Digital Built Environment

Introduction & Overview

Introduction

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Digitalization & BIM TG

CEN/ISO Expert

Objectives for today

- Typical Challenges - Why
- How the industry is changing
- Exploiting & Vision of Digital Built Environment
- Case Studies

Industry Landscape & Typical Challenges

Typical Challenges - Why

Complex ecosystems
Low collaboration
Low visibility

Low profit margins
Low productivity
High cost of failure

Disruption
New materials
New equipment
New ways of working

- Increasing project and site complexities
- ERP used mostly for internal operations
- Little transparency and fragmentation
- **Construction is not standardized**
- **Unstructured and silos data**
- Poor project management and execution
- Insufficient skills

We need to build better performing buildings, with less resource, and quicker!

We need a step-change in productivity in design, procurement & delivery

Carbon emissions from buildings are on average 3.8 times higher than they were designed to achieve**

Source: *UN. **Innovate UK

Many small niche firms providing solutions for AI / Big Data / IoT

Lack of Integrated platform execution

Lack of intelligence across project lifecycle stages, value chain and asset operations

IBM

Platforms reality check

The Current Vision

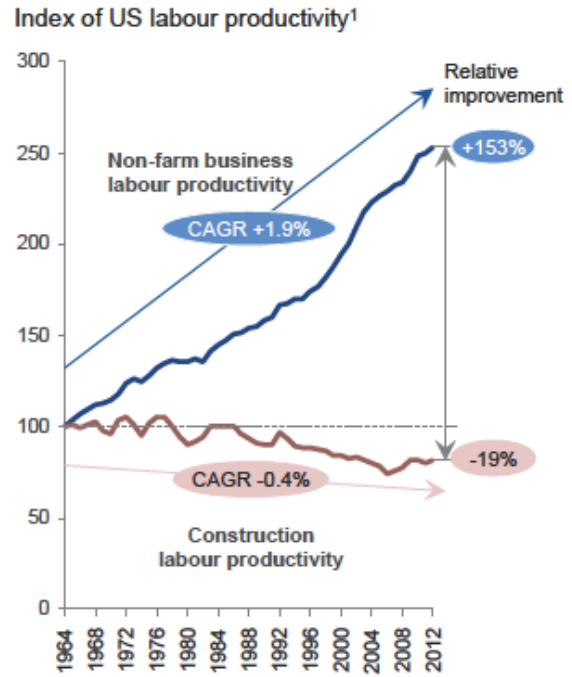
- High operational availability
- Artificial Intelligence predicting failures
- Accurate asset usage, maintenance, procurement, and inventory records
- Condition-based maintenance
- Connected equipment & Digital Twins
- Contextual data at any stakeholder fingertips
- Data insights from ideas to design to construct to operate

The Operational Reality

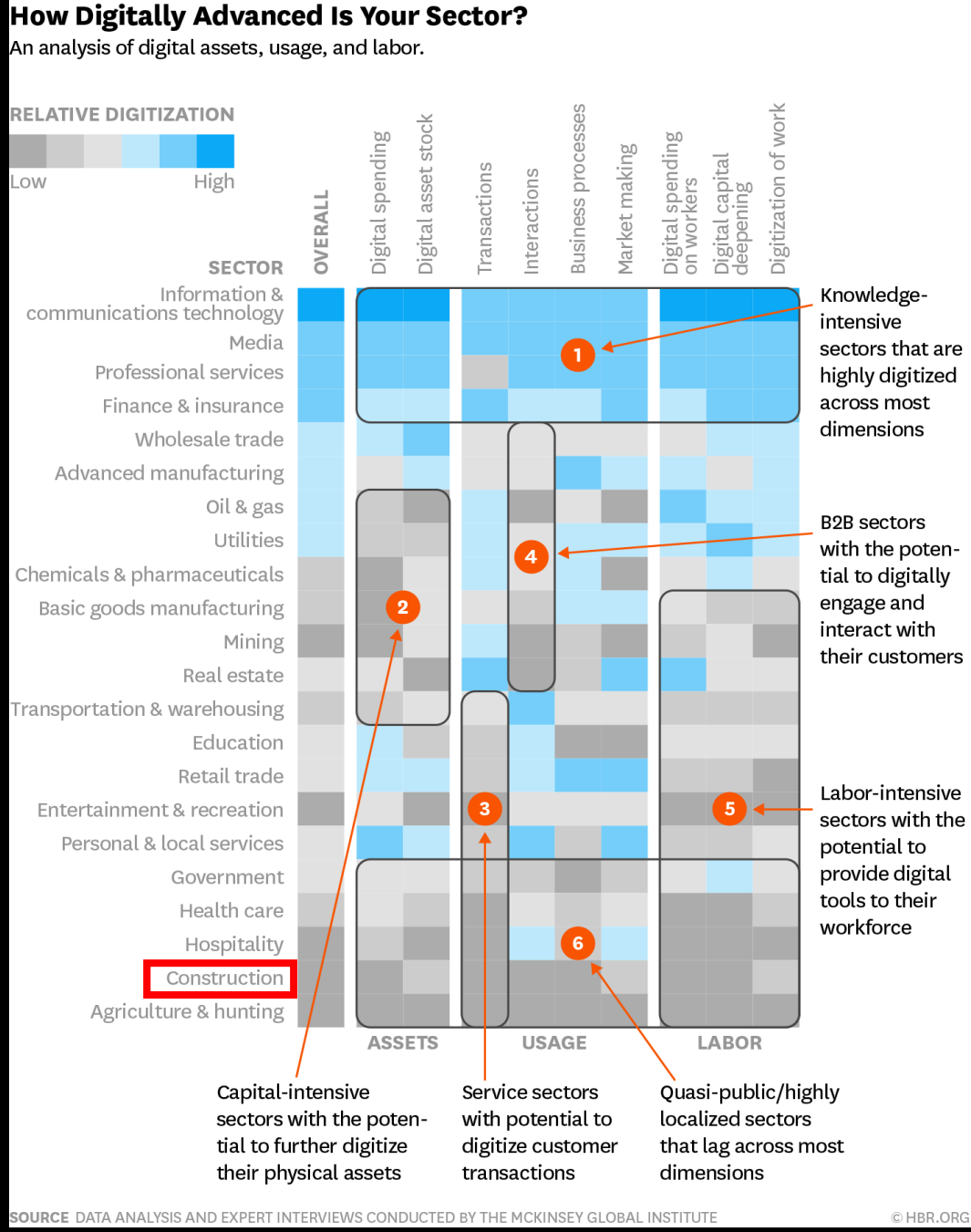
- Accurate Bill of Materials Do Not Exist
- Lack of IT & OT security of Digital Twins and Models
- Equipment Not Physically Tagged or In Digital Format
- Sites lack infrastructure for data needs
- Multiple Vendors with siloed data and no interoperability
- Parts/equipment catalog lacks structure/classification
- Massive data cleansing projects needed
- Install base lacks sensors and embedded monitoring to benefit from IoT
- With a lot of effort and reliability studies, you can “sometimes” achieve “predictability”
- Limited by Human capabilities

Productivity and Digitization
the only way is up

Figure 3: US Industry Productivity and Performance, 1964-2012[28]

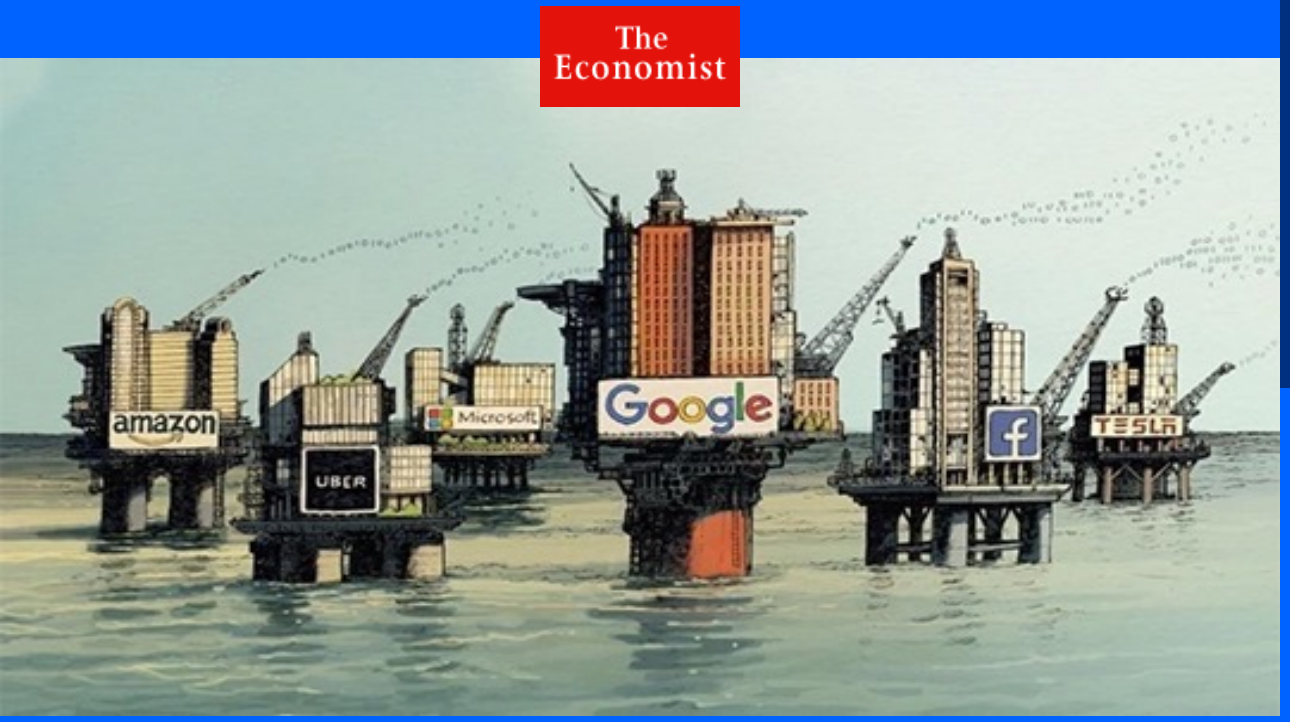


[1] Peer set based on US companies with Engineering, Construction and Services-related Standard Industrial Classification codes. Financials are inflation-adjusted and indexed to 1964; output per working hours.
CAGR = compound average growth rate
Source: Global Vantage; Compustat; Bloomberg; www.aecbytes.com/viewpoint/2013/issue_67.html; www.nber.org/papers/w1555.pdf; S&P Capital IQ; BCG ValueScience Center; World Economic Forum



How the industry is changing

Thriving in a data-driven world



The world's most valuable resource is DATA

Companies average almost

5

private and public clouds

80% of companies moved applications or data from public clouds in 2018

IDC Survey

Reasons to migrate from public cloud

- Business Transformation
- Security
- Performance
- Cost
- Control
- Ecosystem
- Big Data

