BIM: CHANGING BEHAVIOURS TO DELIVER VALUE

PAUL WILKINSON (MD, PWCOM.CO.UK LTD) - @EEPAUL

POOR UK CONSTRUCTION INDUSTRY PERFORMANCE IS WELL DOCUMENTED:

Bossom (1934)
Simon (1944)
Philips (1948)
Emerson (1962)
Banwell (1964)
Tavistock Inst. (1966)
Potts (1967)
Wood (1975)
NEDO (1978, 1983, 1988)

Latham (1993, 1994)
RCF (1995)
Levene (1995)
CIB (1996, 1997)
Egan (1998, 2002)
NAO (2001)
Saxon (2005)
Calcutt (2007)

Construction Matters (2008)
Wolstenholme (2009)
Government construction strategies (2011, 2016, 2017)
Construction 2025 (2013)
Digital Built Britain (2015)
Farmer (2016)
Industrial Strategy (2017)

(and this is just a selective list!)

CONSTRUCTING THE TEAM

BY SIR MICHAEL LATHAM

FINAL REPORT OF THE
GOVERNMENT/INDUSTRY REVIEW OF
PROCUREMENT AND CONTRACTUAL
ARRANGEMENTS IN THE UK
CONSTRUCTION INDUSTRY

"… Partnering includes the concepts of teamwork between supplier and client, and total continuous improvement. It requires openness between the parties, ready acceptance of new ideas, trust, and perceived mutual benefit."

INTEGRATED PROJECT TEAMS – HISTORICAL CONTEXT

- *Partnering* movement – 1990s development of ideas, eg:

- Lean Thinking (Toyota)

- CRINE (Cost Reduction Initiative for the New Era)

- ACTIVE (Achieving Competitiveness through Innovation and Value Engineering)

- Construction Industry Board

- Reading Construction Forum (*Trusting the Team*)

INTEGRATED PROJECT TEAMS

- ***Egan*** "Rethinking Construction" (1998, p13)

- **integrate the process and the team around the product:** the most successful enterprises do not fragment their operations - they work back from the customer's needs and focus on the product and the value it delivers to the customer. The process and the production team are then integrated to deliver value to the customer efficiently and eliminate waste in all its forms.

The Task Force has looked for this concept in construction and sees the industry typically dealing with the project process as a series of sequential and largely separate operations undertaken by individual designers, constructors and suppliers who have no stake in the long term success of the product and no commitment to it. Changing this culture is fundamental to increasing efficiency and quality in construction.
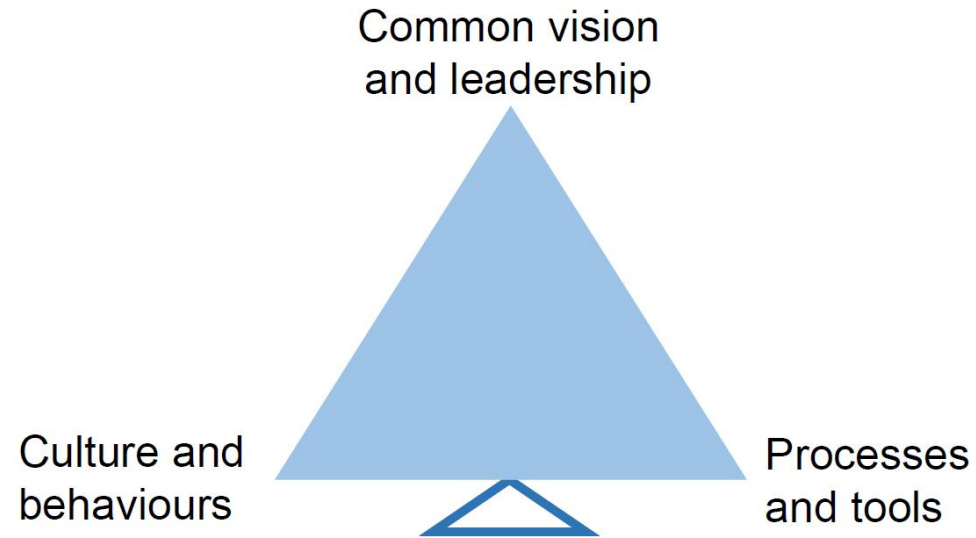
EGAN – 5 DRIVERS OF CHANGE

RETHINKING CONSTRUCTION

THE REPORT OF THE CONSTRUCTION TASK FORCE

- committed leadership
- a focus on the customer
- integrated processes and teams
- a quality driven agenda
- commitment to people

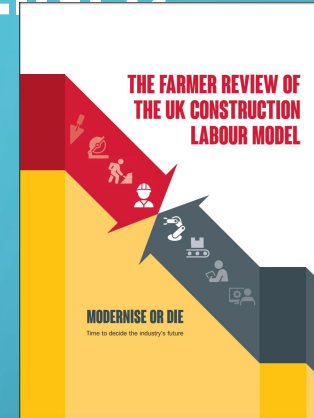## *EGAN* (AND CONSTRUCTING EXCELLENCE) – 6 CRITICAL SUCCESS FACTORS

- Early involvement

- Selection by value

- Aligned commercial relationships

- Common processes and tools

- Performance measurement

- Long-term relationships

INTEGRATED PROJECT TEAMS – HISTORICAL CONTEXT

- *Egan* movement

- developed collaborative working ideas through:

  - Movement for Innovation

  - Construction Best Practice Programme

  - Construction Clients Charter

  - Building Down Barriers, Prime Contracting

  - Partnering contracts

  - KPIs, toolkits

  - **And the net impact of all these ideas….?**

WHY HAS CONSTRUCTION PRODUCTIVITY FLATLINED?

- "**fragmented transactional and risk transfer interfaces**, lack of early well-defined client briefs, a propensity for clients to change their requirements late in the process, design – procurement – construction process separation, and large scale industry re-working and defects rectification." (**Farmer**, 2016)

- **Inertia** (industry culture still strongly contractual / adversarial / lowest price)

- **Lack of innovation** (low appetite for R&D)

- **Under-investment in IT** = low digitisation

- Result:

- Poor industry performance (time, cost, quality, fitness for purpose, reputation)

The MGI Industry Digitization Index

2015 or latest available data

Relatively low digitization → Relatively high digitization

● Digital leaders within relatively undigitized sectors

Sector	Overall digitization[1]	Assets		Usage				Labor			GDP share %	Employment share %	Productivity growth, 2005–14[2] %
		Digital spending	Digital asset stock	Transactions	Interactions	Business processes	Market making	Digital spending on workers	Digital capital deepening	Digitization of work			
ICT											5	3	4.6
Media											2	1	3.6
Professional services											9	6	0.3
Finance and insurance											8	4	1.6
Wholesale trade											5	4	0.2
Advanced manufacturing											3	2	2.6
Oil and gas											2	0.1	2.9
Utilities											2	0.4	1.3
Chemicals and pharmaceuticals											2	1	1.8
Basic goods manufacturing											5	5	1.2
Mining											1	0.4	0.5
Real estate	●										5	1	2.3
Transportation and warehousing	●										3	3	1.4
Education	●										2	2	-0.5
Retail trade	●										5	11	-1.1
Entertainment and recreation											1	1	0.9
Personal and local services											6	11	0.5
Government	●										16	15	0.2
Health care											10	13	-0.1
Hospitality	●										4	8	-0.9
Construction											3	5	-1.4
Agriculture and hunting											1	1	-0.9

3 Service sectors with long tail of small firms having room to digitize customer transactions

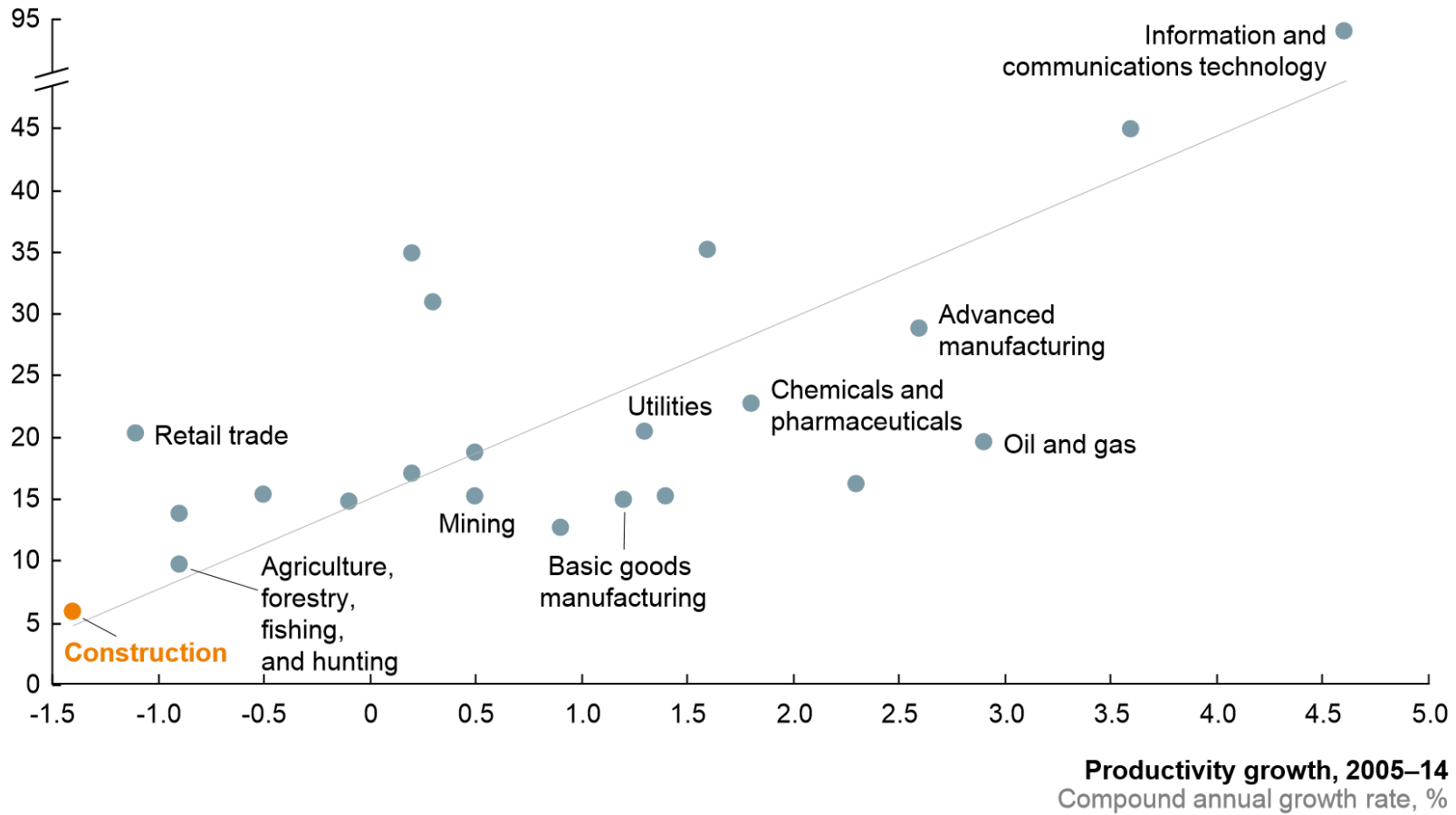**5** Labor-intensive sectors with the potential to provide digital tools to their workforce

