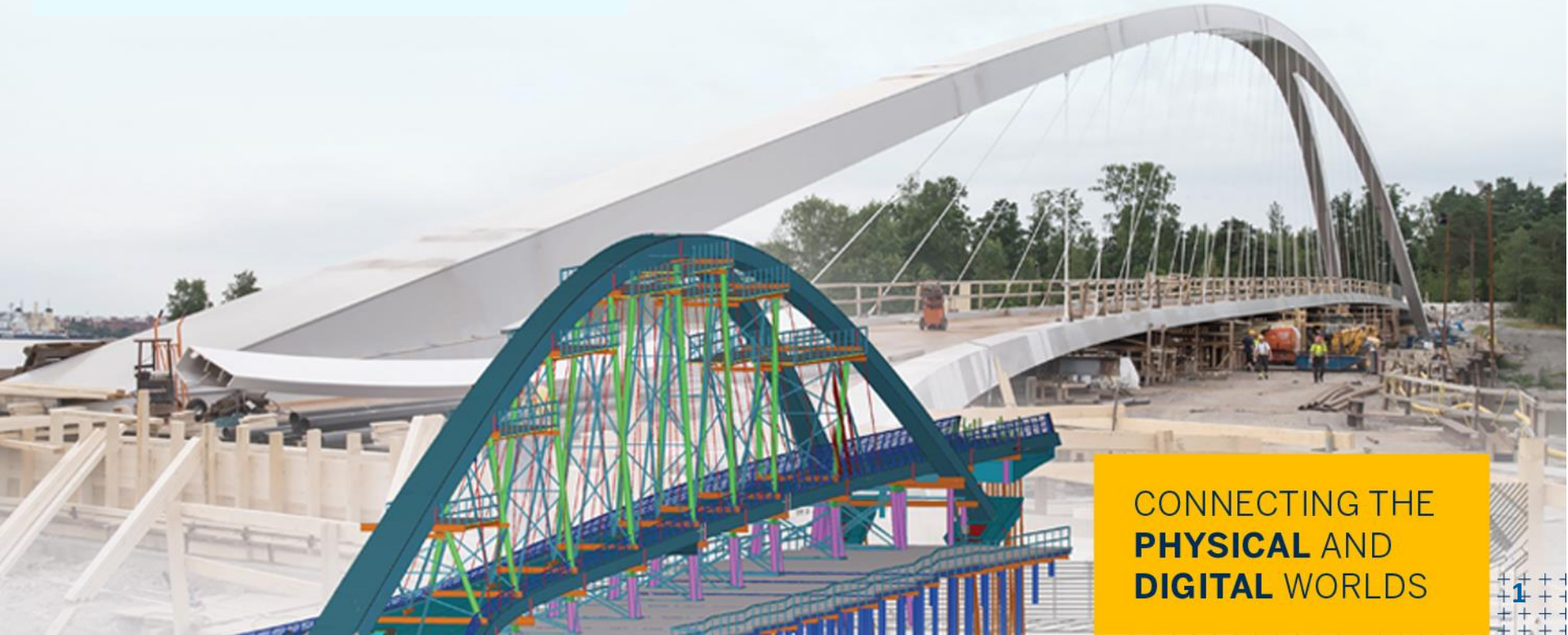
Preparing the Way for Digital Construction Transformation

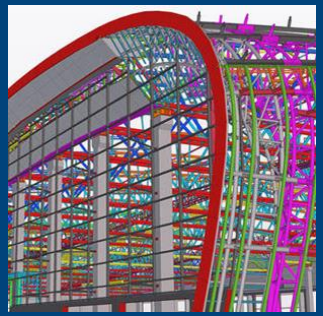
Tab 14



CONNECTING THE **PHYSICAL** AND **DIGITAL** WORLDS

Serving 5 of the worlds largest industries
Transforming the way they work

Agriculture



Building Construction

Civil Engineering and Construction

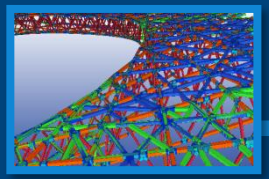
Geospatial

Transportation and Logistics

Our integrated technologies and innovation solutions are helping customers increase productivity and profitability across multiple industries around the world.