IDC Survey

IDC; IBM IBV C-Suite Study; Rightscale

Source: IDC's Cloud and AI Adoption Survey, January 2018

Hybrid multicloud is the platform

85% of companies operate in a hybrid multicloud environment today

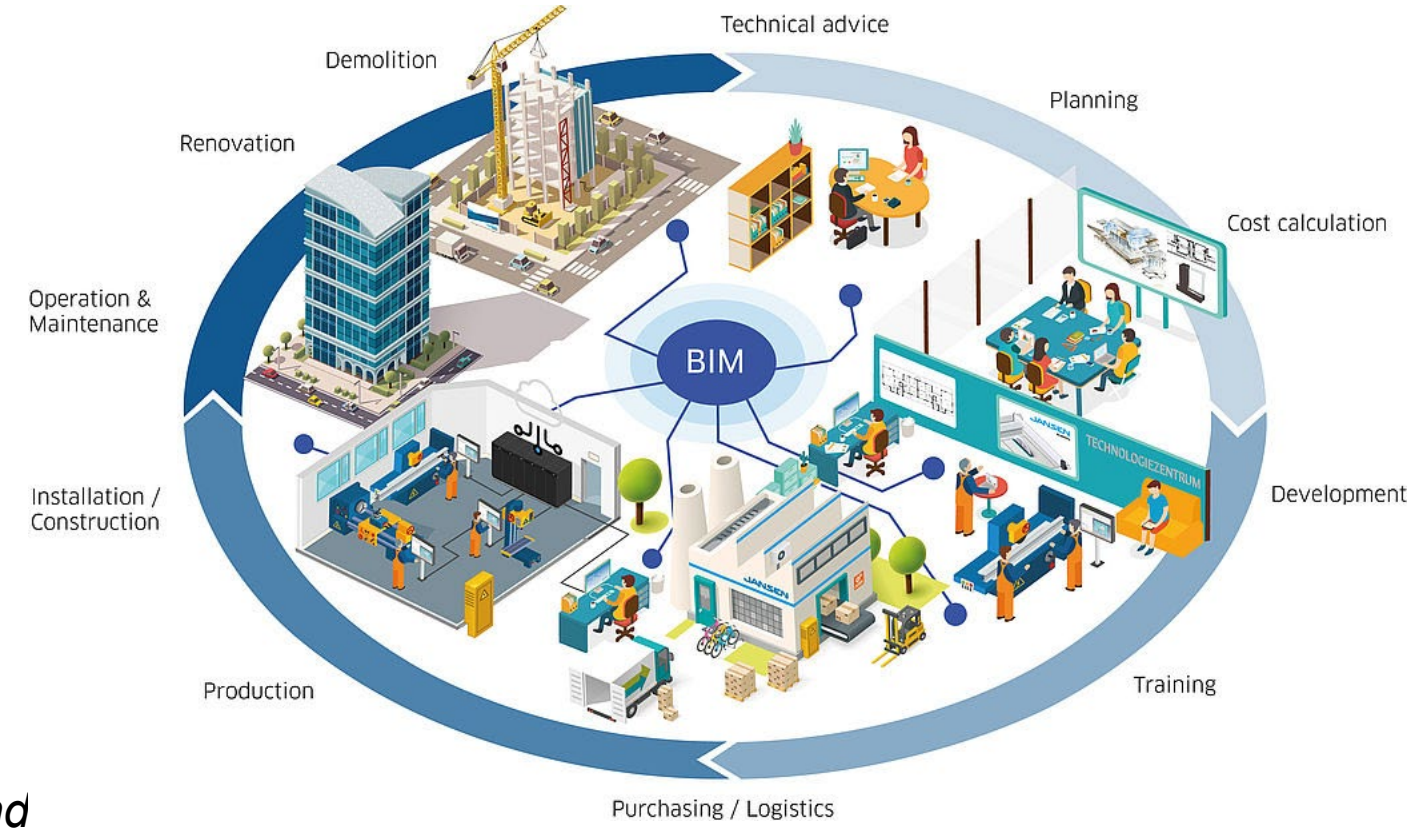
98%

of companies will be hybrid multicloud in three years

BIM is relevant for every stakeholder

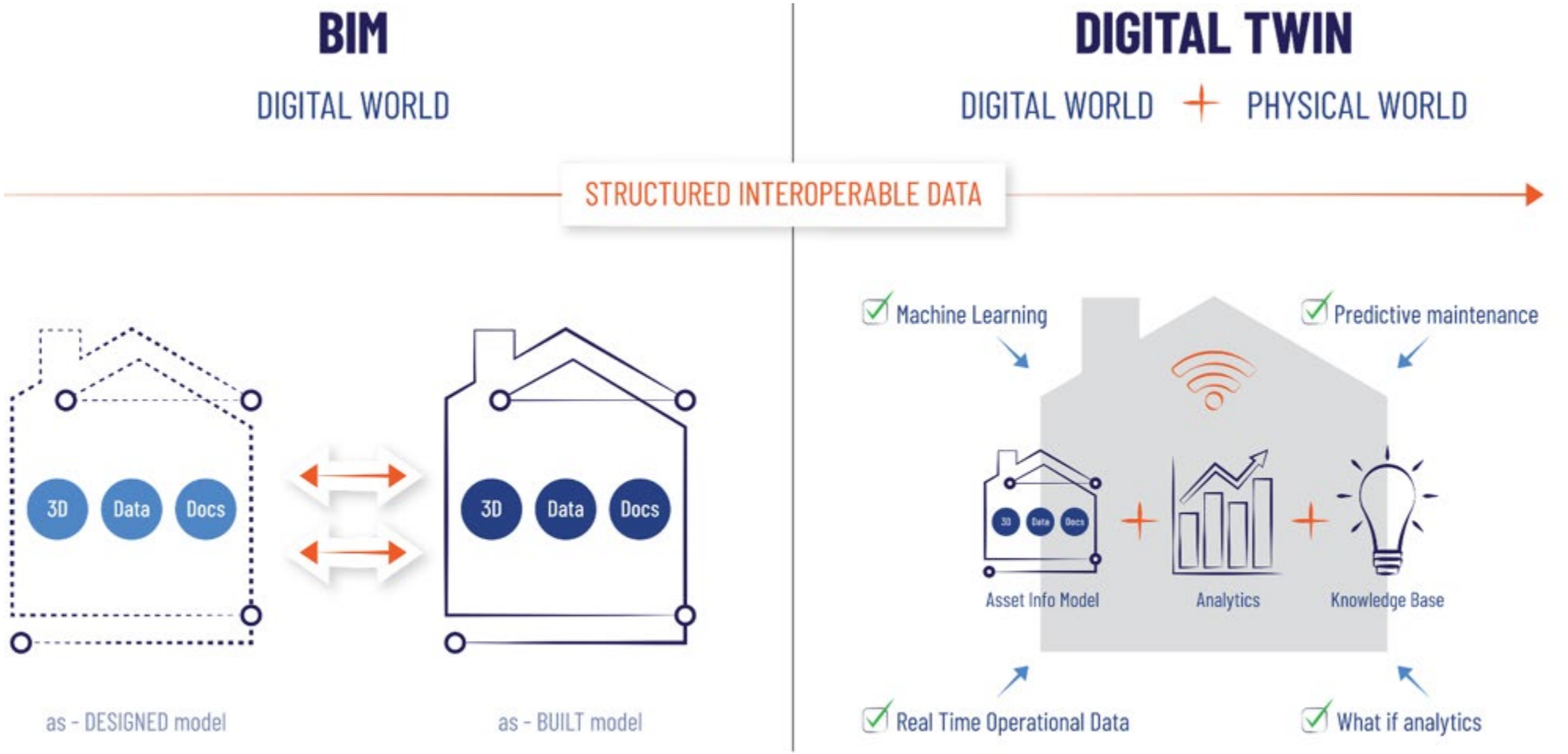
- Building Information Model – **What** thing is produced
- Building Information Modelling – **How** the thing is produced
- Building Information Management – **Who** produces **What** thing and **When**

*'BIM expands from 3D modelling to genuine collaboration; **from design and construction into operations**; **from individual buildings to cities** and their systems; and onto wherever digitizing the built environment may take us.*



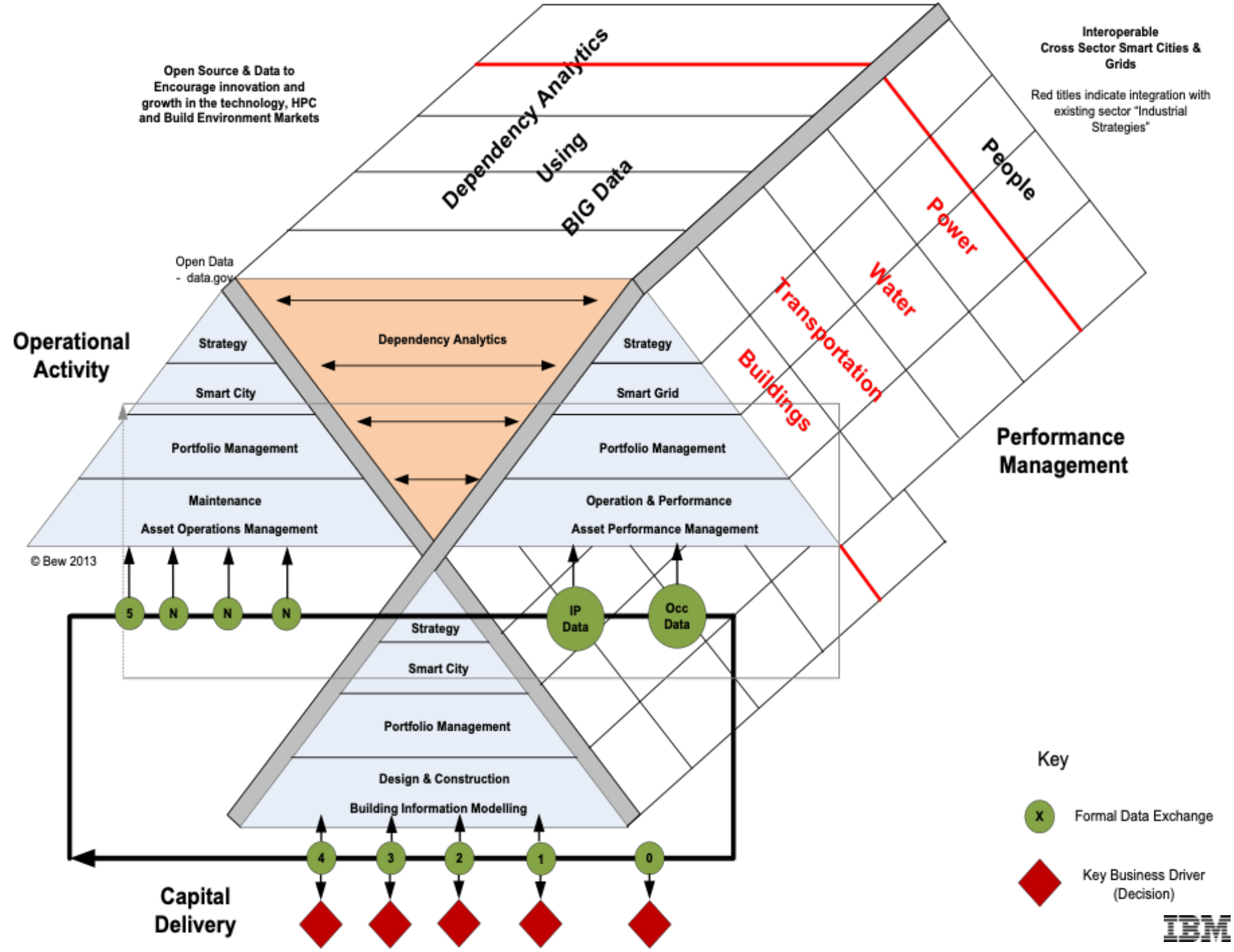
Source: coBuilder, ISO19650, BIMlevel2.org