6 Quasi-public and/or highly localized sectors that lag across most dimensions

Mckinsey Global Institute (December 2015)
Digital America: A tale of the haves and the have-mores

The MGI Industry Digitisation Index for Europe

2015 or latest available data

Relatively low digitisation — Relatively high digitisation

● Digital disruptors within relatively less-digitized sectors

Sector	Overall digiti-sation	Assets		Usage			Labour			Share of value added, 2013[1] %	Share of employ-ment, 2015[2] %
		Digital spending	Digital asset stock	Digital transactions	Digital interactions	Digitised business processes	Digital spend per worker	Digital capital deepening	Digitisation of work		
ICT										4.5	2.7
Media					①					1.2	1.1
Finance and insurance										5.4	3.0
Professional services										6.3	6.0
Wholesale trade										6.5	5.3
Advanced manufacturing										4.4	4.2
Chemicals and pharmaceuticals										1.9	2.3
Utilities			②							2.3	1.0
Oil and gas					④					0.2	0.1
Basic goods manufacturing										8.1	7.8
Mining										0.8	0.4
Real estate	●									12.1	1.0
Transportation and warehousing	●									5.0	5.2
Retail trade	●			③						4.4	8.8
Personal and local services										6.3	7.8
Government	●							⑤		6.5	7.1
Education	●									5.3	7.7
Health care	●									7.4	11.1
Entertainment and recreation	●									1.3	1.7
Hospitality										3.0	4.7
Agriculture			⑥							1.7	4.2
Construction										5.3	6.8

③ Service sectors with long tail of small firms having room to digitize customer transactions

⑤ Labor-intensive sectors with the potential to provide digital tools to their workforce

⑥ Quasi-public and/or highly localized sectors that lag across most dimensions

Mckinsey Global Institute (June 2016)
Digital Europe: Pushing the Frontier, Capturing the Benefits.

Lower digitization in construction relative to other industries has contributed to the productivity decline

Digitization index[1]
%

Information and communications technology

Advanced manufacturing

Chemicals and pharmaceuticals

Utilities

Oil and gas

Retail trade

Mining

Basic goods manufacturing

Agriculture, forestry, fishing, and hunting

Construction

Productivity growth, 2005–14
Compound annual growth rate, %

McKinsey Global Institute (2017) Reinventing Construction: A route to higher productivity.

The global construction sector is large and growing...

12% of world GDP in 2012

13.5% by 2025

Global construction software 2012 TAM
$6bn

... yet, it has among the lowest IT spending penetrations

Industry	IT Spending (%)
Banking and financial services	6.0%
Education	4.7%
Professional services	4.5%
Pharmaceuticals, life sciences and medical products	3.3%
Insurance	3.1%
Transportation	3.1%
Industrial electronics and electrical equipment	2.7%
Utilities	2.5%
Consumer products	2.0%
Retail and wholesale	1.4%
Food and beverage processing	1.2%
Construction, materials and natural resources	1.2%
Energy	0.7%

IT Spending as a % of Revenue by Industry

DIGITISING CONSTRUCTION

Moved from …	To…
Type-writer	word processing
Postal correspondence, faxes	email
Analog photography (film)	digital photography
Audio/video tapes	MP3/4s, .MOV, .WAV etc
Financial ledgers	Excel, accounting software, ERP
Manual drafting	CAD* BIM

*BS1192 first published in 1998

Online AEC collaboration (c. 2000s)

Online file management
- Single central repository
- Fewer interoperability issues
- Less paper
- Latest information
- Complete project record
- Full information audit trail
- Greater re-use of information

But ...
- nearly all still 2D
- email often used instead

'DISRUPTIVE' TECHNOLOGY TRENDS

- **Cloud - SaaS**
- **Mobile**
- **Web 2.0**
- **Reality capture**
- **Building information modelling (BIM)**
- Starting … **Web 3.0** – the semantic web
  - The 'internet of things'
  - Data – linked, open, 'Big'

ONGOING CHANGE
SINCE LATE 1990S

CLOUD –
PERCEPTIONS
CHANGING

MOBILE DISRUPTION

- Gradual change since mid 2000s

- Gathered momentum since 2007

  - Apple iPhone, Android, Blackberry

  - Smartphone to tablet (c. 2010)

  - Move from stand-alone apps to mobile tools integrated with enterprise solutions

  - Growing demand for 'Cloud' (public and private), and for corporate mobile access to real-time business data (BI)

Social Disruption

REALITY CAPTURE DISRUPTION

- Laser-scanning (static + drones)
  - Point clouds (with cloud-based management)

- Photogrammetry

- 360-degree photography (eg: Holobuilder, Matterport)

- 2D data transformation ("RetroBIM")

- Virtual Reality

- Augmented Reality
  - eg Google ARCore (formerly Tango)

GEOSPATIAL DISRUPTION

- Location intelligence

- *"Integration of BIM and GIS is a good place to start connecting BIM and Smart Cities"*

Impact-likelihood matrix of new technologies

Likelihood axis (vertical): Extremely likely — Somewhat likely — Not likely

Impact axis (horizontal): No impact — Some impact — Extremely high impact

- Integrated BIM
- Prefabricated building components
- Wireless monitoring (IoT)
- 3D laser scanning
- Drones
- Augmented reality
- Advanced project-planning tools
- Real-time mobile collaboration
- New active materials
- Advanced building materials
- Big data analytics
- 3D printing of components
- Self-healing materials
- Contour crafting of buildings

from *Shaping the Future of Construction*, World Economic Forum/The Boston Consulting Group (2016)

Nov 2010

Spring 2011

BIM IS NOT A TECHNOLOGY - IT IS A COLLABORATIVE PROCESS SUPPORTED BY PEOPLE AND TECHNOLOGY

- Stage 0: Strategy

- Stage 1: Brief

- Stage 2: Concept

- Stage 3: Definition

- Stage 4: Design

- Stage 5: Build and commission

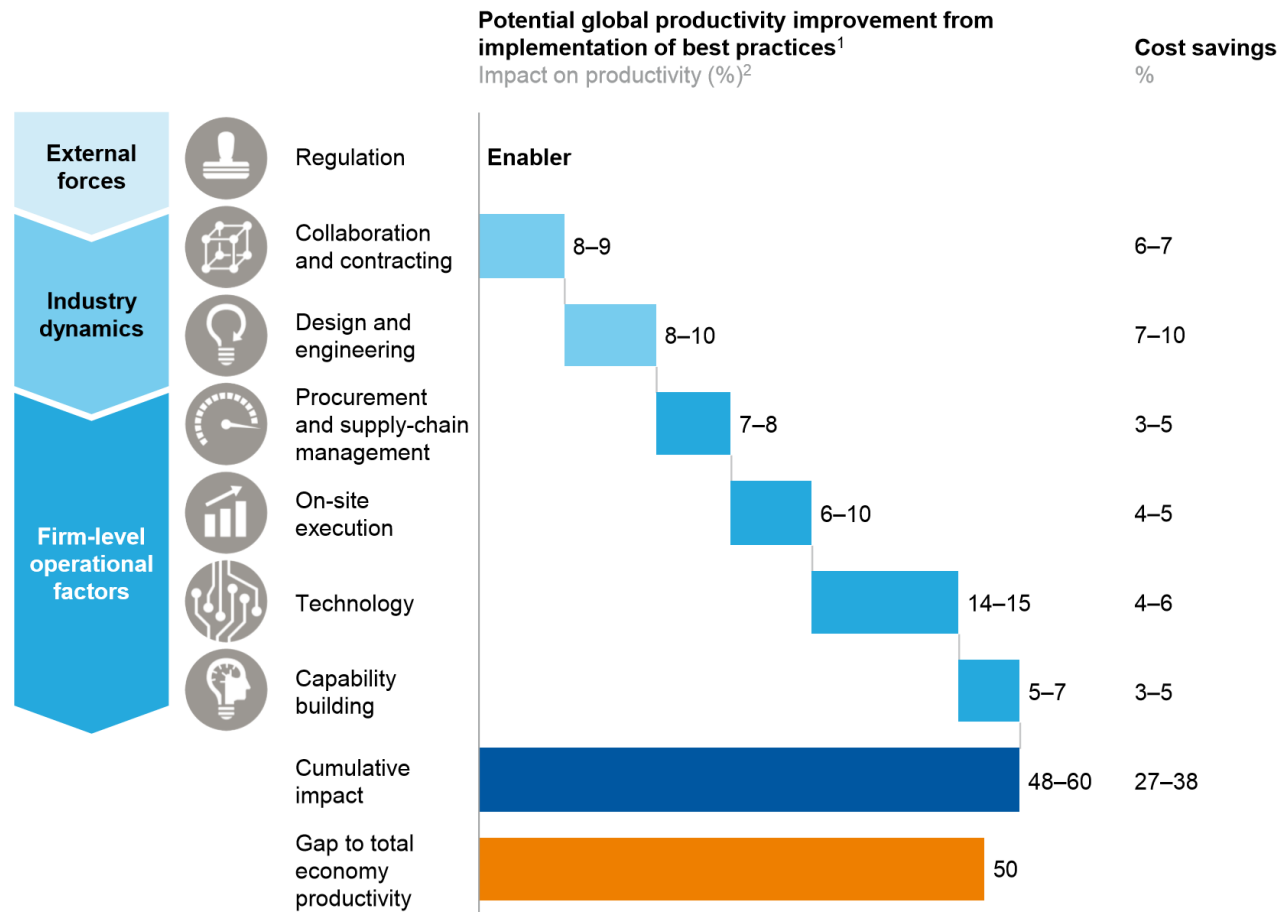- Stage 6: Handover and close-out

- Stage 7: Operation and end-of-life
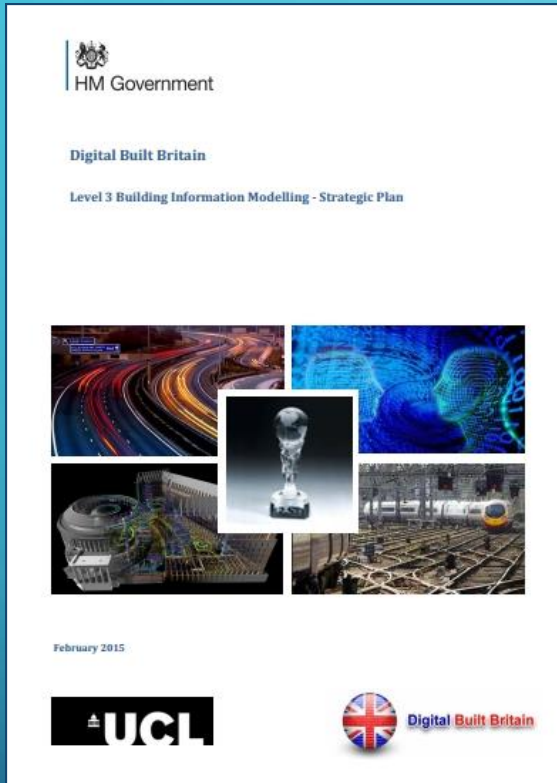
BIM IS A PROCESS SUPPORTED BY PEOPLE AND TECHNOLOGY.