Connecting the Physical and Digital Worlds

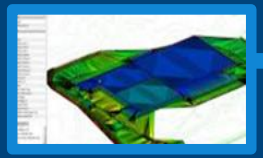
Construction



3D model at anchor bolt level detail drives pinpoint construction accuracy during fabrication and construction

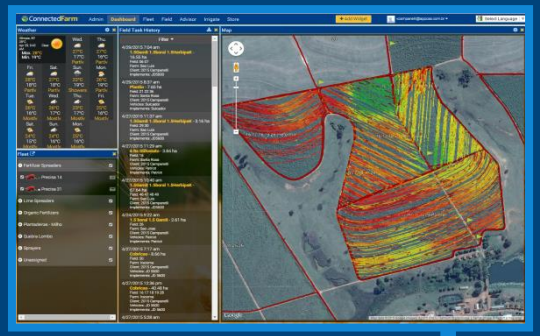
Construction verification against the model

3D design model imported to the machine control and guidance equipment in the field



Progress monitoring enables schedule optimization

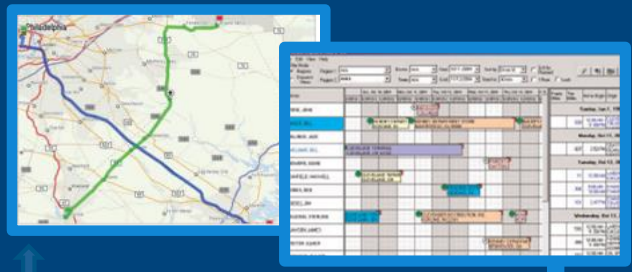
Agriculture



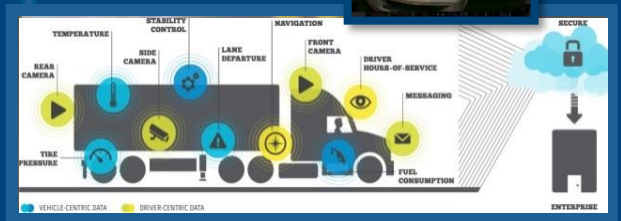
Real time field conditions update and inform optimal farm management plan

Farm/crop management plans flawlessly executed in the field

Transportation

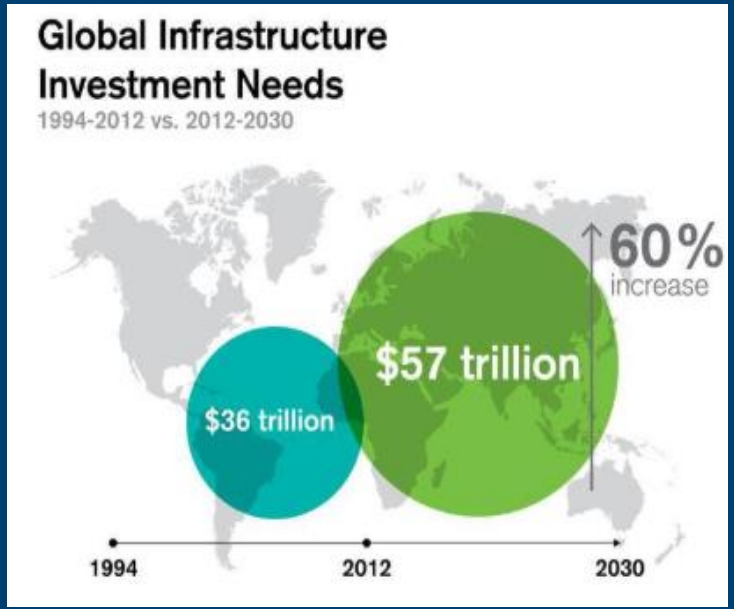


Real time road, vehicle, and driver conditions aligned, managed and optimized to meet customer needs