A shift from modelling to intelligence



coBuilder

BIM & Built Environment



Mark Bew

Exploiting Digital Built Environment

Transforming the **Built Environment**

Transform Enterprise

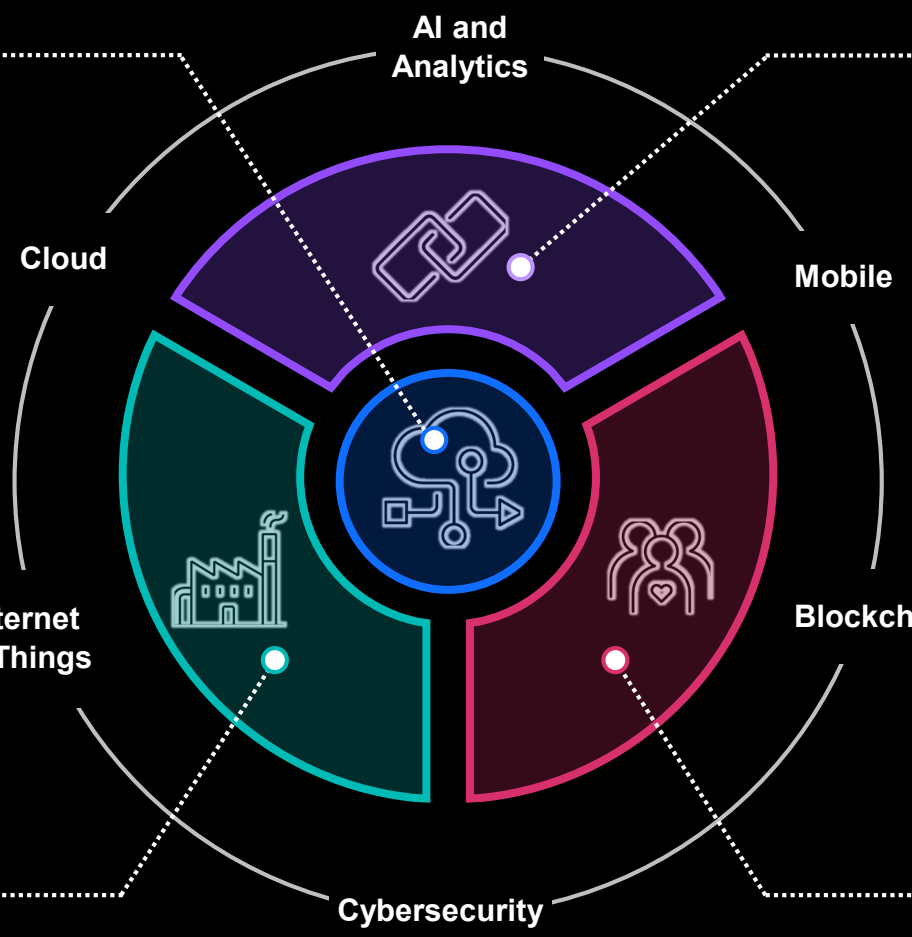
Improving Enterprise Efficiency & Effectiveness

Areas of Focus:
Business Digitization, Enterprise-as-a-Service

Transform Operations

Improving Operations Efficiency, Product Quality & Supply Chain Visibility

Areas of Focus:
Connected Operations, Connected Spaces + Construction



Transform Products

Developing New Ways of Realizing & Monetizing Value

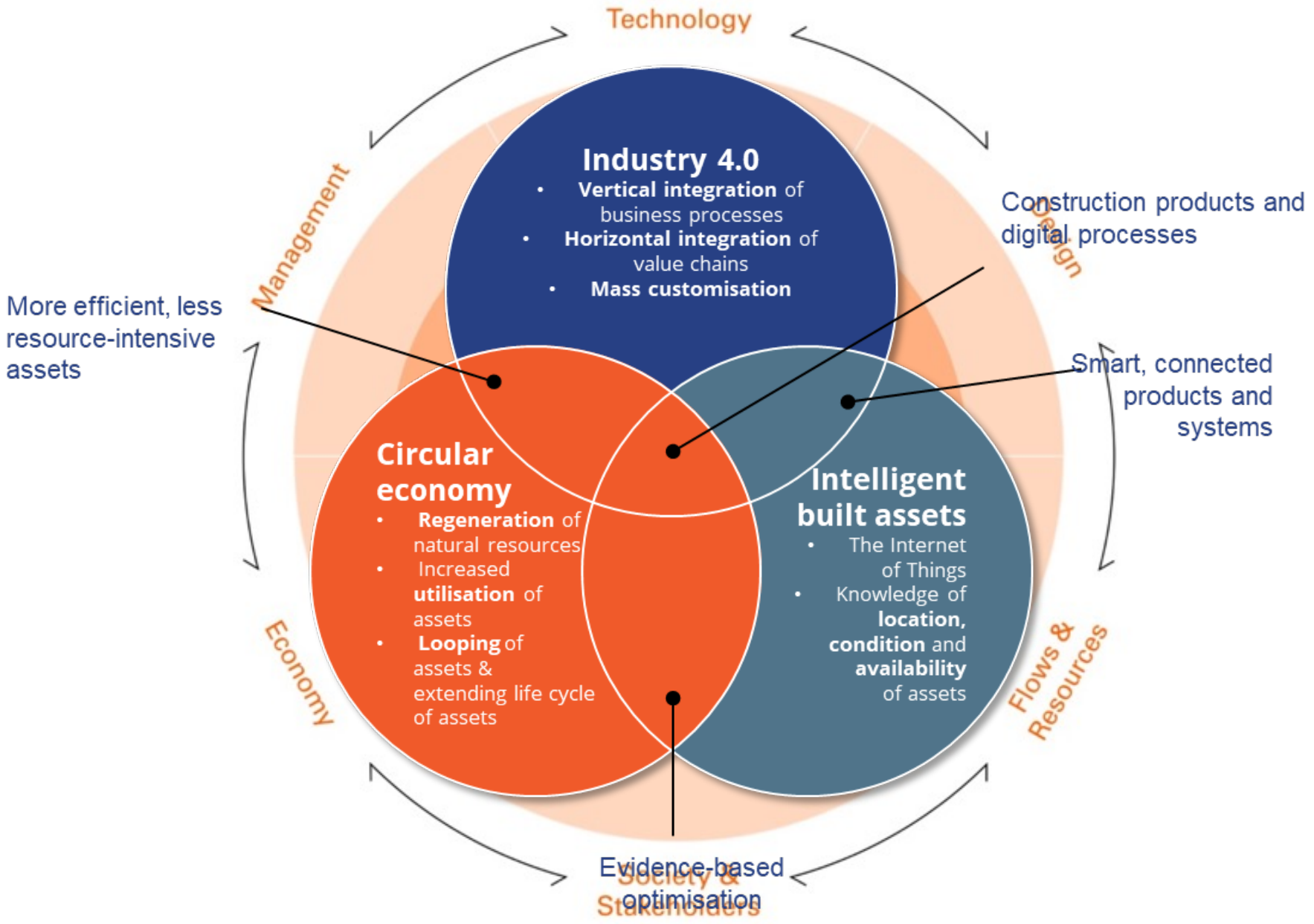
Areas of Focus:
Product and Job Site Reinvention, Connected Built Environment

Transform Experiences

Creating Differentiating Experiences for Customers, Employees & Others

Areas of Focus:
Digital Experience, Knowledge Management, Workforce Transformation

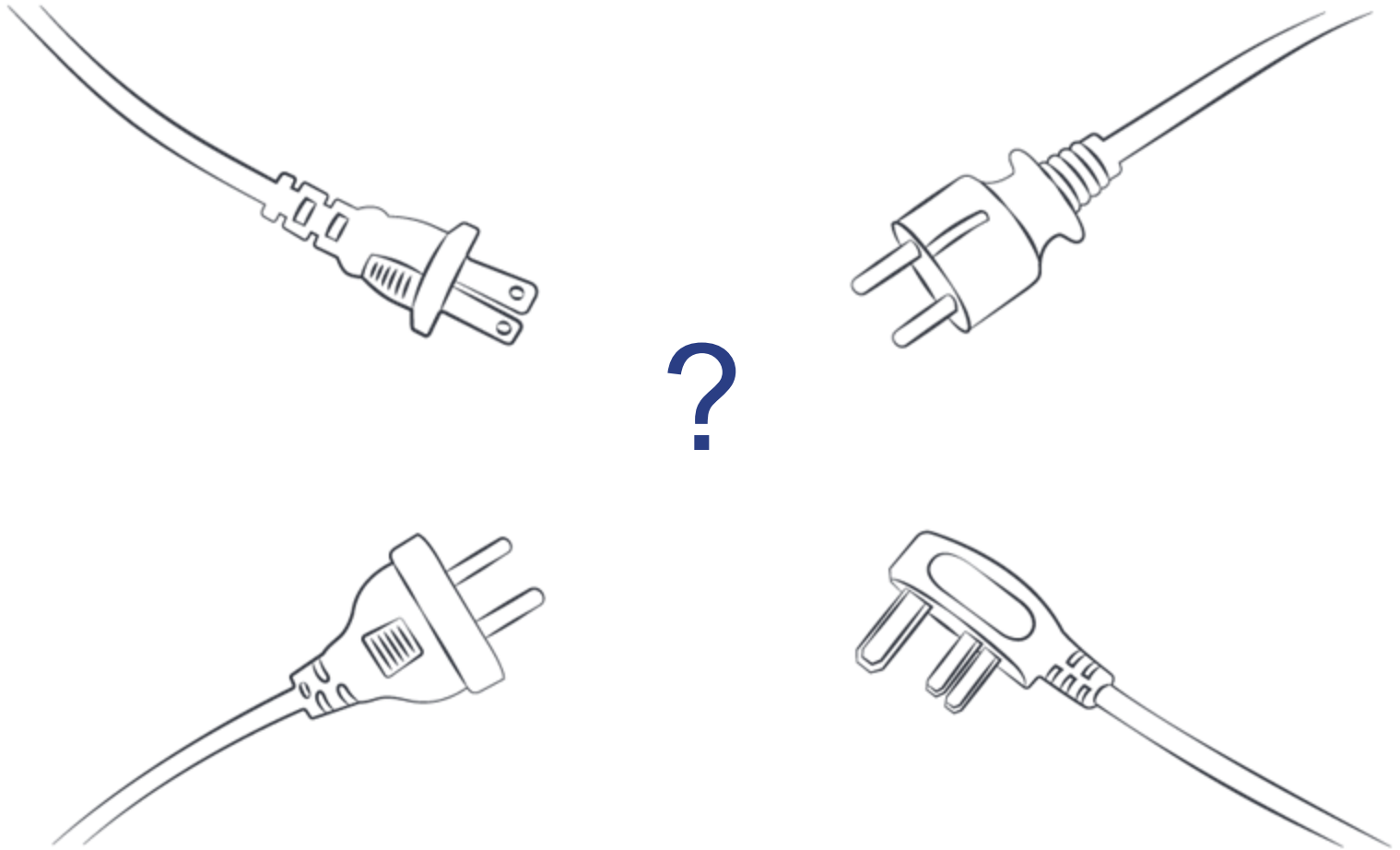
Holistic approach is the key to a success



Source: CPA (2016) – Future for Construction Product Manufacturing: Digitalization, Industry 4.0 and the Circular Economy