THEREFORE, CHANGE IS NEEDED IN INDUSTRY STRUCTURES AND PROCESSES

Construction can catch up with total economy productivity by taking action in seven areas

Cascading effect
Regulation changes facilitate shifts in industry dynamics that enable firm-level levers and impact

Potential global productivity improvement from implementation of best practices[1]
Impact on productivity (%)[2]

Cost savings
%

		Impact on productivity (%)	Cost savings %
External forces	Regulation	Enabler	
Industry dynamics	Collaboration and contracting	8–9	6–7
	Design and engineering	8–10	7–10
Firm-level operational factors	Procurement and supply-chain management	7–8	3–5
	On-site execution	6–10	4–5
	Technology	14–15	4–6
	Capability building	5–7	3–5
	Cumulative impact	48–60	27–38
	Gap to total economy productivity	50	

Digital Built Britain (February 2015)

Actions needed to address:

- Delivery mechanisms

- Commercial

- Technical

- **Cultural**

- Research requirements

- "a ten-year programme" – Mark Bew

Digital Built Britain (February 2015)

Figure 2 – Business Change Model

CONSTRUCTION 2025 (JULY 2013)

Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

INDUSTRIAL STRATEGY (NOVEMBER 2017)

HM Government

Industrial Strategy
Building a Britain fit for the future
November 2017

INDUSTRIAL STRATEGY

Lower costs
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reduction in the initial cost of construction and the whole life cost of built assets

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reduction in the trade gap between total exports and total imports for construction products and materials

"work to ensure construction projects ... are procured and built based on their whole life value, rather than just initial capital cost."

INTEGRATED PROJECT TEAMS – PROCUREMENT

- Project partnering

- Strategic partnering (alliancing)

- Prime contracting / Building Down Barriers

- New models of procurement
  - Two Stage Open Book
  - Cost Led Procurement
  - Integrated Project Insurance (insurance-backed alliancing)

INTEGRATED PROJECT TEAMS – ALLIANCING

INTEGRATED PROJECT TEAMS – ALLIANCING

- In complex delivery environments, many alliances have been shown to deliver significantly better outcomes than more traditional contractual arrangements.

- To ensure success an emphasis has to be placed on the **behavioural** aspects of both the organisations and individuals involved.

- The organisations involved in an alliance need to be highly **integrated**, including the client.

- Effective alliances depend on committed and visible client and delivery team **leadership** to drive change and performance.

- **Commercial** models that reward the delivery of agreed outcomes and drive the required behaviours deliver the best results.

INTEGRATED PROJECT TEAMS – ALLIANCING

ANGLIAN WATER AND THE @ONEALLIANCE

A 15,000 POPULATION WASTEWATER TREATMENT PLANT IN CAMBRIDGE WORTH £11M WAS DELIVERED FOR 20% LESS COST AND 45% LESS CARBON. "THE PARTICULAR CHALLENGE FOR THIS JOB WAS TO GO FROM CONSTRUCTION TO OPERATION IN 12 MONTHS, THEY ACTUALLY DID IT IN LESS THAN 9 MONTHS…."

Existing Member

email address

password

Login

Forgot password?

@one AllianceSCOPE
Supply Chain Online Procurement Engagement

Home | Work Opportunities | Find a Subcontractor | Partners & Buyers | Action Board | FAQs | News | Contact Us

My Space [-]
- Buy and sell materials
- Change my details/password
- Update my organisation accreditations & memberships
- Work opportunities
- Search work opportunities

Do You Want To...? [-]
- Ask admin

Welcome to the @one Alliance website

...more...

The relationship between the members is defined in a comprehensive agreement which also sets out contractual obligations. The @one Alliance is overseen by a Board of directors comprising representatives from each organisation. The Board's purpose is to provide strategic direction to the @one Alliance and coordinate its activities with those of their home organisations.

AMP6 KEY BUSINESS PLAN TARGETS FOR THE @ONE ALLIANCE
- *Accident and Incident Frequency Rate*
- *No accidents, no incidents and no pollutions*
- *Totex Delivery Index – including efficiency expenditure and outputs*
- *Customer satisfaction*
- *Community engagement - commitments delivered*
- *Waste reduction – zero waste: right first time, every time*
- *Carbon – further reduction in embodied and operational carbon*
- *To be an employer of choice*
- *A drive to reduce the DM0 to DM4 timescales by 50% alongside a drive to reduce the DM3 to DM4 timescales by 50%.*
- *Commercial performance – minimum £293M efficiency savings against the FBP*

THE AMP6 INITIATIVES THAT WILL DELIVER THESE TARGETS::
- BENEFIT BY DESIGN - where intelligent PLM designs are standardised to enable assembly with the benefit of reducing design time.
- COMMERCIAL - implementing the new commercial model providing a reduction of overhead and increased levels of commercial rigour across the commercial and delivery teams.
- CUSTOMER - development of improved customer processes and culture.
- INDUSTRIALISED CONSTRUCTION - focus on increasing the efficiency of delivery and time on site targeting a 50% reduction.
- PEOPLE - providing an organisational environment that enables the initiatives to be delivered and embedded.
- PRODUCTION - generation of a continuous improvement framework covering all @one Alliance activities and delivering underlying improvements in reliability and productivity.
- PROGRAMME MANAGEMENT - where an agreed forward works programme is made visible at a sufficiently early stage to improve delivery strategies, procurement and productivity.
- SUSTAINABLE PROCUREMENT - where additional Framework contracts are developed and where closer and increasingly incentivised relations with the supply chain are formed.

INTEGRATED PROJECT INSURANCE

INTEGRATED PROJECT INSURANCE

Construction All Risks
Public Liability
Latent Defects
Financial Loss

One Team - Seamless Cover
2014 © Integrated Project Initiatives Ltd

- collectively insures the client and all other Alliance partners: consultants, specialists, manufacturers, construction managers and their supply chains.

- replaces liability-driven professional indemnity insurance with financial loss cover where the outturn cost above the target cost plus pain-share is insured.

INTEGRATED PROJECT INSURANCE

- Cost savings targeted: 15% - 20%
- Other key success criteria:
  - Programme certainty at below Target Cost
  - Highly efficient methods, including off-site manufacturing where best for project, and new methods of construction, eliminating waste in materials, processes and procedures
  - Leading BIM methods and technologies from commencement
  - Flexibility of the facility to be remodelled to meet future changes in demands and training methods

GROUP WORK

COMPETENCE = KNOWLEDGE + SKILL + BEHAVIOUR

- For example, sales competence is made possible by knowledge of the industry, the customer and the company, together with the skills of listening and communicating, and the behaviours of professionalism and initiative.

FIGURE 7.10 Key sales attributes

Knowledge	Skill	Behaviour
Market Environment	Listening	Professionalism
Company Proposition	Questioning & Probing	Commitment
Competitive Positioning	Communicating & Presenting	Initiative
Company Procedures	Trading Value & Negotiating	Tenacity
	Closing	Self-motivation
	Analysing & Planning	Diligence
		Desire
		Energy & Enthusiasm

DEFINE…

- **Knowledge** – what information I have about a subject

- **Skills** – using what I know in a situation

- **Behaviours** – the way I use my skills - what you see me do

SOME DESIRABLE BEHAVIOURS

- **Co-ordination**

  - avoid gaps and overlap in team members work

- **Co-operation**

  - obtain mutual benefit by sharing work

- **Collaboration**

  - achieve results which could not be accomplished alone

COLLABORATIVE LEADERSHIP

- **Behaviour**

  - **Redefining success**. From narrow agendas to bigger goals

  - **Involving others.** From autocratic to inclusive decision making

  - **Being accountable.** From blaming to taking responsibility

- **What it means**

  - Collaborative leaders redefine success and **focus on goals bigger than their own narrow agendas**. They seek common ground, look for pragmatic solutions, and compromise

  - Collaborative leaders involve others in decision making and **exhibit an open mind** to alternative divergent views, dialogue and working with others

  - Collaborative leaders **hold themselves accountable** and also demand accountability from others

NEW WAYS OF WORKING?

- Suppliers increasingly focus on value-adding business outcomes: '**assets-as-a-service**' backed by data (eg: 'illumination', not light fittings)

- More 'whole asset life-cycle' data-connected approaches (the '**digital twin**')

- Rationalised, more integrated and collaborative supply chain organisations (vertical industry specialists – joined by data)

- Construction = data-driven, leaner, safer, lower carbon ... more automated, more 'sophisticated manufacturing'

IT'S NOW OR NEVER….

- "The current pace and nature of technological change and innovation in wider society is such that unless the industry embraces this trend at scale, it will miss the greatest single opportunity to improve productivity and offset workforce shrinkage." *(p.09)*

ADAPT, EVOLVE (OR DIE?)