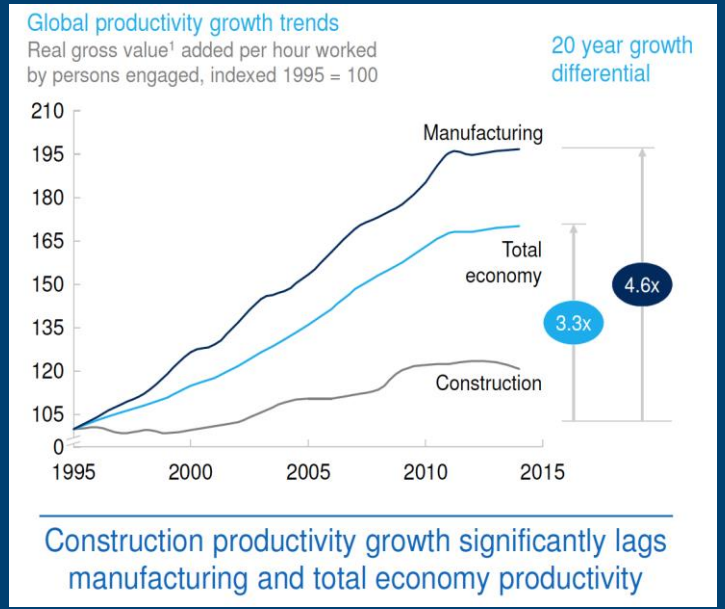


Challenges in Digital Construction Transformation

Urbanization & Population growth



Productivity lags industry average



Skilled Labor Shortage

90% of companies face shortage

30% Less workers under 24yrs

Advancing Digital Construction Transformation

Adoption

Growth in AEC tech from 300 vendors in 2016, to 1,000 to 2017 to over 2,000 in 2018

Noninvasive & Wearable Technology on the Rise

240%
Increase in Drone Adoption

80%
Capture FIeld Data on Mobile Devices

80%
Prefer Cloud to On Premise

AEC Firms hiring data scientists, Chief Data Officers and Blockchain experts

Return on Investments

30%
Reduction in Errors and Clashed with Mixed Reality

Free up Capital by
5-15%
Allocating Money to Value Add Projects

90%
Decrease In Time Measuring and Processing Site Data

10%
Compression in Project Schedule

80%
Reduction in Rework

30%
Increase in Prefab

50%
Increase in Productivity of FIeld Tasks

5%
Increase in Accuracy of Estimates

30%
Reduction in Operations and Maintenance

Digital Construction accelerates Efficiency and Accountability

Between stakeholders

Owner ⇔ architect engineer ⇔
General contractors ⇔ sub contractors

Project capital program management

Project document & contracts management

Production schedule, work order mgmt as built QA

In the office

Business ⇔ project/team ⇔ field
Between departments
Building product manufacturer supply

Procurement

Reporting

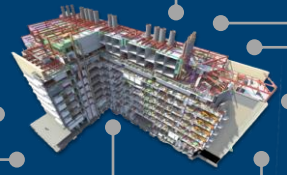
Job Cost

Scheduling

In the field

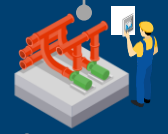
Scope ⇔ actual ⇔ handover
Labor ⇔ equipment ⇔ materials
Models/production vs. documents

