (ICMA)

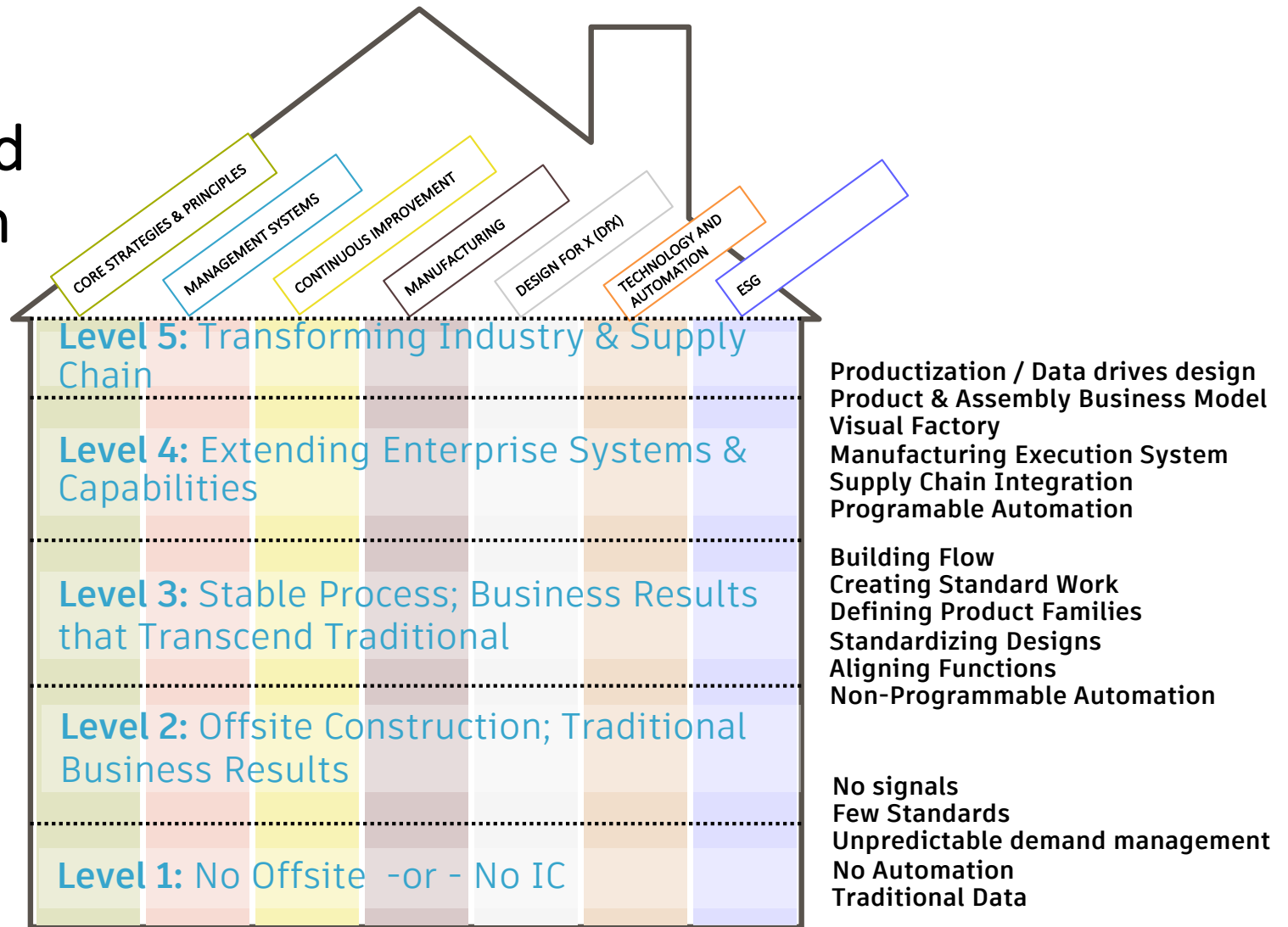
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**HALEY  
ALDRICH**