As the digital frontier expands, there is constant pressure to **adapt and evolve**

Companies
- Create new digital business models, and accelerate digital interactions with customers and suppliers
- Prioritise a handful of initiatives to exploit the biggest opportunities
- Be continuously vigilant to spot new technologies, startups, and disruptions
- Leverage new collaborative models such as data-sharing initiatives, crowdsourcing, and virtual collaboration
- Put digital tools in the hands of employees to ramp up productivity

Governments
- Promote the standardisation of telecom networks, regulation standards, and the logistics of e-commerce to create a single digital market
- Increase the flow of venture capital funding
- Promote free flow of data initiatives
- Make digital skills a core part of education curricula
- Develop targeted programmes to fill critical talent shortages such as data scientists

The Digital Single Market could add **€375 billion–415 billion per year to annual GDP** by 2022, and by 2025, digitisation of companies and industries could add **€2.5 trillion to European GDP**

Mckinsey Global Institute (June 2016) Digital Europe: Pushing the Frontier, Capturing the Benefits.

A dysfunctional industry

THE FARMER REVIEW OF THE UK CONSTRUCTION LABOUR MODEL

MODERNISE OR DIE
Time to decide the industry's future

SYMPTOMS

The critical symptoms of failure and poor performance have been identified in this review as:

- Low Productivity
- Low Predictability
- Structural Fragmentation
- Leadership Fragmentation
- Low Margins, Adversarial Pricing Models & Financial Fragility
- A Dysfunctional Training Funding & Delivery Model
- Workforce Size & Demographics
- Lack of Collaboration & Improvement Culture
- Lack of R&D & Investment in Innovation
- Poor Industry Image

The construction business model is broken!

more disruptions

change the industry

THE FARMER REVIEW OF THE UK CONSTRUCTION LABOUR MODEL

MODERNISE OR DIE

Time to decide the industry's future

"... changing commissioning trends from traditional to pre-manufactured approaches"

"... producing talent which is appropriate for a digitally enabled world..."

break the silos

THE FARMER REVIEW OF
THE UK CONSTRUCTION
LABOUR MODEL

MODERNISE OR DIE
Time to decide the industry's future

"Industry-wide adoption of digitisation through … BIM … is predicated on collaboration. BIM … only functions fully if traditional design and construction barriers are broken down…"

"The culture of 'data silos' within the industry needs to be broken…."

SMART targets

Lower costs
33%
reduction in the initial cost of construction and the whole life cost of built assets

Faster delivery
50%
reduction in the overall time, from inception to completion, for newbuild and refurbished assets

Lower emissions
50%
reduction in greenhouse gas emissions in the built environment

Improvement in exports
50%
reduction in the trade gap between total exports and total imports for construction products and materials

HM Government

Industrial Strategy: government and industry in partnership

Construction 2025

July 2013

Q3 2013

new ways of thinking

Digital Built Britain — Level 3 Building Information Modelling - Strategic Plan, HM Government, February 2015

new ways of doing things

new ways of thinking

new business models

the DIGITAL economy

new business relationships

new institutions

new performance metrics
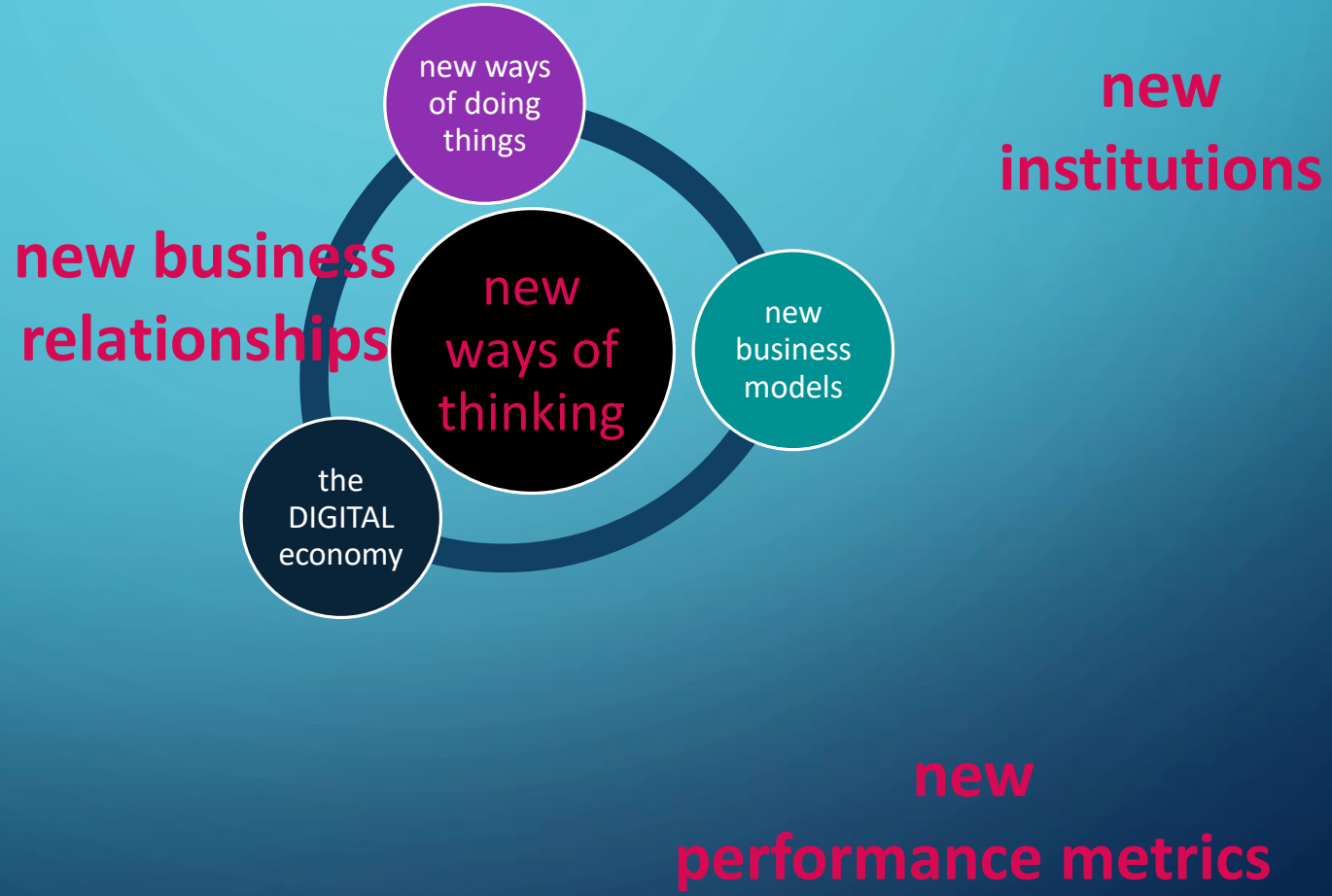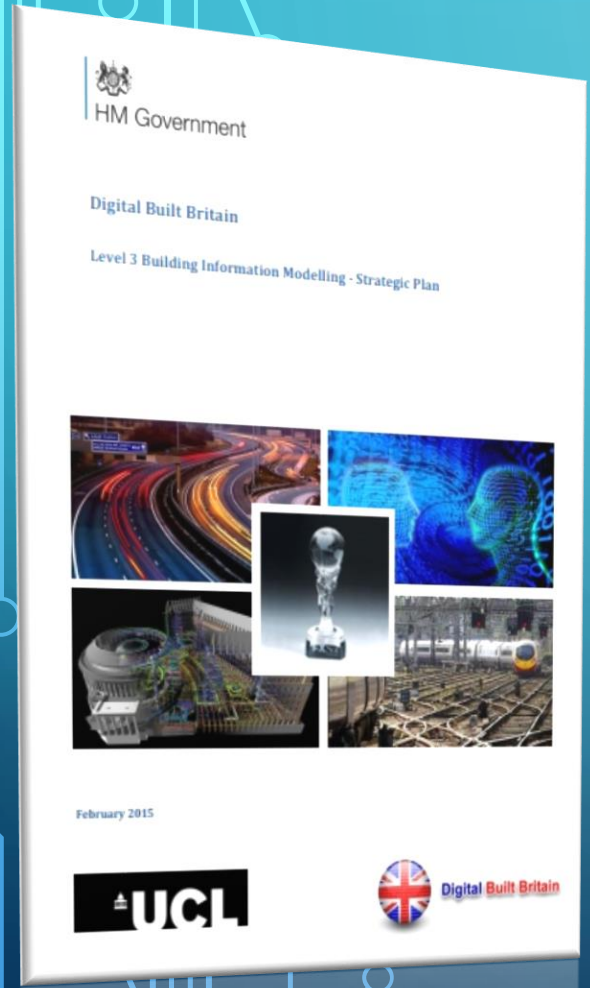
Q1 2015

the DIGITAL drive
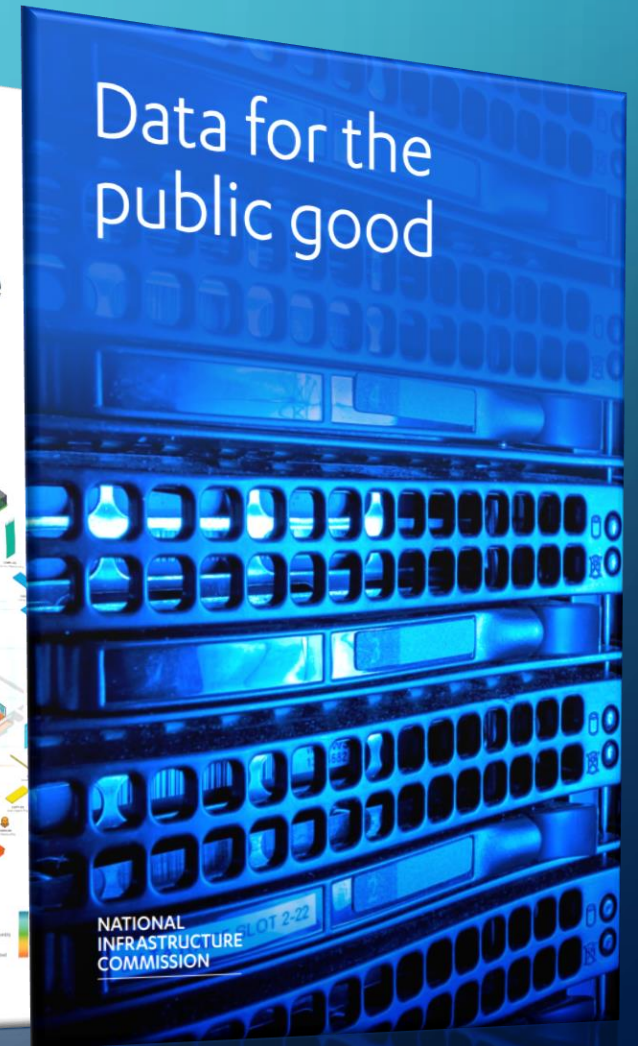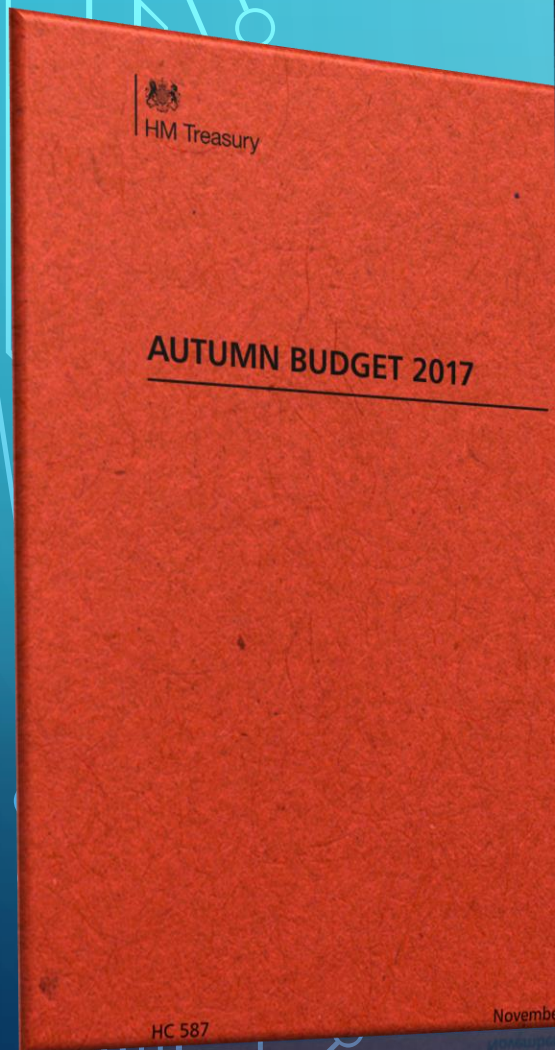
Q4 2017