Supervise



Instrument

Equipment

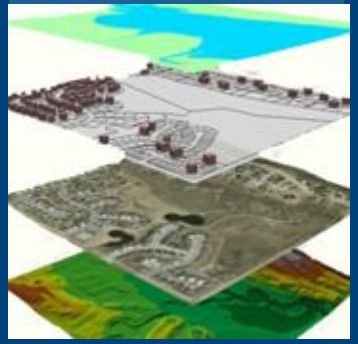


Fabrication
Pre-fab

Labor

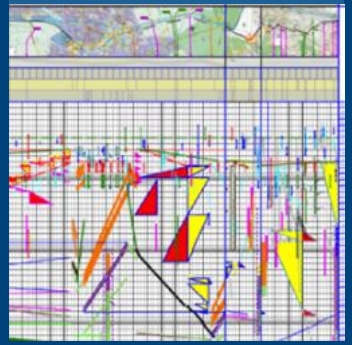
Material

Geospatial data



BIM data

Project & Timeline data



Machine & equipment data

Financial & Supply data

Visualize, optimize, connect, inform and automate construction process

The next transformation: Data Driven Construction

Data is king, powering other emerging technologies

Big Data, IoT & Cloud Computing

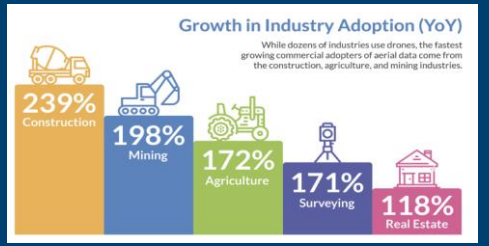
AI & Machine Learning

xR, Mixed Reality

Autonomous Machines

Connected Construction

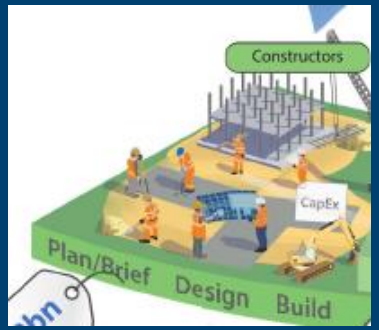
Drones & Vision

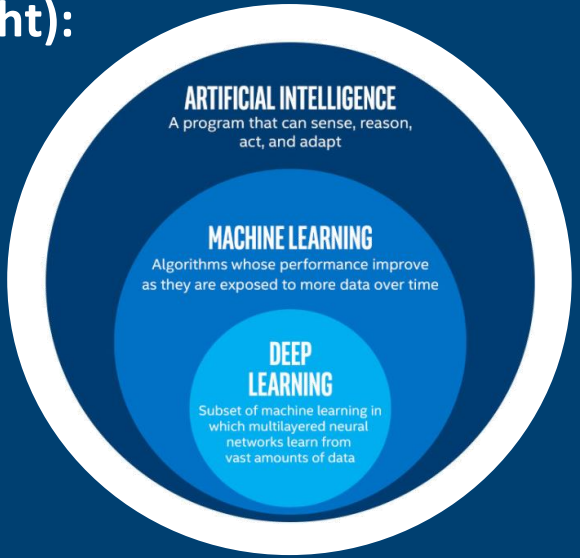


Data powers AI, providing intelligent decision making for construction productivity and automation

From reporting (hindsight):

- Progress
- Expenses
- Alerts





To informing (insight):

