DIGITAL TRANSFORMATION OF THE AECO* INDUSTRY

#BUILDTECH #PROPTECH #DESIGN4.0

*Architects Engineers Contractors Owners
1. What has changed with technology?

2. What is #digital_transformation in AEC?

3. Our Journey

4. How can we collectively help?
what has changed with technology?
Technology adoption

Years until used by one-quarter of American population

- Electricity (46)
  - 1873

- Telephone (35)
  - 1876

- Radio (31)
  - 1897

- Television (26)
  - 1926

- PC (16)
  - 1975

- Mobile phone (13)
  - 1983

- The web (7)
  - 1991

First commercially available year

Source: Singularity.com
Economist.com/graphicdetail
digital clockspeed in 1 minute…
4th Industrial Revolution is powered by Moore’s law

1.0 1784 based on mechanical production equipment driven by water and steam power

2.0 1870 based on mass production enabled by the division of labor and the use of electrical energy

3.0 1969 based on the use of electronics and IT to further automate production

4.0 tomorrow based on the use of cyber-physical systems

the number of transistors in a dense integrated circuit doubles approximately every two years

Gordon Moore – co-Founder Intel - 1965
We don't understand exponential
1966 : Science fiction

2017 : Billion of Users (2.32)
does this apply to construction?
Building Industry is Inefficient

Unlearning by doing
United States, gross value-added*
Per hour worked, 1947=100

- 50% (in)efficiency & 100% unpredictability

50%

Source: BuildingSMART Alliance

10% Recounting, remeasuring, overestimating
15% Rework, avoidable collisions between trades
10% Poor or late planning
12% Material inefficiencies, overproduction
10% Labour inefficiencies, information treasure hunts

70% Delivered Late
73% Over Budget

Source: McKinsey Global Institute *At constant prices

Economist.com
The construction industry is a prime candidate for a complete transformation
What is Digital Transformation?
WHAT IS DIGITAL TRANSFORMATION

© Cogital AECO Digital Transformation Framework
© MIT Sloan: Digital Transformation Framework
What is Digital Transformation

Where you innovate and what strategy you follow matters

Are you only Digitising?
Are you Ambitious?

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Our Journey:
What is happening at BuroHappold?
What happened when we introduced BIM?
MOVE FROM TACTILE INTERACTION...
...TO DIGITAL INTERACTION
What happened when we Digitized?
“A computer on every desk and in every home.”

Bill Gates, 1980
FULL DOCUMENTATION IN BIM
MODEL INTEROPERABILITY TO IES AND ANSYS
COMPLETE MEP SYSTEMS IN BIM

Joined MEP Model
Smart Systems
Electrical Circuits and Panels
Calculated Duct Flow
Plumbing Fixture Counts
SMART SYSTEMS FOR CALCULATED DUCT FLOW

Design check tool rather than just a drafting tool

Checks flow, velocity, static pressure, and pressure loss
INTEGRATED DATA FLOWS
FULLY INTEGRATED BIM MODEL
What happened when we **Leveraged**?
Delivery BIM

Design Analysis
Delivery
BIM

Design Analysis
Delivery
BIM

Design
Analysis
Integrated Digital Workflows
Museum of the Future - 2017
LEAD CONSULTANCY
BIM – And Beyond
FULL ALGORITHMIC GEOMETRY GENERATION
FULL COMPUTATIONAL DESIGN

- COMPLEX GEOMETRY
- DRAWING PRODUCTION
- DATA PLOTTING
- ANALYSIS MODEL GENERATION
- DESIGN EXPLORATION
- HAND CALCULATION VERIFICATION
BIM – Advanced Analytics

- CFD Smoke Modelling
- Fire Systems Integration with MEP Design
- Evacuation Modelling

RESULTS SUMMARY

- Full Building Evac: 15 mins
- Last Floor cleared: 7 mins 40 secs
What happens when we Transform?
DATA DRIVES DECISION MAKING
POOR PREDICTABILITY OF OUTCOMES...

Often too late to know the outcomes... which means costly operational fixes.
IF ONLY...!

If we were able to use these insights and predict these outcomes early stage into design. Testing, optioneering, optimising which sketching... before the key decisions are locked in!
Imagine...

If you had a **fingers on the pulse** of your property / portfolio...
FROM CATCHMENT AREA TO IN-STORE LAYOUTS

Using tweep maps, tripadvisor and anonymised phone data to map Journey patterns, catchment areas, and seasonal variations.
Imagine...

...and If you could use the insights to predictively model human behaviour.

Test scenarios/ideas/options... on the fly... over a sketch...
From Data to Decisions
Imagine...

...or keep an eye on a properties portfolio and test new scenarios...
Measuring, mapping and enhancing campus experience

Shadows 23 July 07:00
- Hour
- Day
- Month

Back to overview

Home  About  Contact
Measuring the success

Economics

Energy

Experience

$ CO₂ 😊
Integrated, Data Driven, Outcome Based

\[
\text{$$ Value = View + Access + Daylight + Noise + Energy + Access + Air Quality + ...} \]

Rapid prototyping, optioneering and design exploration
Imagine...

If could push *home advantage* further for your favourite team...
DATA DRIVES DECISION MAKING
APPLYING MACHINE LEARNING
STADIUM DESIGN – SAFE STANDING

Turning raw data

Into actionable insights
STADIUM DESIGN: HOME ADVANTAGE

Germany 1 - 1 Italy
33:42

Ball Handling
- 0 Saved
- 5 Shots on Goal
- 278 / 302 Successful Passes / Total Passes

Pass Completion
- 92.1%

Ball Handling
- 1 Saved
- 6 Shots on Goal
- 181 / 200 Successful Passes / Total Passes

Pass Completion
- 90.5%
HOME ADVANTAGE
BHoM_ENGIN - OUR TOOLS
ACOUSTIC ANALYSIS

Sound pressure level
Direct rays (0°, ±5°, ±10°)
Image Source model up to 3 order reflections:
1°, ±0°, ±5°

Direct Rays
Reflected Rays
How can we collectively help?
Focusing on two key ideas
1. Common understanding
Trigger: **BIM** is the medium to digitise our industry

Business as Usual: **BIM Level 2** invites us to leverage the new #digital medium

Innovation: **#data** is the fuel to transform our industry
BIM IS THE DIGITAL MEDIUM THAT ALLOWS US TO DIGITISE THE AECO INDUSTRY

To **rethink** our approach to the use of data

To **innovate** and **reshape** the project space

To **transform** our industry
In other words....
BIM is not the thing....

...BIM is what gets us to the Thing!
2. Work collectively
GENUINE
CO-CREATION
CONTRIBUTE...
CONTRIBUTE...
BHoM.
Sustainable Code at Scale
MASS PARTICIPATION IN INTRODUCING 100% DIGITAL LITERACY
FORM
FOLLOWS
DATA
DATA DRIVES OUTCOMES