not only about digitisation
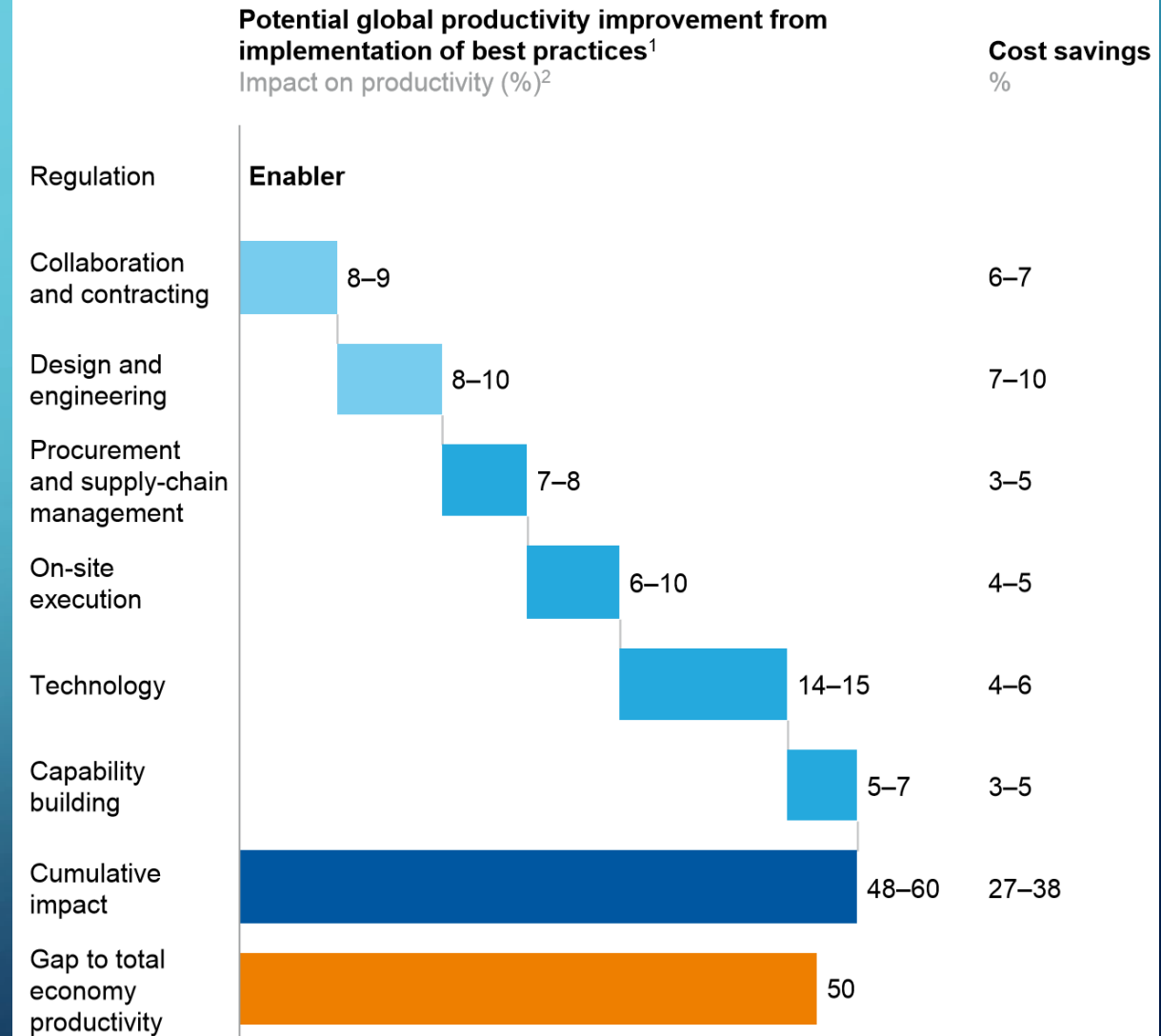
the deal
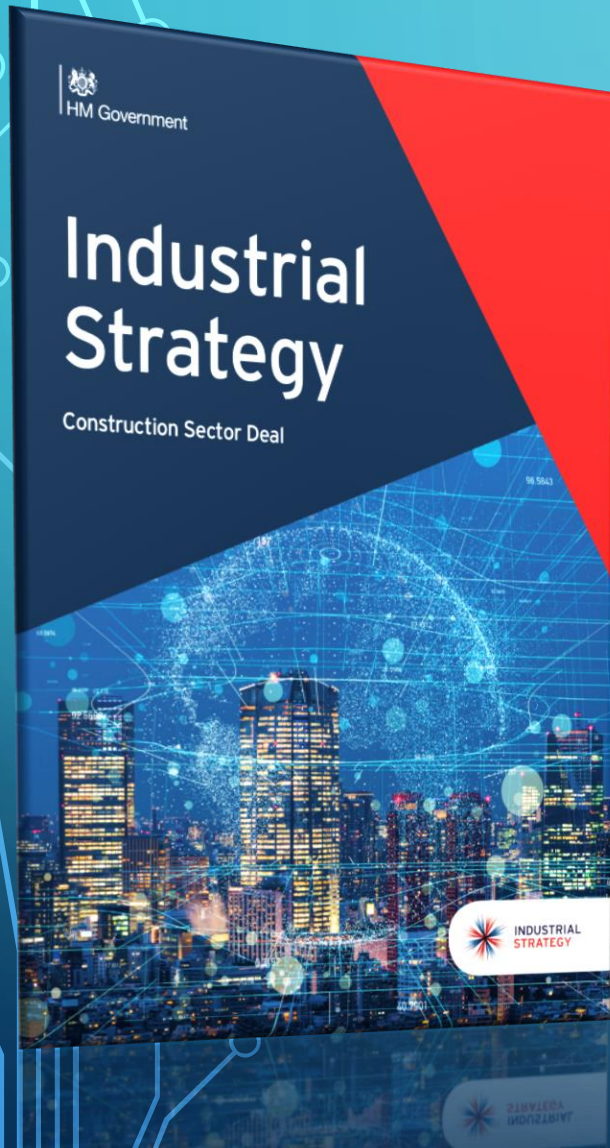
Construction Sector Deal (July 2018)

STRATEGIC areas

1. Digital Techniques

2. Offsite Manufacturing

3. Whole Life Performance

Offsite, DfMA
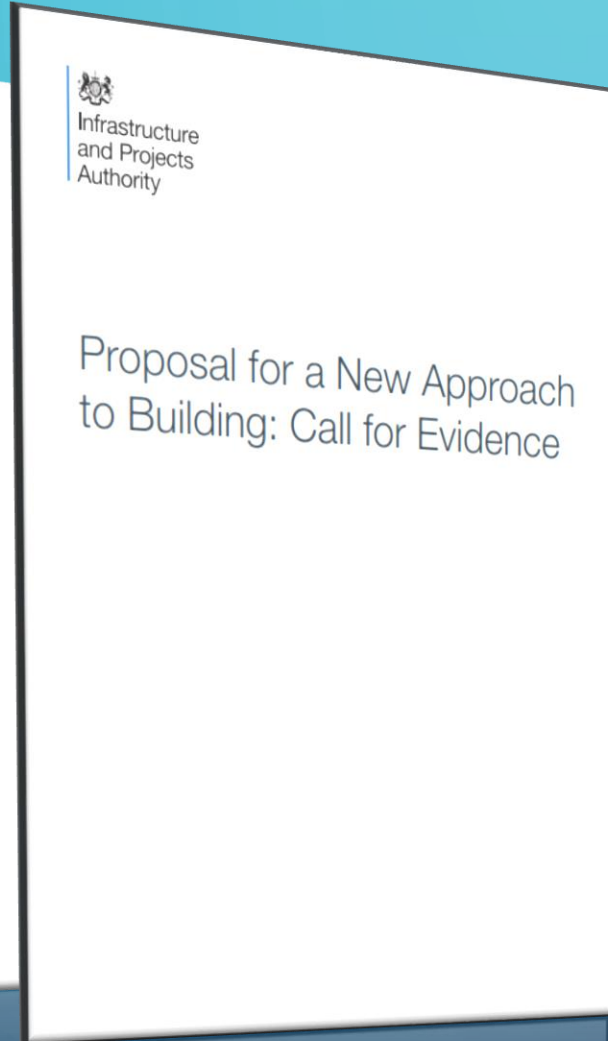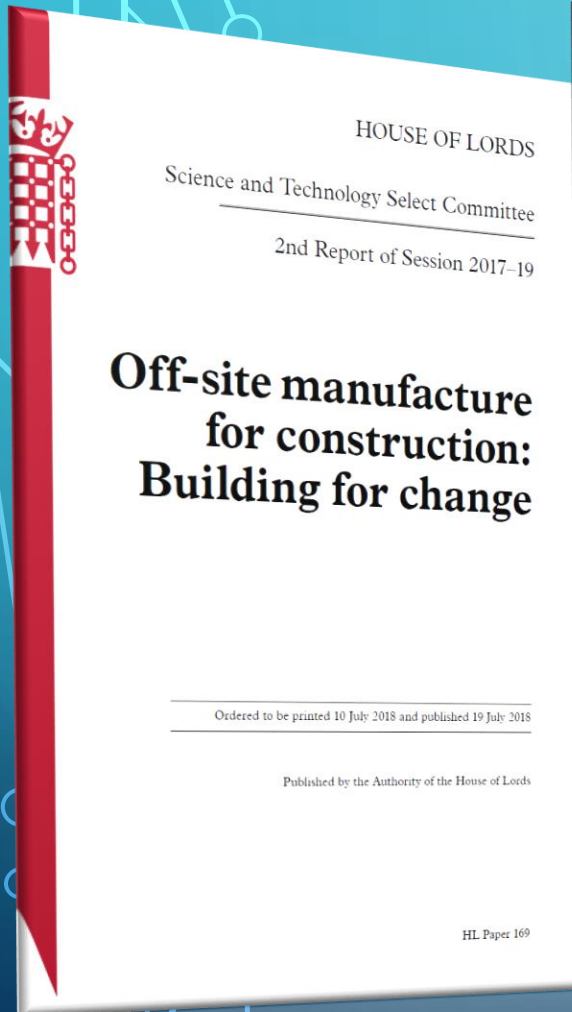
Platform approach to Design for Manufacture and Assembly (P-DfMA)