IBM

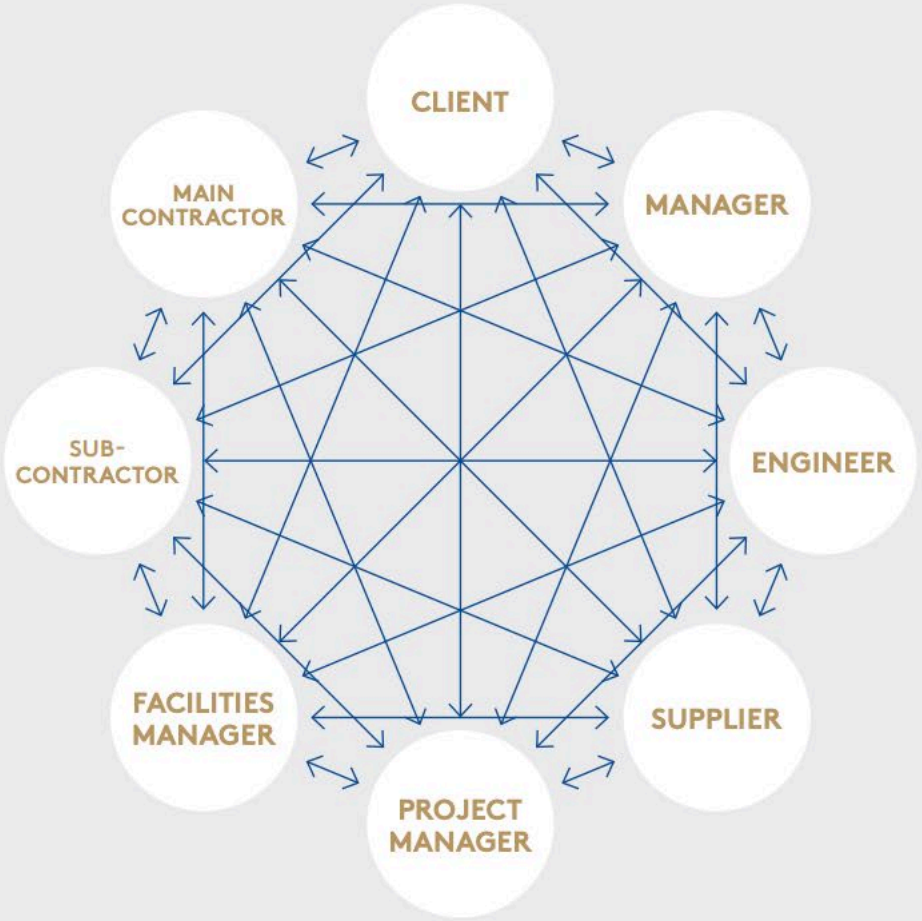
Without standards ?

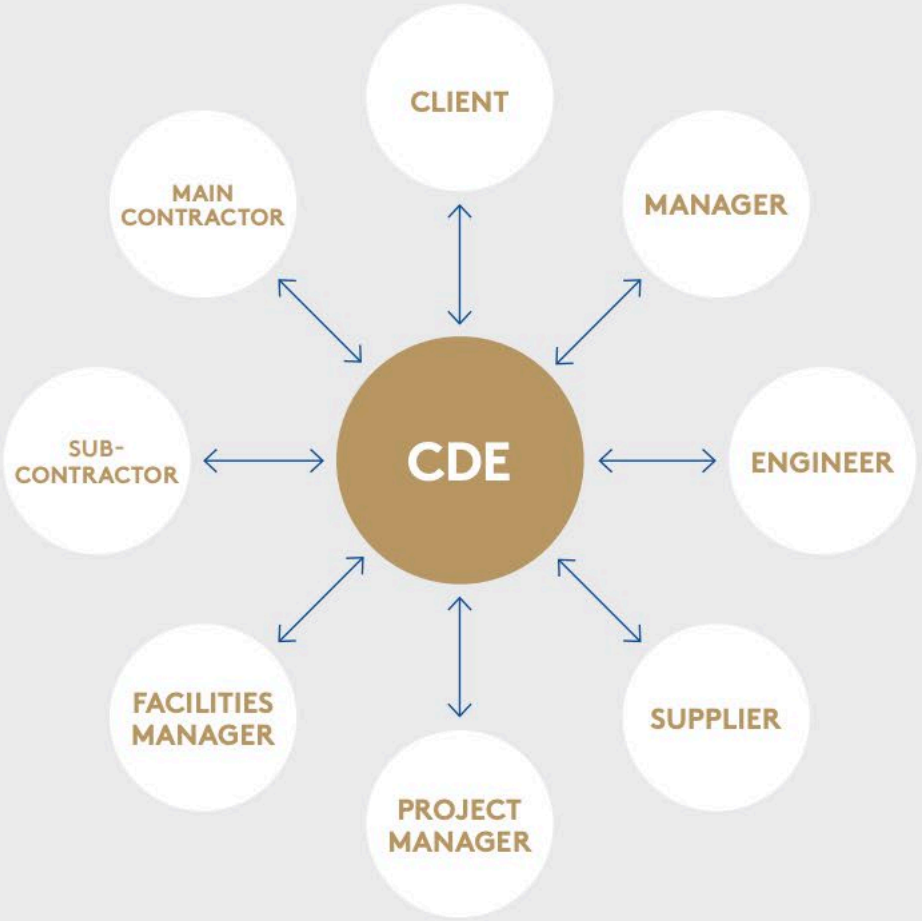


Ongoing International standardization and harmonization work

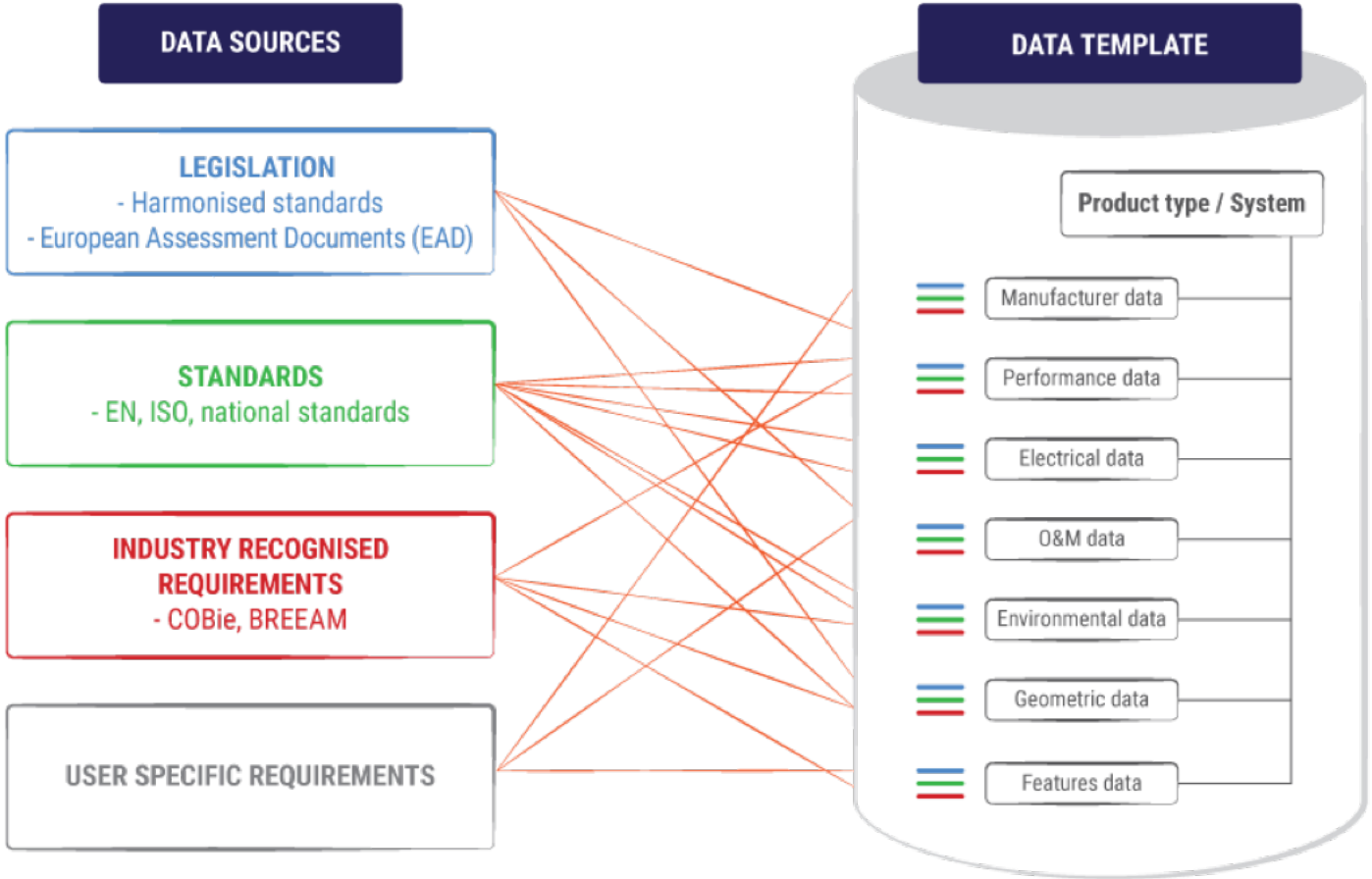
- **CEN/TC 442** – Standardization in the field of structured semantic life-cycle information for the built environment.
- **Smart CE Marking**
- **ISO 19650 Part 1** - Organization of information about construction works — Information management using building information modelling: Concepts and principles.
- **ISO 19650 Part 2** - Organization of information about construction works — Information management using building information modelling: Delivery phase of the assets.
- **ISO-TC59-SC17-WG3** - Enabling use of Environmental Product Declarations (EPD) at construction works level using building information modelling (BIM)

Traditional Sharing v ISO 19650





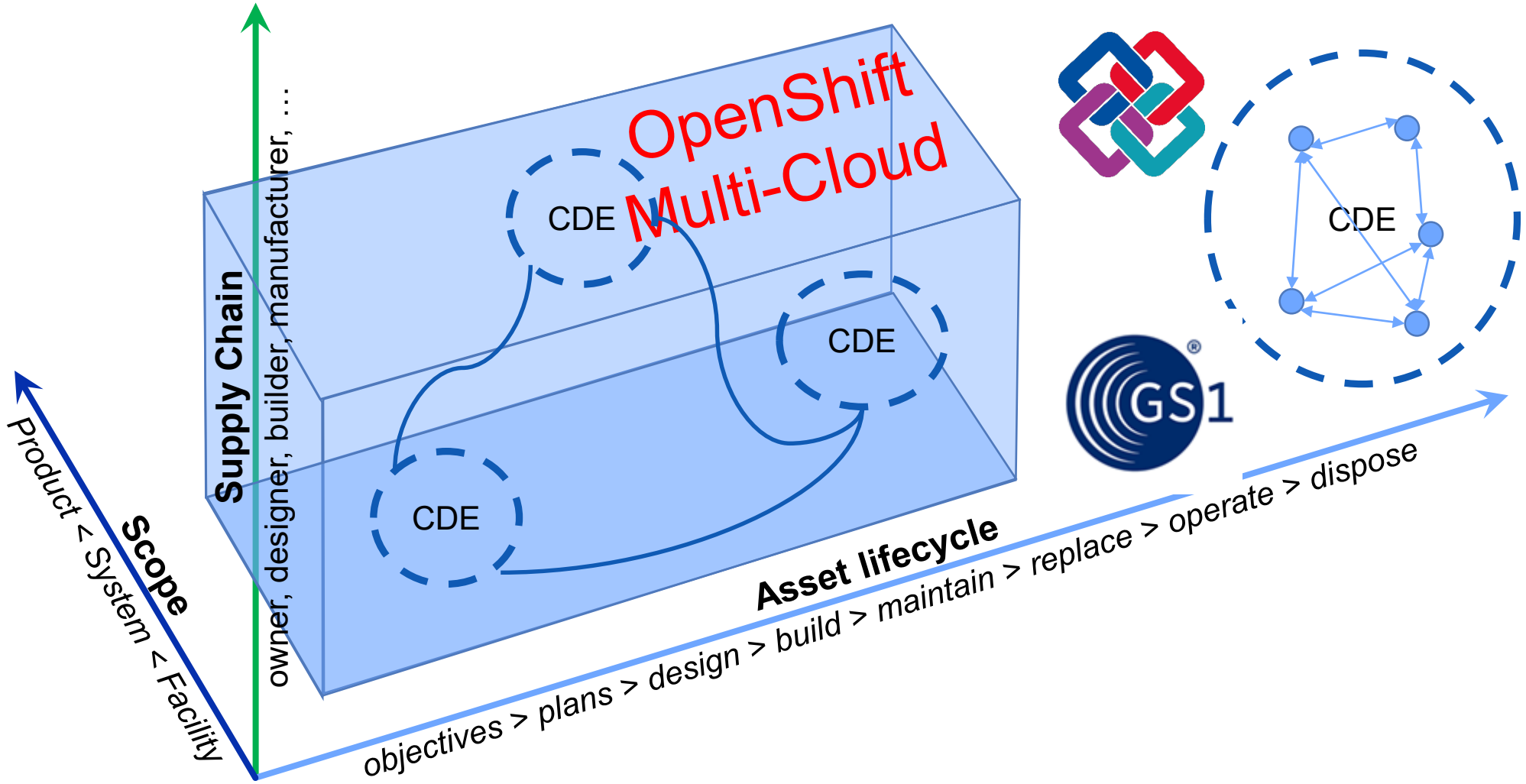
Standardised properties & Data Templates