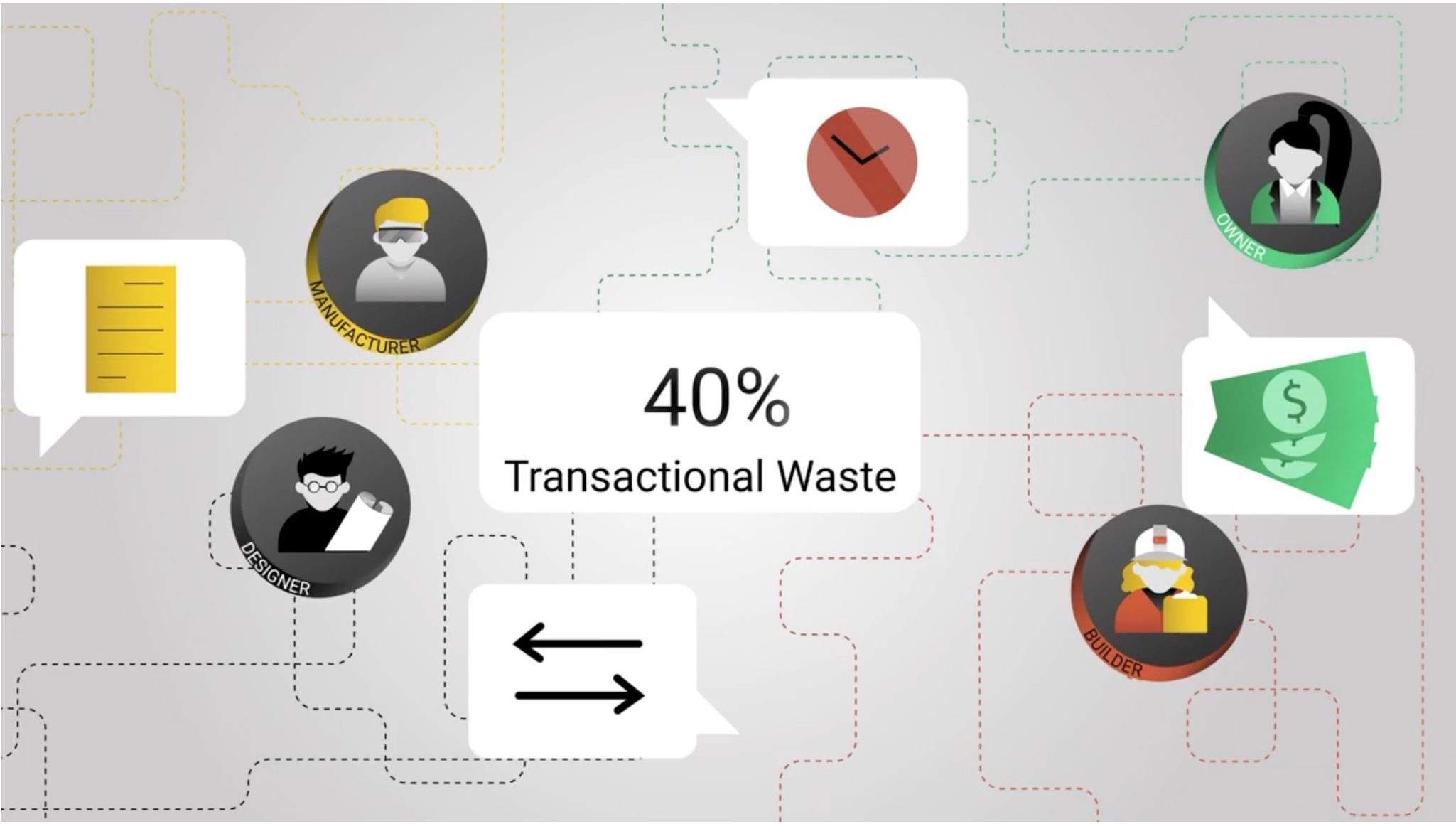


# Industrialized Construction Maturity Assessment

Assessing  
75 Specific  
Attributes of  
Maturity



**Why we must work  
together...**





40% Construction Waste

TRASH



# Amy Marks

VP, Enterprise Transformation Practice

- Queen of Prefab streaming series 9M+ views
- Alumna of Harvard Business School and a graduate of the UF
- Ambassador of Advancing Prefabrication Conference
- Catch me on YouTube, LinkedIn, Instagram, Twitter, TikTok, Facebook



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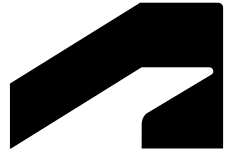


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# Questions & answers