Three principles:
1. Design for manufacture
2. Use a platform approach
3. Open for manufacture, use and procurement

rules-based design tools
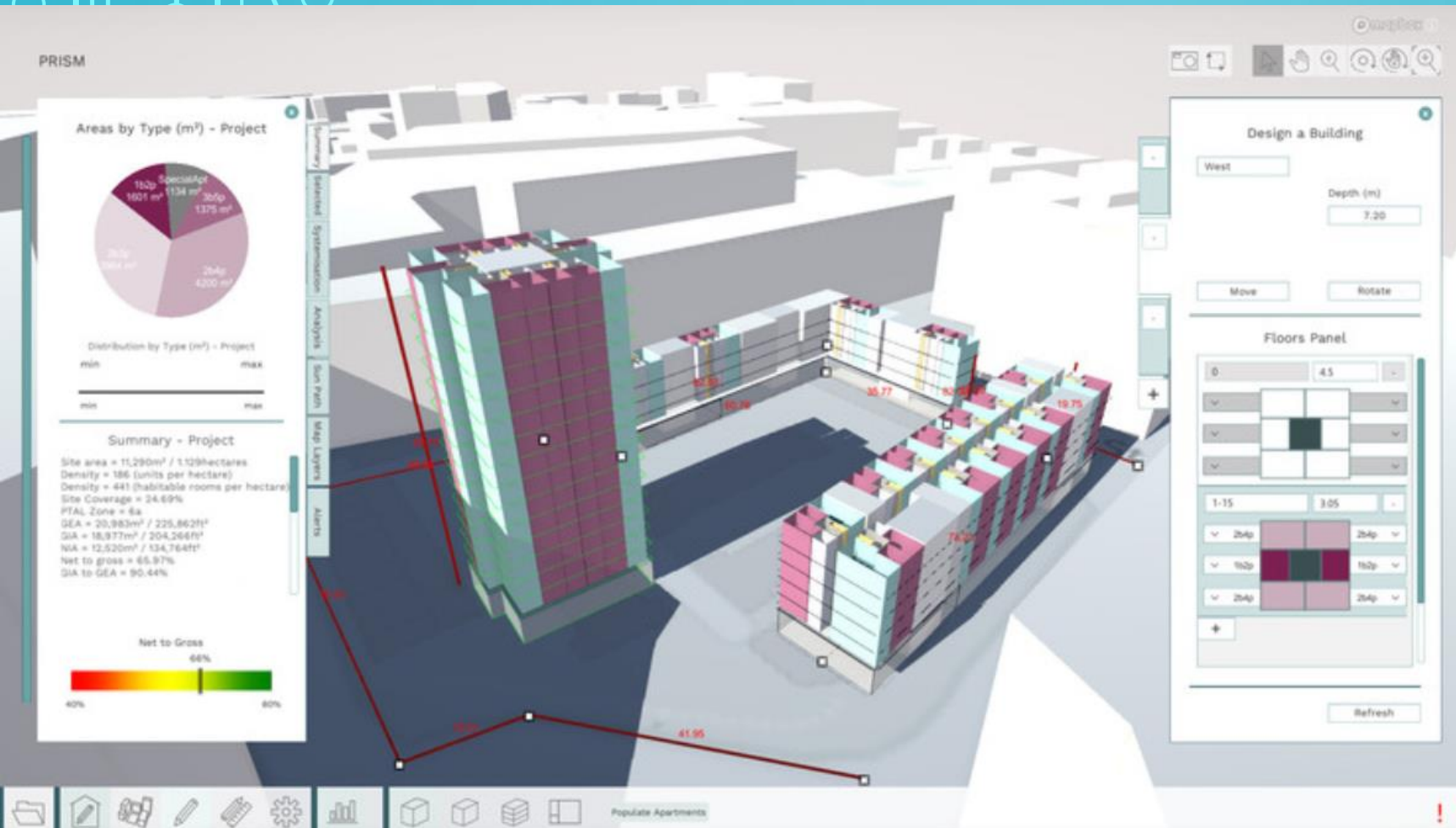
PRISM

- Launched July 2019
- Open-source software free for anyone to use
- Bryden Wood, CAST, Mayor of London.

Digital dashboard delivering data for better design.
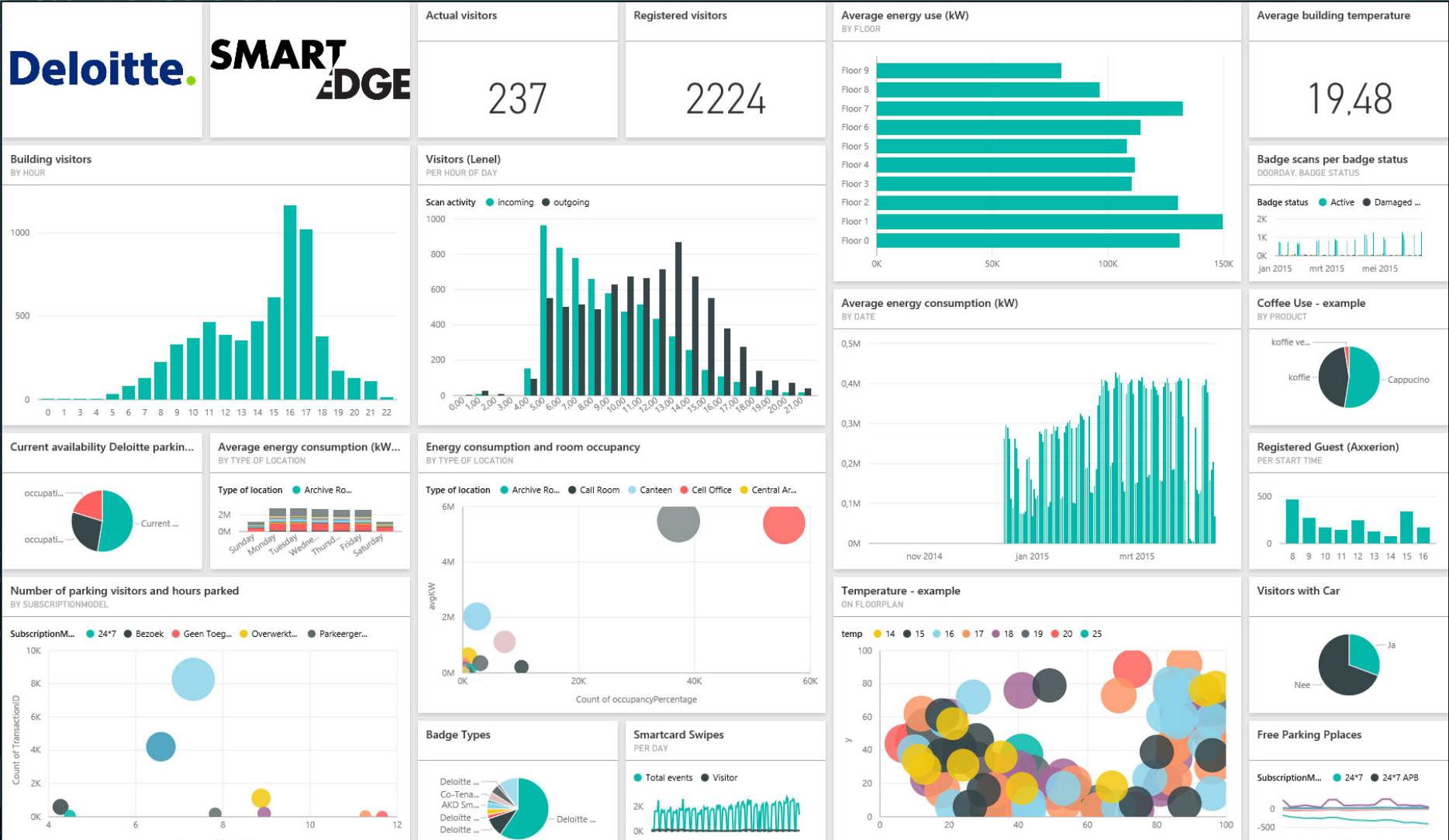
digitally enabled decisions
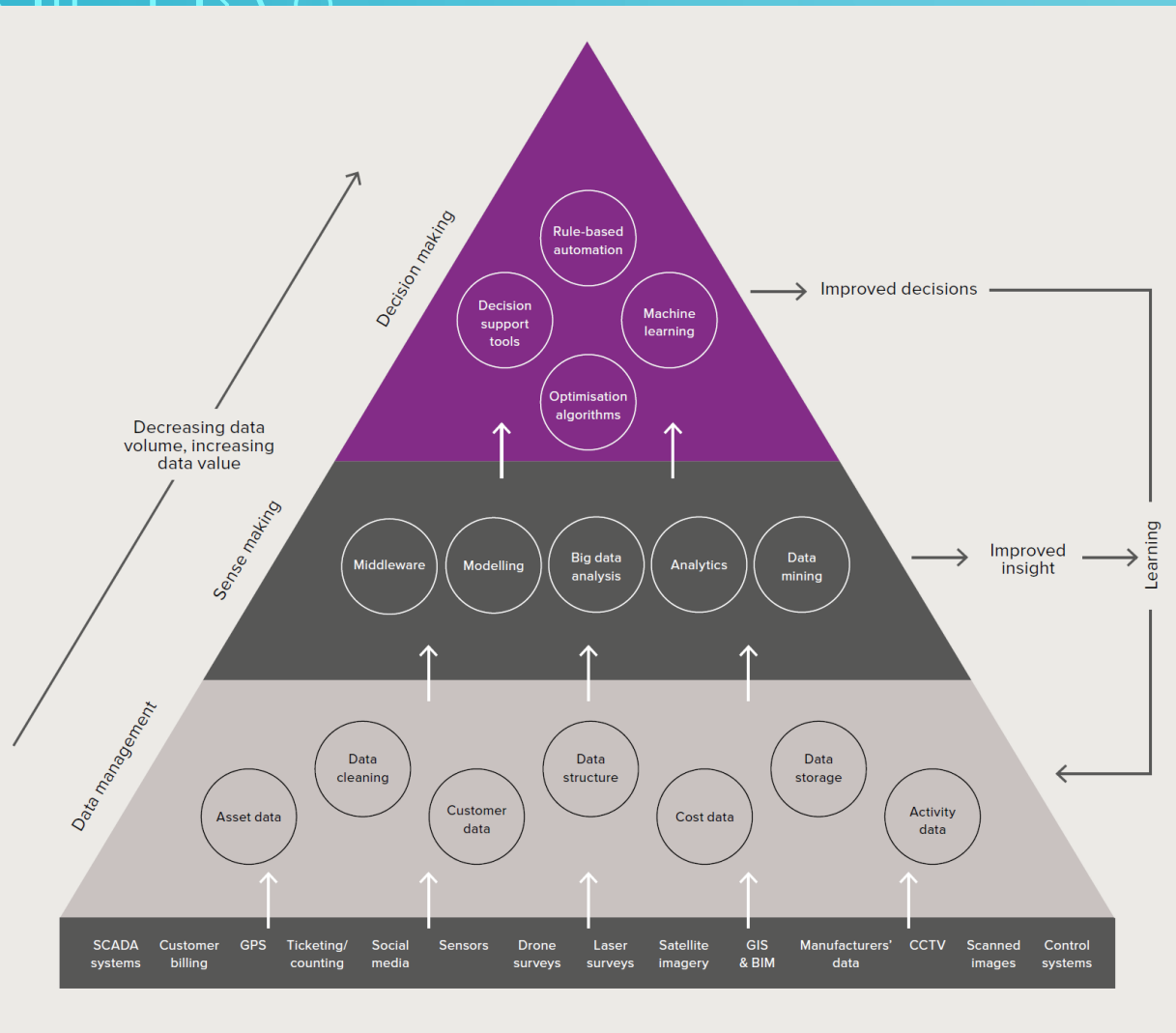
DIGITAL TWIN..