A Data Template is a **common data structure** defining the 'properties' (essential and non-essential product characteristics e.g. fire rating and colour) that describe any type of product in a way that can be traced to a credible source.

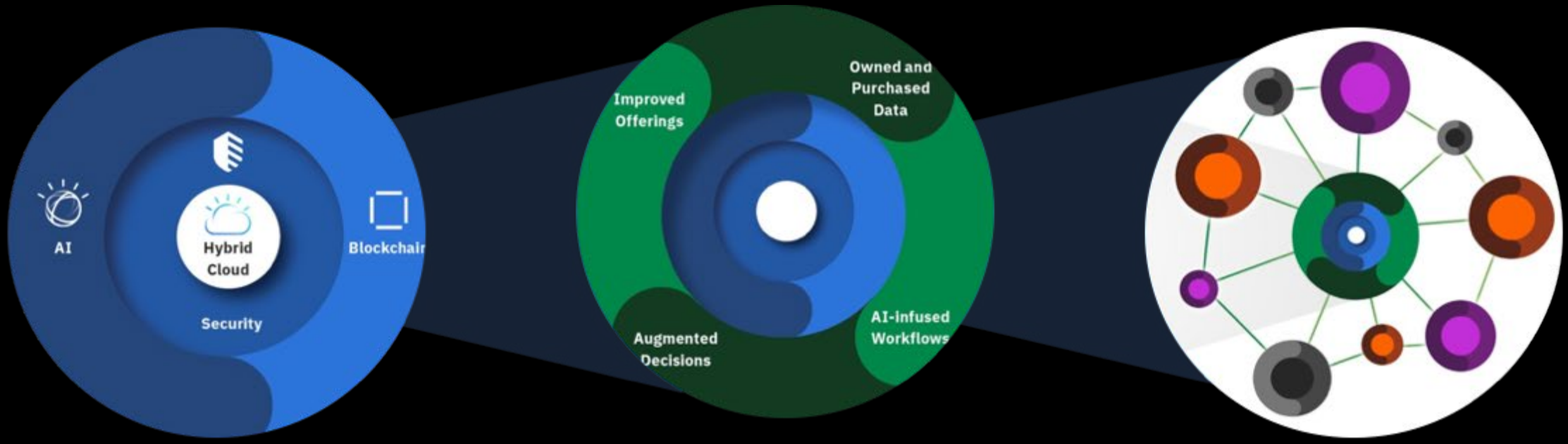
Source: coBuilder

Digital environnement in 3 dimensions



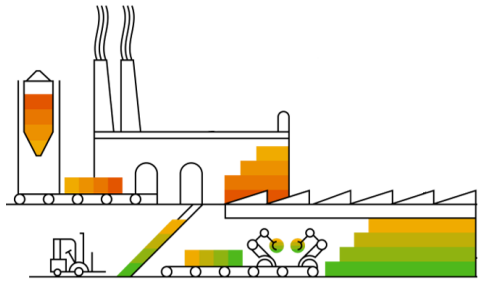
Source: buildingSMART

The need to deploy in any technology platform



Technology Platforms **Industry Platforms** **Business Platforms**

Ecosystem of stakeholders



SIEMENS

AUTODESK.

ABB

Other Business Networks

BOSCH

Honeywell

Subcontractors

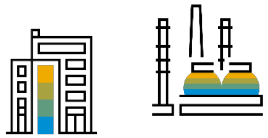
openShift

openSource

openBIM

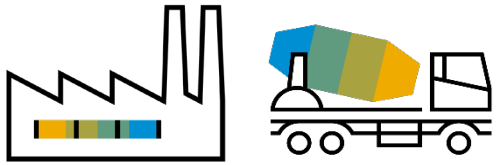
Integrated with Blockchain

GLOBAL I MULTI-MODE I END-TO-END



Owners

Engineering Service Providers



Manufacturers & Suppliers

Contractors

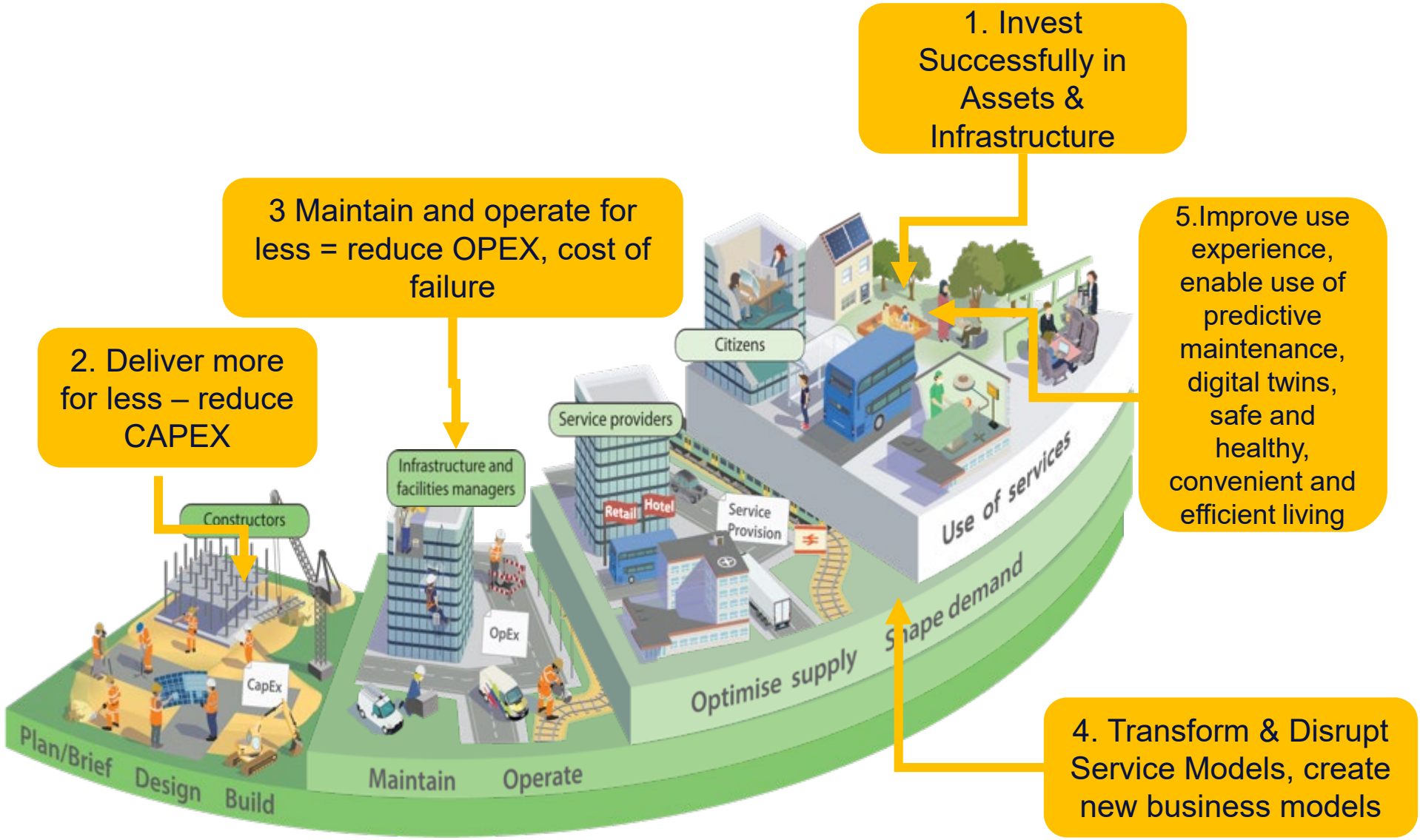
Authorities

SAP, IBM

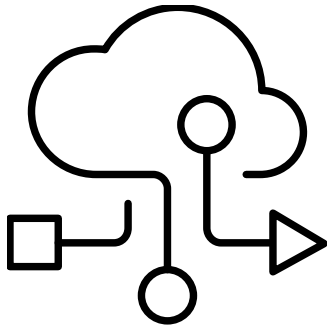
… with consensus, provenance, immutability and finality

IBM

Summary of Digital Built Environment



Source: CDDB, IBM



Industry Digitalization has benefited from the emergence of new **digital technologies** that are completely redefining the possibilities in design,construction, operations and manufacturing

APIs & Microservices

Rapidly creates new applications. Enables ecosystem partners to collectively innovate.

Automation & Advanced Robotics

Enhances productivity by working autonomously or in conjunction with staff. Increases worker safety.

Additive Manufacturing

Creates new and more efficient products. Slashes manufacturing processes.

Blockchain

Improves identity management and distribution. Enables transformational business model innovations, smart contracts, health & safety

Cloud

Allows data and applications to be stored and accessed from anywhere. Delivers cost-effective innovation quickly.

AI & Analytics

Supports staff to make decisions. Identifies business-critical operational improvements.

Internet of Things

Equips physical assets with digital data. Optimizes existing operational processes.

Mobile

Connects people with insights where they are. Enables on-going status and decisions.

Cybersecurity

Embeds safeguards into systems. Surfaces threats.