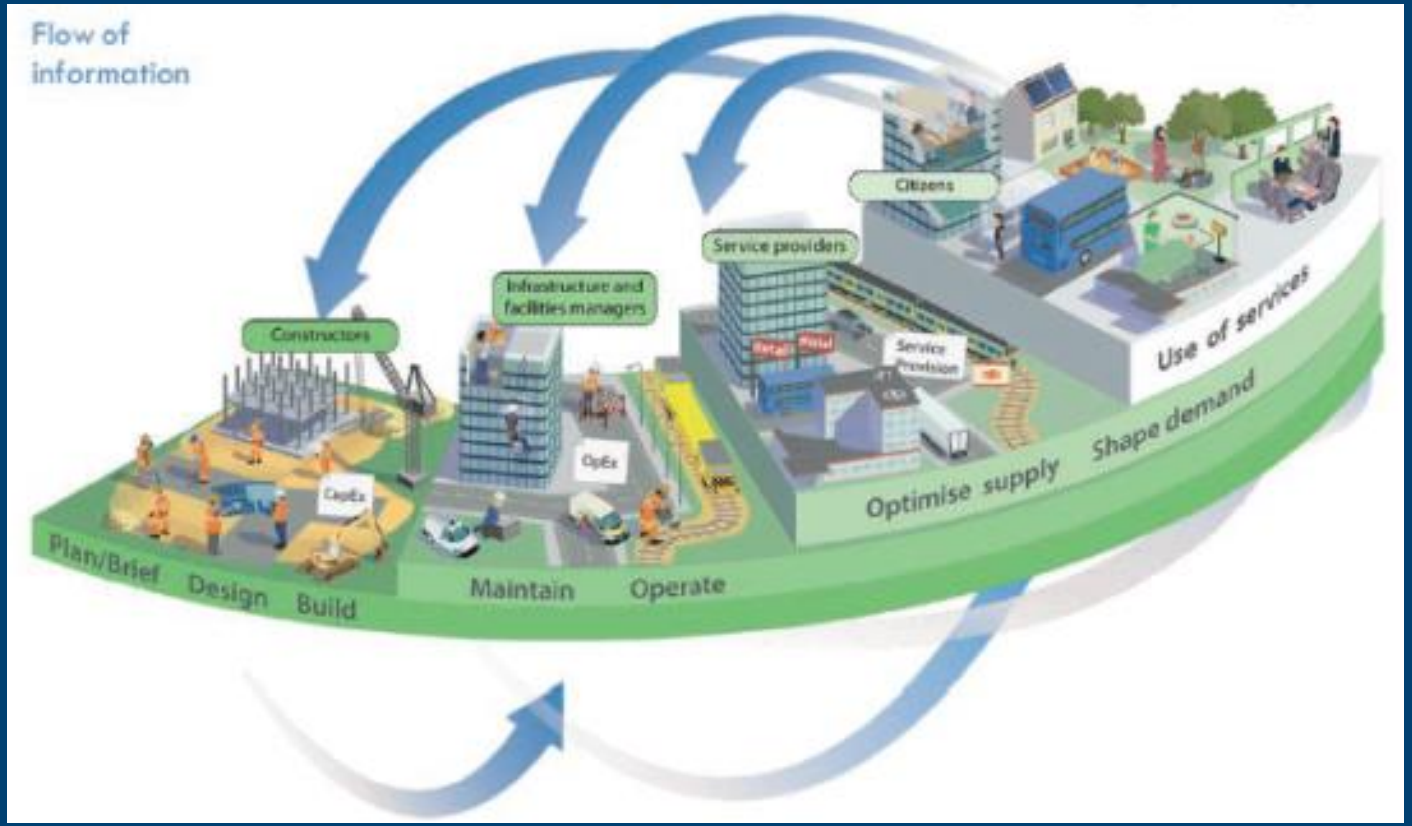
- How to finish faster
- How to finish cheaper

To automating:

- Estimates
- Schedules
- Work orders
- Machines

Industry Trend: Chief Data Officers and data scientists being hired by leading contractors

…..it will extend beyond construction to optimize and automate design, maintenance and operation of our cities



How can governments accelerate adoption?

- Develop a Digital Construction Strategy to encourage the use of digital technologies both internally and, externally with contractors to increase collaboration and transparency and, reduce time, rework and change orders.
- Foster a culture of innovation and encourage and nurture institutional knowledge to use new technologies to be more effective in all phases of the project delivery life cycle from pre-design through maintenance operations.
- Leverage incentives or programs encouraging the use of digital construction technologies that improve the quality, costs and schedules of a project.
- Ensure transparency with your partners by leveraging digital technologies to access shared analytics and dashboards which provide daily insight into project errors, costs, schedules, materials, and labor.

*McKinsey April 2019 Capital Projects & Infrastructure