"a realistic digital representation of assets, processes or systems in the built or natural environment"
+ connected to the physical twin

NATIONAL DIGITAL TWIN..

An ecosystem of digital twins connected via securely shared data.

digital twins

The Gemini Principles

Purpose:
Must have
clear purpose

Trust:
Must be
trustworthy

Function:
Must function
effectively

Public good
Must be used to
deliver genuine public
benefit in perpetuity

Value creation
Must enable
value creation
and performance
improvement

Insight
Must provide
determinable insight into
the built environment

Security
Must enable security
and be secure itself

Openness
Must be as open
as possible

Quality
Must be built on data of
an appropriate quality

Federation
Must be based on a
standard connected
environment

Curation
Must have clear
ownership, governance
and regulation

Evolution
Must be able to adapt
as technology and
society evolve

Q4 2018

national digital twins
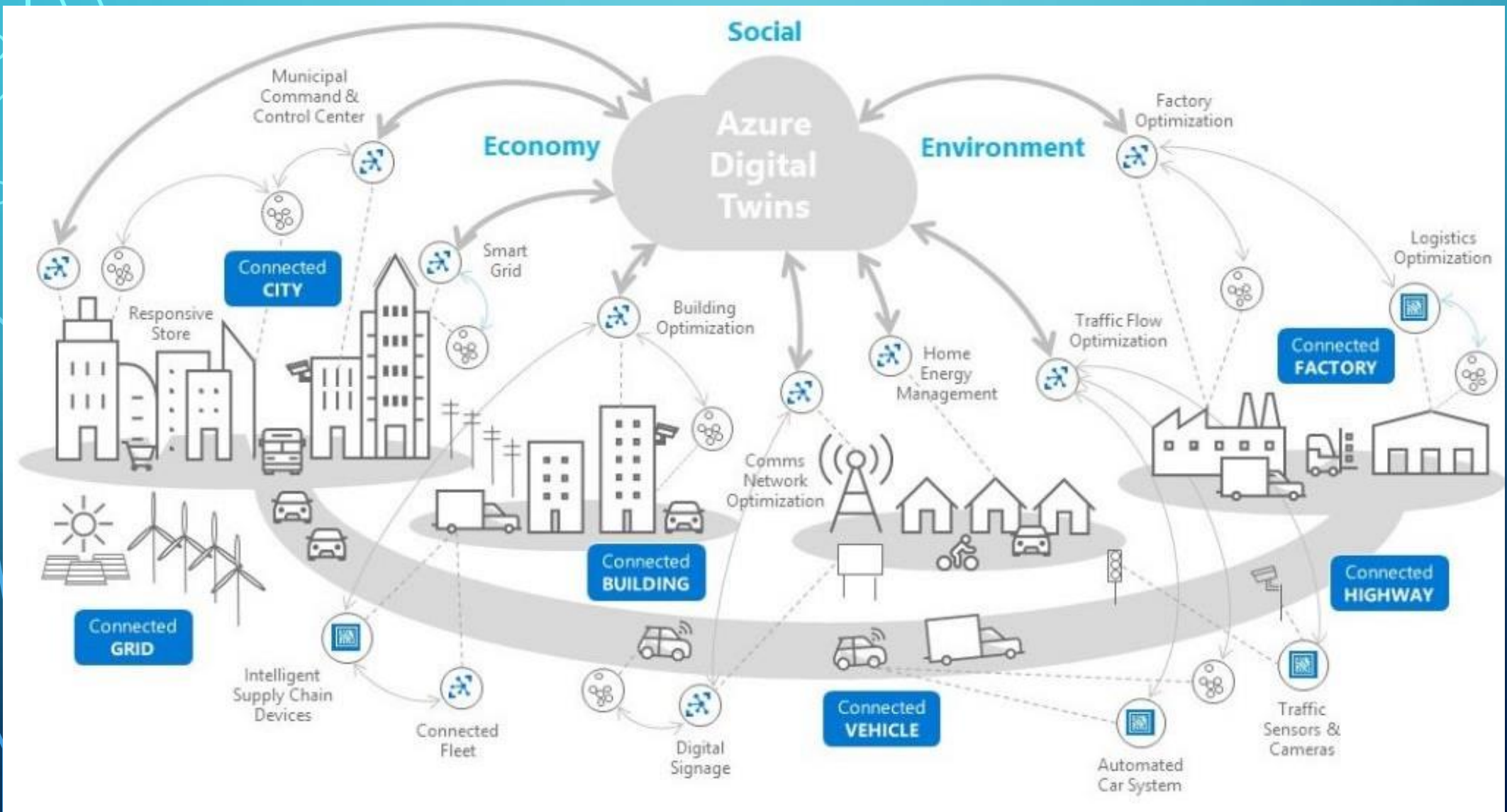
change procurement

"work to ensure construction projects ... are procured and built based on their whole life value, rather than just initial capital cost"

+ offsite construction by government

CLC: procuring on the basis of whole-life value and performance
+ Measuring and rewarding good asset and supplier performance

new thinking

new ways of doing things

new business relationships

new ways of thinking

new business models

the DIGITAL economy

new institutions

new performance metrics

pre-manufactured solution

+

whole life value/performance based outcomes

+

data, IoT, digital twins etc.

=

SERVITISATION

COCOMPETENCE

Paul Wilkinson

(Ethos VO)

'Experience in other industries suggests that failure to understand and adapt human behaviour, rather than technology, is the biggest impediment to collaborative working' - Sir Michael Latham.

Collaboration adds value in construction projects

- Collaboration yields results that could not be achieved by people working separately
- Effective collaborative working is enabled by:
    - early involvement
    - selection by value
    - common processes & tools
    - performance measurement
    - long term relationships
    - modern commercial arrangements
- But in past 20+ years, most UK construction has barely changed …

Accelerating change…

Partnering, integrated teams, collaborative working, alliancing, lean … - over 20 years of industry initiatives

Lean Construction Institute UK formed (2010)

New procurement models (2014)

Low Carbon Construction (2010)

Government Construction Strategy (2011)

Alliancing Best Practice (2014)

Latham Report (1994)

Egan Report (1998)

Accelerating Change (2002)

Be Valuable (2005)

Never Waste a Good Crisis (2009)

Procurement / Lean client task group (2011)

Digital Built Britain (2015)

Building Down Barriers (1999)

SFfC integration toolkit (2003)

2012 Construction Commitments (2006)

Construction 2025 (2013)

B4C (2014)

BIM Level 2 (2016)

1994   2000   2005   2010   2016

Business web access   Mobile web access

Convergence …

Procurement / Lean Client Guide

ICG Alliancing Guide

B4C Profession Map

Government Construction Strategy - Procurement/Lean Client Task Group *(July 2012)*

Define the characteristics of an "intelligent client" in the context of [new] procurement models, and provide a maturity model for the measurement of those characteristics to help industry and government clients progress relationships in a manner that secures significant efficiency.

Government Construction Strategy - Procurement/Lean Client Task Group *(July 2012)*

Infrastructure Clients Group – Alliancing Best Practice in Infrastructure Delivery *(2014)*

- in complex delivery environments, many alliances have been shown to deliver significantly better outcomes than more traditional contractual arrangements.