Case Studies & Use cases

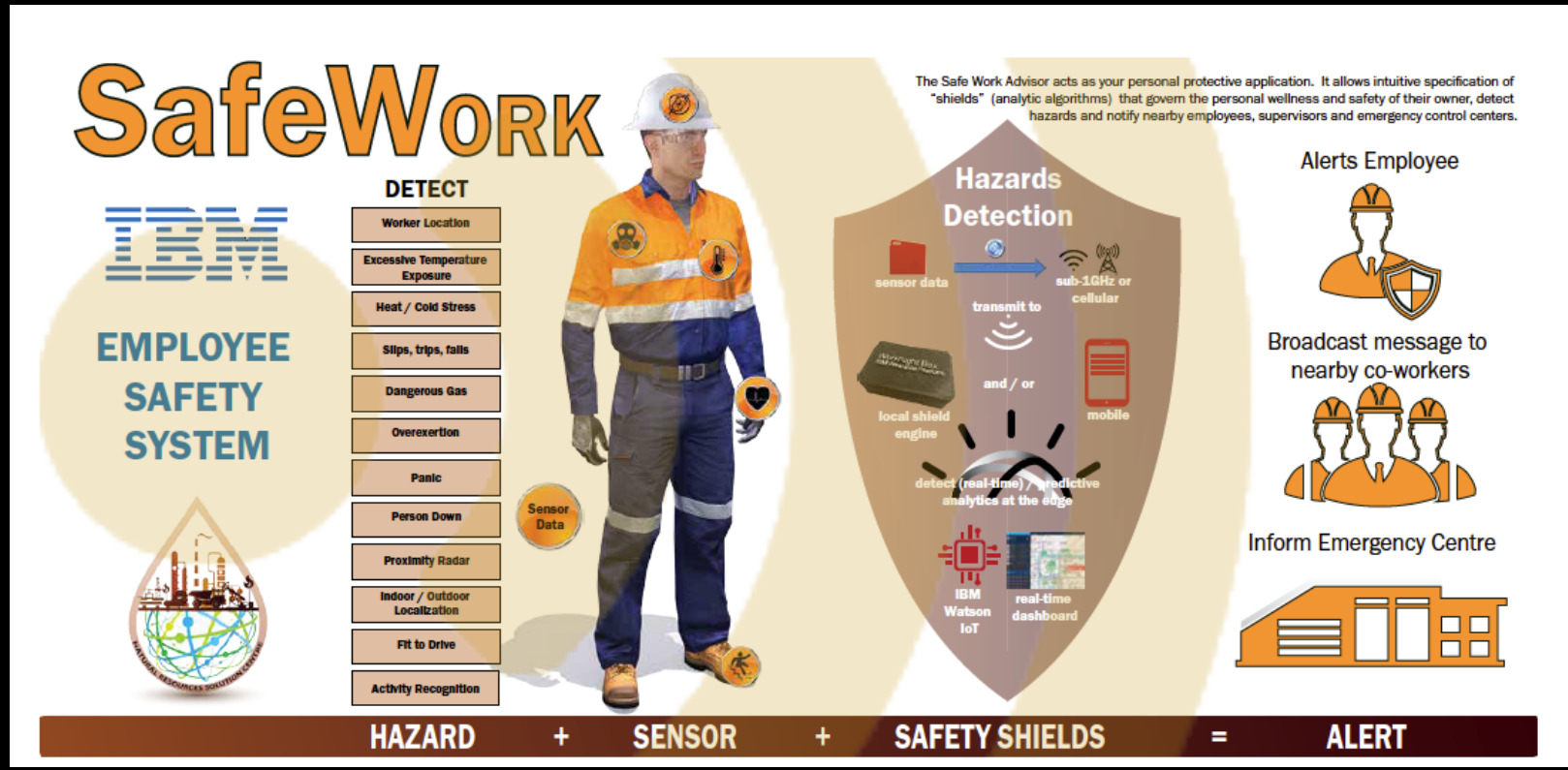
IoT Worker Insights for Safer Workplace

Overview

- Analyze and manage safety risks by utilizing sensor, environmental and enhanced data sources to gain insights in the workplace
- Avoid accidents and reduce severity and frequency of injuries
- Detect hazards and mitigate risks for employees and the general public

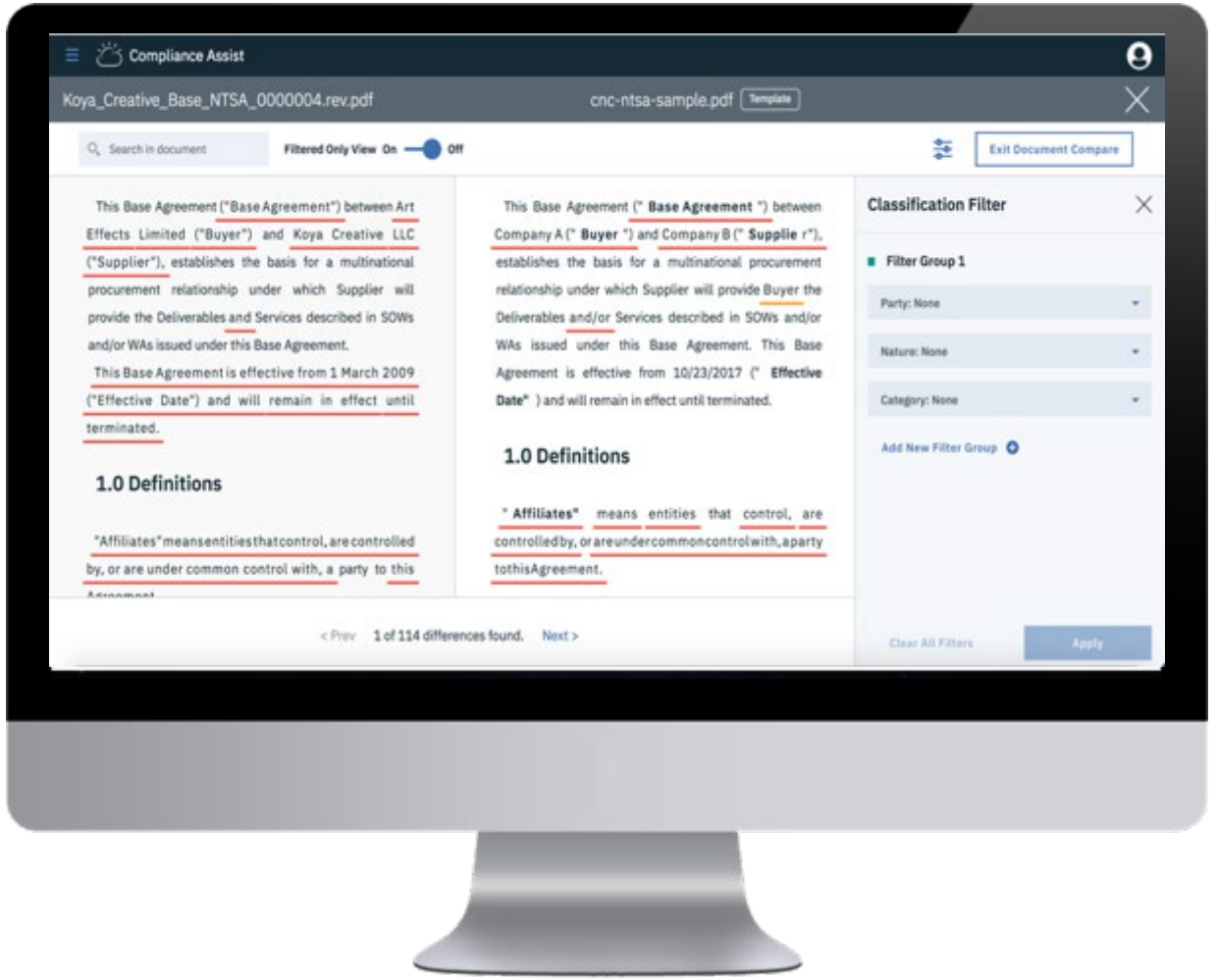
Benefits

- Continuously improve protection and reduce risks from predictive and cognitive analytics
- Improve operating efficiencies and decrease cost
- Decrease worker's compensation claims
- Significant reduction in disruption of workflows



AI for Compliance Assist

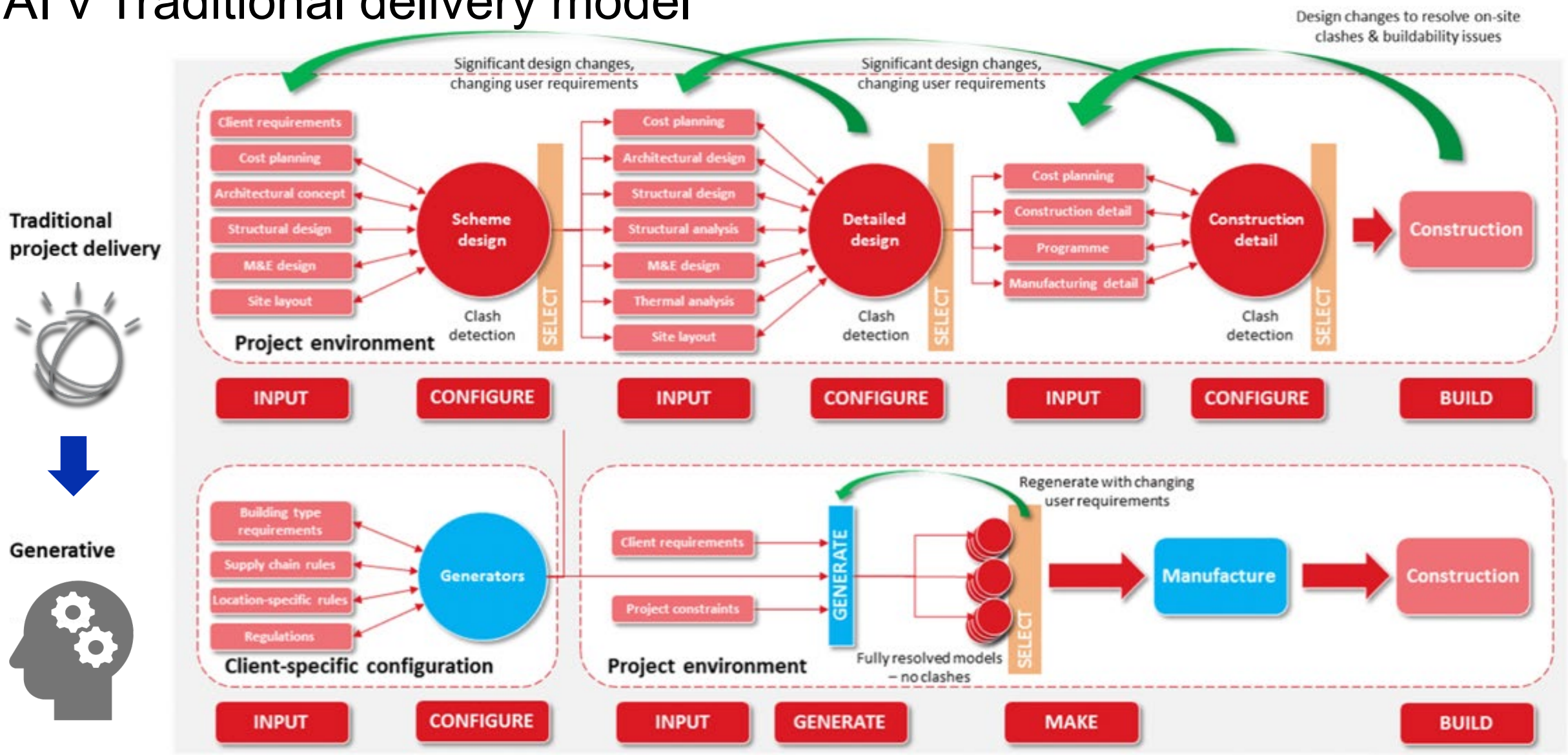
"I have the contract I need. Let's use AI to help identify the information I need quickly and flexibly."



Powered By:

Watson Natural Language Classifier

AI v Traditional delivery model



AMB Àrea Metropolitana de Barcelona

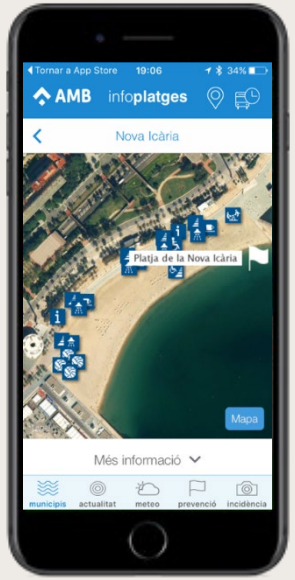
AMB serves 36 municipalities with a territory of 636 km2 with more than 3.2 million people

‘A City of Smart Cities’

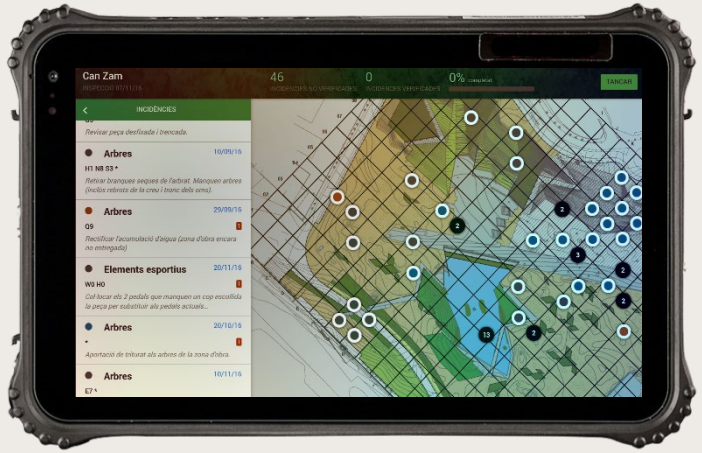
AMB is the most important metropolitan agglomeration of the western Mediterranean

Integrated Management Center

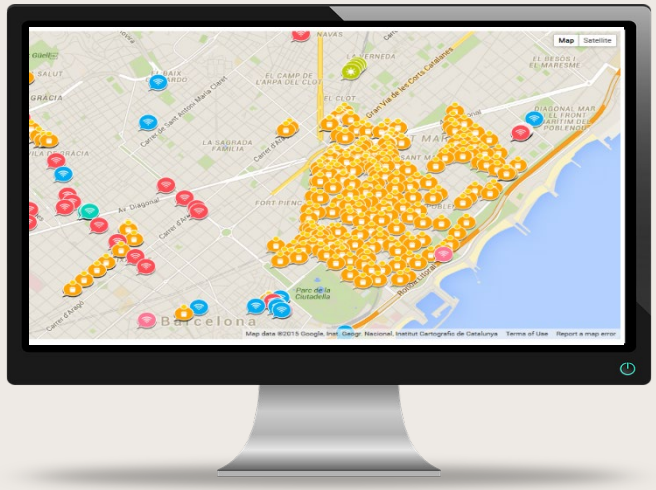
Citizen Apps



Tablet app for AMB inspectors



Sensors Platform

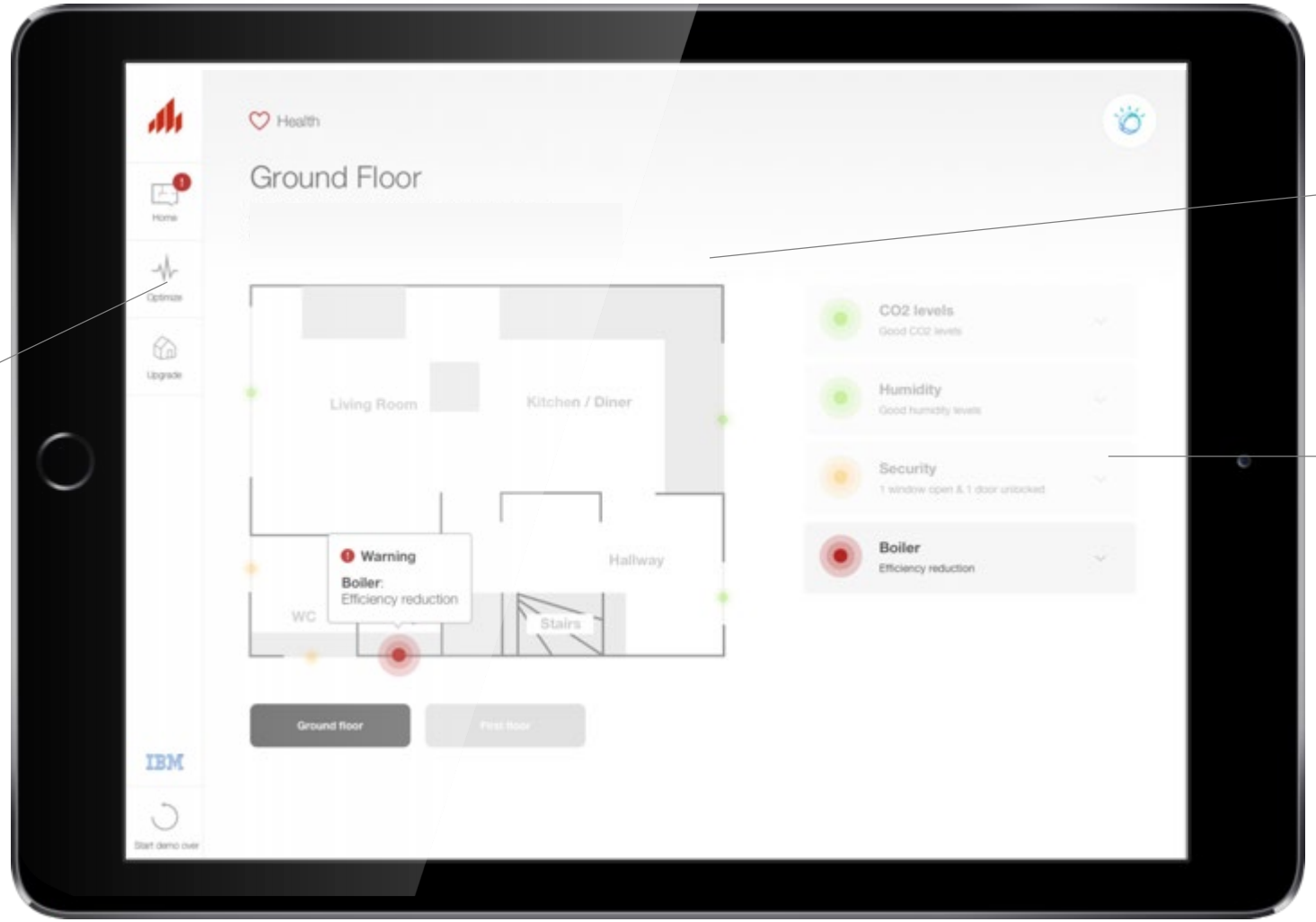


Municipalities Dashboard Portal

Case study: Wienerberger e4 House

The Wienerberger e4 House concept combines traditional building materials and techniques with standardisation and digital design to reduce construction time whilst maintaining a high level of build quality.

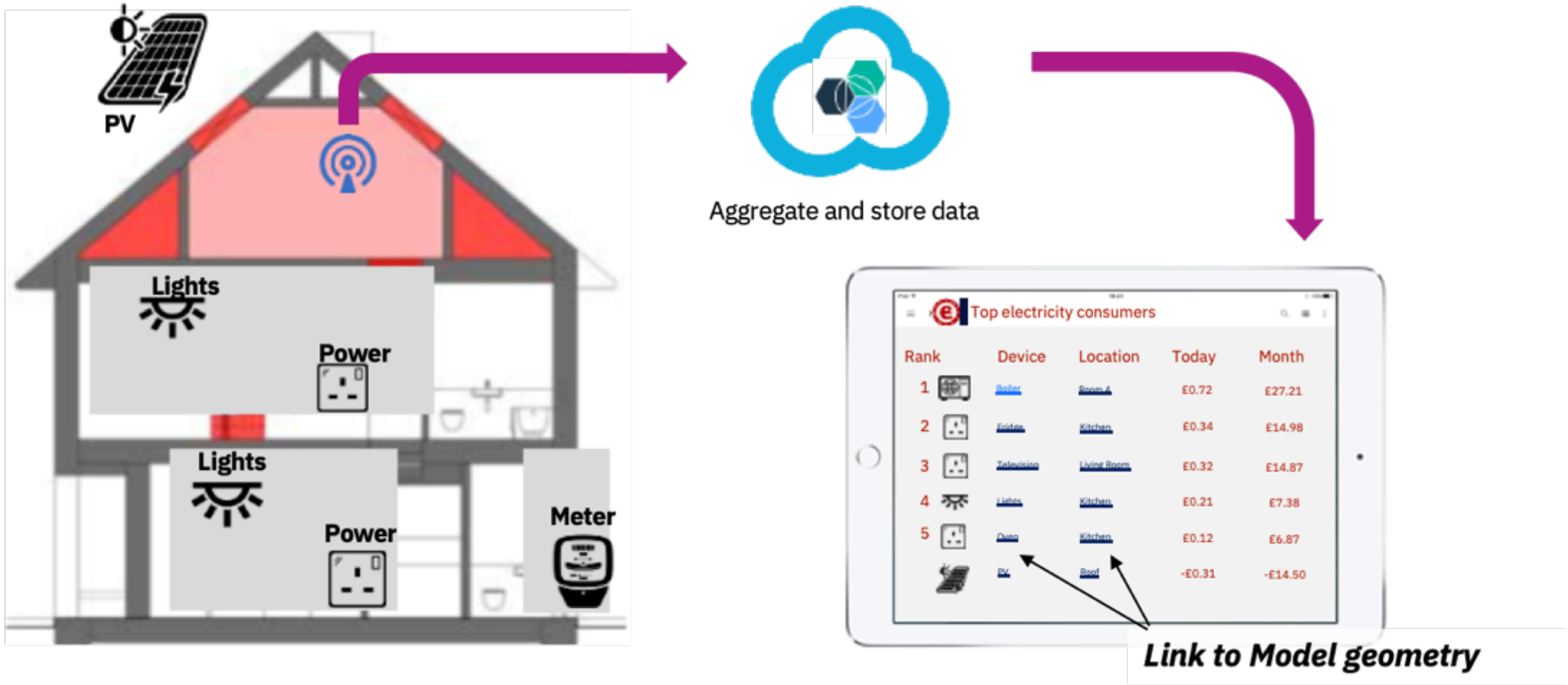
The optimise page presents cards that provide advice to the user based on data collected by the house, for example to help save money on energy bills.



The floor plan is set out to reflect the house in order to be intuitive

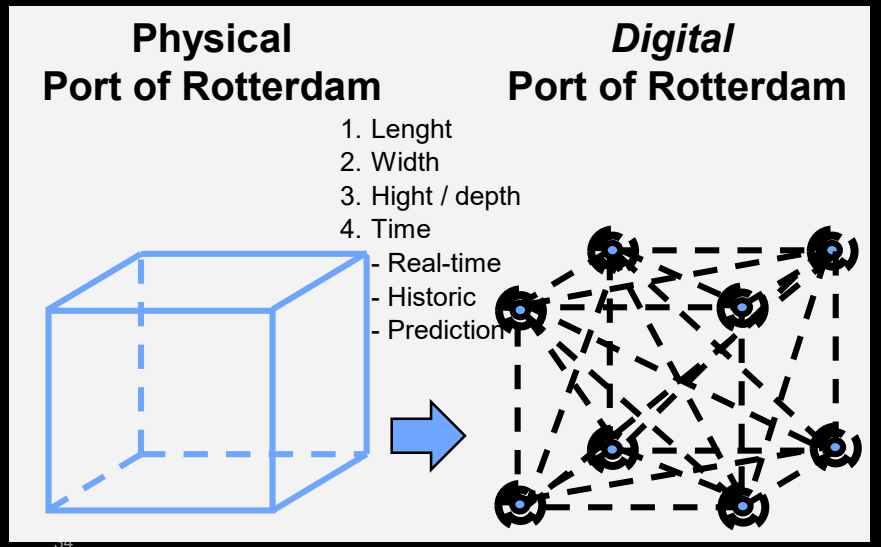
Alerts are displayed for the occupant's attention

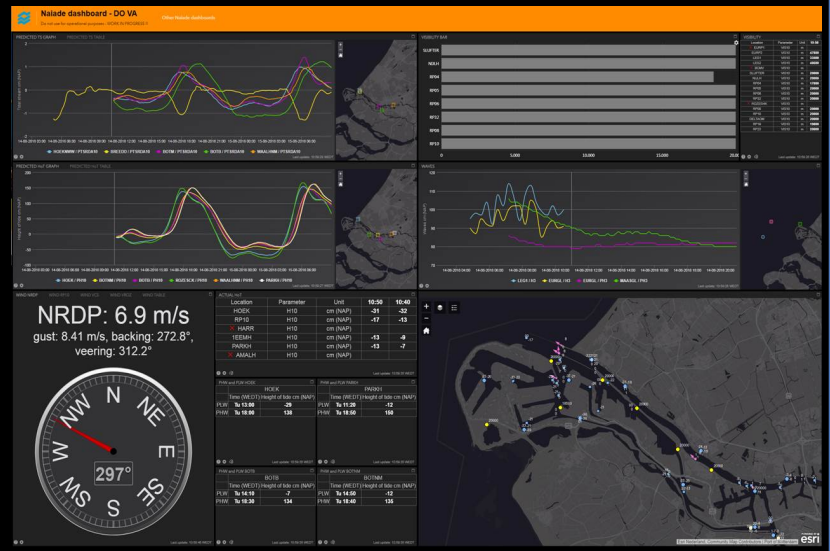
Smart Services and Predictive Maintenance



Get granular information on energy to empower people to reduce their bills

Port of Rotterdam Smart Infra: Near future are autonomous ships





PartnershipExperience

esri
IBM
CISCO

Deliver use-cases that contribute to vision, and deliver value now

First use case

Hydro/meteo

Water
Wind
Current
Salinity
Temperature
Airpressure

1 cm more depth delivers largest ships 1 mio USD per annum

Deliver and predicts near realtime

Future use cases

Improve utilisation of physical infrastructure predictive maintenance

Enlarge capacity to handle largest ships per day

Vision

Leverage solutions with Ports via global partnership

Controlled tradelane

Collaboration: Digital Platform for Infrastructure Projects

Challenges

- Fragmented data across teams, stand alone projects
- Poor information handover, no common language
- Limited collaboration and synchronization across teams and multi-tier supply chain
- Efficiency and productivity challenges

Activities and enablers

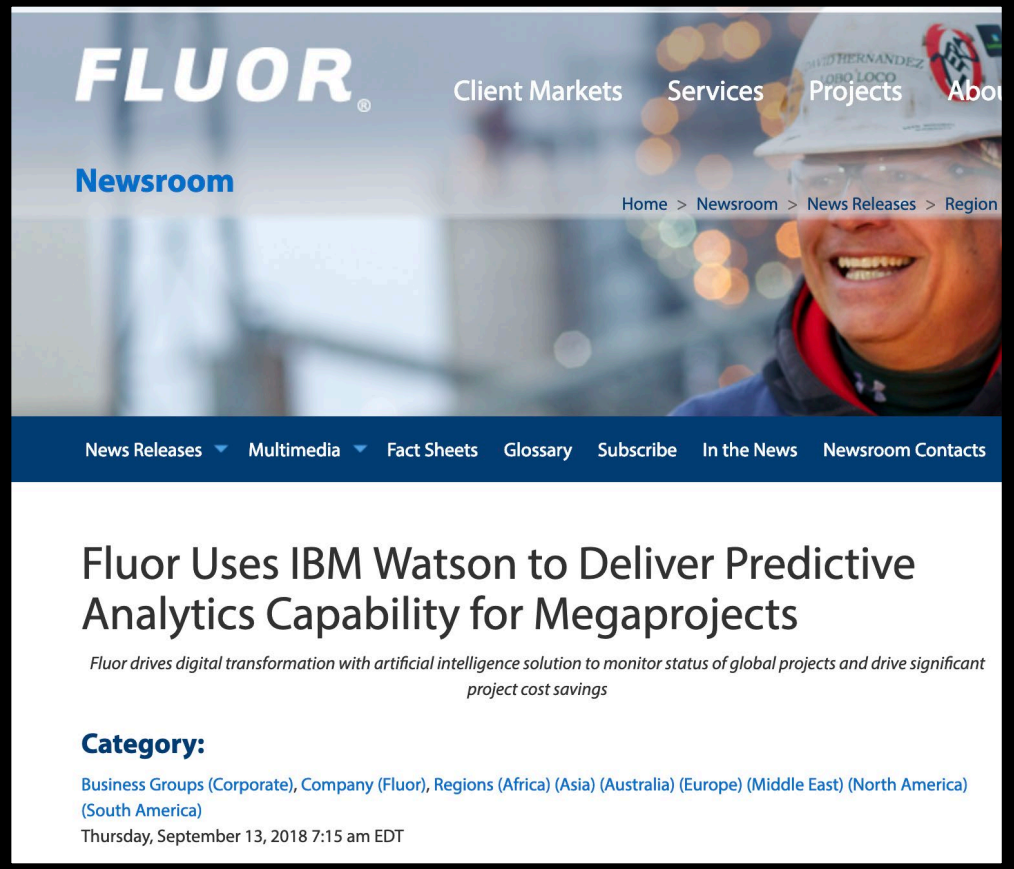
- Formulation of digital platform strategy based on collaborative ‘Through Life’ principles
- ‘Digital Plan for Works’ with information centric ways of working
- Capability to become information / digital infrastructure contractor and operator
- Solutioning and Business Case for the digital platform

Expected Results:

- 13% NPV benefits on project design and admin costs in first project, increasing at average 20% for subsequent projects
- 6% NPV savings in O&M costs, increasing 6% for subsequent projects
- Additional $5M - $20M additional revenue in O&M due to efficiencies in design and construction
- Reduction in contractual risks and change requests across project lifecycle

ferrovial

Client Use Case – Fluor & IBM: AI in Procurement & Construction



NEWS

Can artificial intelligence change construction?

As IBM's Watson adds its computational power to construction sites, tech sees an industry in need of an upgrade

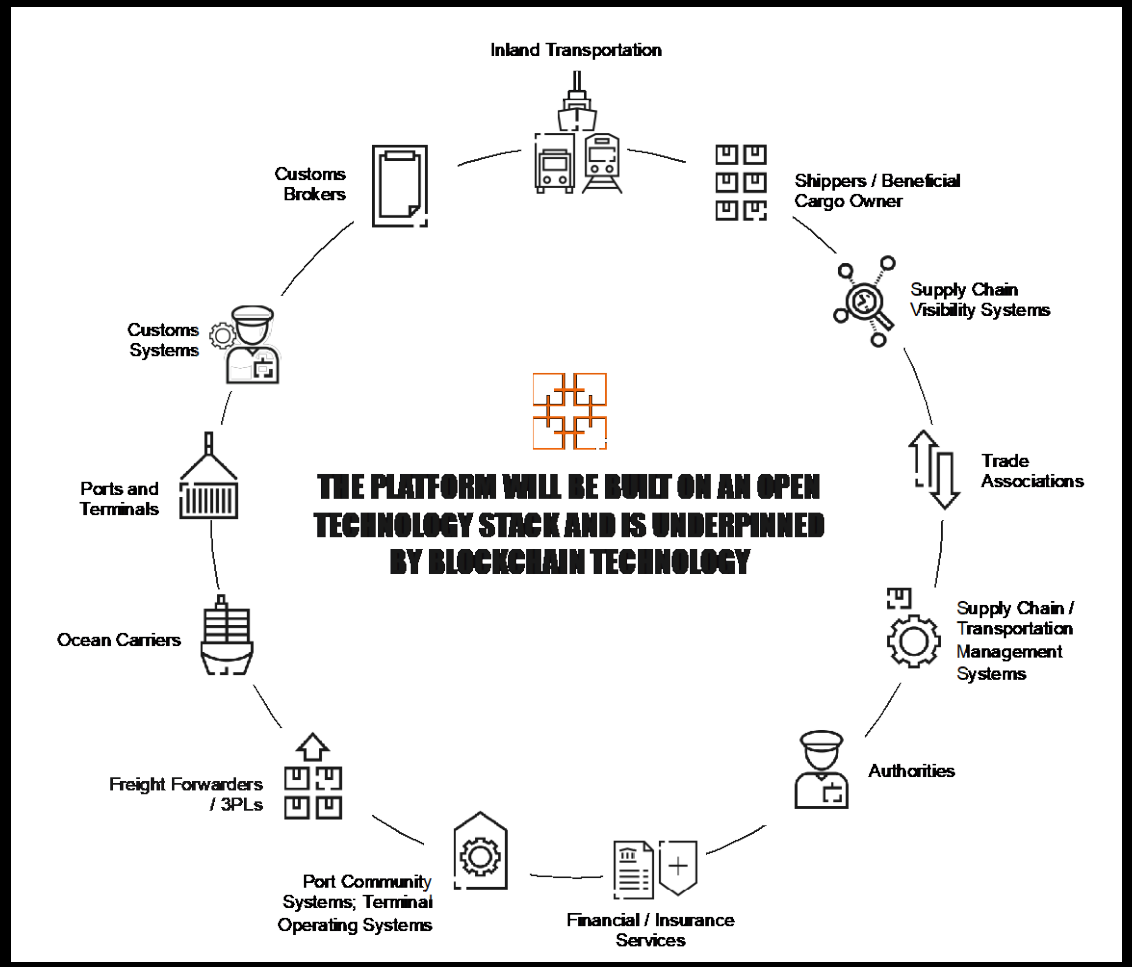
By Patrick Sisson | Oct 12, 2018, 5:23pm EDT

FLUOR®

- Improve project outcomes
- Increase margins from project execution
- Improve project management efficiency
- Competitive advantage in bidding
- Improve customer satisfaction
- Real-time market analysis and trends

Maersk and IBM Introduce Blockchain Solution

TradeLens, an open and neutral supply chain platform to transform the supply chain industry



"Industry-wide collaboration advances as more than 90 organizations participate in the global trade solution. More than 154 million events captured on the platform and growing by one million per day"

Working with an eco-system of partners

Some Examples:

Siemens

"December 14, 2016 - Siemens and IBM announced a plan to integrate IBM's Watson Analytics and other analytics tools, powered by Cognos Analytics, into MindSphere, the cloud-based Siemens operating system for the Internet of Things."

Cisco

"30 June 2016: IBM and Cisco today announced they will partner to combine the market-leading strengths of each company to transform how knowledge-workers collaborate and work."

Key takeaways

- **DATA is the oil of the industry**
- **BIM will create a common industry digital language**
- **Legislation and standards are still relevant**
- **Technology as an enabler to transformation**
- **As Built Digital Twins and AI improve and enhance the inspection and operations of assets**

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