- to ensure success an emphasis has to be placed on the **behavioural** aspects of both the organisations and individuals involved. …

- commercial models that reward the delivery of agreed outcomes and drive the required **behaviours** deliver the best results. …

Infrastructure Clients Group – Alliancing Best Practice in Infrastructure Delivery *(2014)*

Four fundamental themes of successful alliances:

- commercial model
- behaviour
- integration
- leadership

Infrastructure Clients Group – Alliancing Best Practice in Infrastructure Delivery *(2014)*

Summary of Key Enabling Activities

Figure 3
Alliance Characteristics

Behaviours4Collaboration *(formed 2014)*

- Industry/academic group

- UWE plus universities of Bristol, Salford, Bath, Reading

- A "BIM4" group – part of CIC communities

- Led by Elizabeth Kavanagh (of Stride Treglown)

- Supported by Constructing Excellence

- Aim: to **enable collaboration** by **specifying the behaviours** of collaboration …

- … by developing a 'profession map' focused on collaborative behaviours

Behaviours4Collaboration
(formed 2014)

Trust / Respect

Maturity / Role	Project Contributor	Project Leader	Sector Service Department/ Portfolio leader	Group leader	Subject/ Industry leader
4	Getting the job done as described	Giving and receiving feedback openly		Uses failures and mistakes as an opportunity for improvement	
3	Avoids engaging in gossip	Fault finding and transparency in discussion	Presents feedback in a positive manner		
2	Does not allow themselves to be distracted (e.g. phones)	Display appropriate body language			
1	Communicates necessary information	Discusses colleagues in a respectful manner.	Encourage a no gossip climate		
0				New ideas mean the trust is lost if you don't agree	Does not invalidate input of others Let's go of the right to be right

Longer-term B4C outcome: A profession CPD map

Some common threads …

Similarities include:

- five-level views of capabilities
- maturity models
- checklists of behaviours

Combine
Codify
Mobilise

= **Collaborative Competence**
= **CoCompetence**

COMPETENCE =
KNOWLEDGE + SKILL + BEHAVIOUR

- Knowledge - information about a subject

- Skills - using what I know in a situation

- Behaviours - the way I use my skills: what you see me do

COCOMPETENCE = COLLABORATIVE KNOWLEDGE + SKILL + BEHAVIOUR

- Knowledge – using information about a subject in a collaborative way

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Demonstrating CoCompetence = what others see me do

Demonstrating CoCompetence

- Target: <u>not</u> traditional (often adversarial, lowest price) projects
- Target: progressive construction clients deploying:
  - new models of construction procurement
  - Alliancing
  - framework agreements
- Likely, therefore, to be 'intelligent clients' (utilities or public sector)
- Thus, leading edge, potential exemplar projects

Demonstrating CoCompetence
= what others see me do …

…in teams

…in tasks

…in supply chain clusters

…on projects

…in companies

…in alliances

CoCompetence – context

- Project teams include clients and tier 2/3/n suppliers
- Pain/gain-sharing (or similar incentivisation) helps promote value-adding collaboration and a 'virtual company' (not silo-based) perspective
- CoCompetence is not a specifiable standard
- CoCompetence cannot be accredited - behaviour changes over time
- CoCompetence benchmarks are comparative and will change as the industry evolves
- CoCompetence complements and is a catalyst for the core knowledge and skills required across disciplines

Assessing CoCompetence – 1/2

- CoCompetence is a tool for projects embracing collaborative working
- whole project team commits to collaborative approach
- individual team members identify any initial learning or skills development needs
- online tool, eventually accessible via mobile app(s)
- create personal, role-based profile
- mark others - 360-degree appraisal
- sliding scales
- give/receive comments/feedback
- 'social kudos rewards' (eg: ratings, stars, medals)

Assessing CoCompetence – 2/2

- "Wisdom of the (project) crowd"
- anonymously score colleague behaviours (scores aggregated and averaged)
- share stories or anecdotes
- applaud/reward excellence
- 'CoCompetition' – league tables (potentially individuals, teams, projects)
- real-time feedback on individual, team, project, organisational CoCompetence

CoCompetence benefits – clients

- Correlate CoCompetence to:
  - project information flows – who facilitates, where are the bottlenecks? Frictions?
  - achievement of lean and value-adding project objectives
- Real-time key performance indicators (KPIs) / feedback:
  - supply chain collaborative behaviours
  - CoCompetence / skills needs of client employees
  - project best practice exemplars

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- CoCompetence becomes company competitive differentiator (with evidence base)

CoCompetence benefits – individuals

- Reliable real-time feedback:
  - monitor personal collaborative skills/behaviours
  - identify training, personal development needs
  - ascertain impact of training/development
- provide constructive focused feedback to fellow project team members
- CoCompetence becomes a capacity that can be linked to career advancement

Following slides show results reporting from the Strategic Forum for Construction (SFfC) toolkit's Maturity Assessment Tool.

These are company-based scores, but intention is for CoCompetence tool to provide similar benchmarking capabilities, and to allow users to make meaningful comparisons on their metrics against other individuals in similar roles (eg: a project manager can see how they score in comparison with other project managers).

SFfC Maturity Assessment – 1/2

SFfC Maturity Assessment - 2/2

COCOMPETENCE

Paul Wilkinson

(Ethos VO)

...ogy, is the biggest i...

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SFfC Maturity Assessment – 1/2

SFfC Maturity Assessment - 2/2

POOR UK CONSTRUCTION INDUSTRY PERFORMANCE IS WELL DOCUMENTED:

Bossom (1934)
Simon (1944)
Philips (1948)
Emerson (1962)
Banwell (1964)
Tavistock Inst. (1966)
Potts (1967)
Wood (1975)
NEDO (1978, 1983, 1988)

Latham (1993, 1994)
RCF (1995)
Levene (1995)
CIB (1996, 1997)
Egan (1998, 2002)
NAO (2001)
Saxon (2005)
Calcutt (2007)

Construction Matters (2008)
Wolstenholme (2009)
Government construction strategies (2011, 2016, 2017)
Construction 2025 (2013)
Digital Built Britain (2015)
Farmer (2016)
Industrial Strategy (2017)

(and this is just a selective list!)

INTEGRATED PROJECT TEAMS – HISTORICAL CONTEXT

CONSTRUCTING THE TEAM

BY SIR MICHAEL LATHAM

FINAL REPORT OF THE
GOVERNMENT/INDUSTRY REVIEW OF
PROCUREMENT AND CONTRACTUAL
ARRANGEMENTS IN THE UK
CONSTRUCTION INDUSTRY
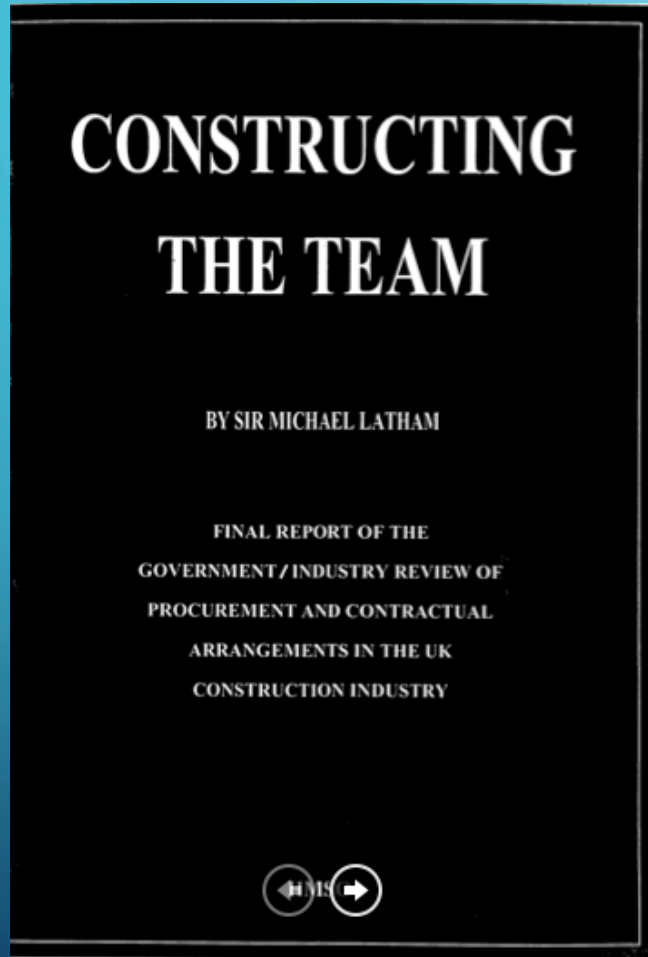
- **Latham** (1994) on *partnering*:

- "… Partnering includes the concepts of teamwork between supplier and client, and total continuous improvement. It requires openness between the parties, ready acceptance of new ideas, trust, and perceived mutual benefit."

INTEGRATED PROJECT TEAMS – HISTORICAL CONTEXT

- *Partnering* movement – 1990s development of ideas, eg:

- Lean Thinking (Toyota)

- CRINE (Cost Reduction Initiative for the New Era)

- ACTIVE (Achieving Competitiveness through Innovation and Value Engineering)

- Construction Industry Board

- Reading Construction Forum (*Trusting the Team*)

INTEGRATED PROJECT TEAMS

- *Egan* "Rethinking Construction" (1998, p13)

- **integrate the process and the team around the product:** the most successful enterprises do not fragment their operations - they work back from the customer's needs and focus on the product and the value it delivers to the customer. The process and the production team are then integrated to deliver value to the customer efficiently and eliminate waste in all its forms.

The Task Force has looked for this concept in construction and sees the industry typically dealing with the project process as a series of sequential and largely separate operations undertaken by individual designers, constructors and suppliers who have no stake in the long term success of the product and no commitment to it. Changing this culture is fundamental to increasing efficiency and quality in construction.

EGAN – 5 DRIVERS OF CHANGE

RETHINKING

CONSTRUCTION

THE REPORT OF THE CONSTRUCTION TASK FORCE

- committed leadership
- a focus on the customer
- integrated processes and teams
- a quality driven agenda
- commitment to people

EGAN (AND CONSTRUCTING EXCELLENCE) – 6 CRITICAL SUCCESS FACTORS

- Early involvement

- Selection by value

- Aligned commercial relationships

- Common processes and tools

- Performance measurement

- Long-term relationships

INTEGRATED PROJECT TEAMS – HISTORICAL CONTEXT

- *Egan* movement

- developed collaborative working ideas through:

- Movement for Innovation

- Construction Best Practice Programme

- Construction Clients Charter

- Building Down Barriers, Prime Contracting

- Partnering contracts

- KPIs, toolkits

- **And the net impact of all these ideas….?**

WHY HAS CONSTRUCTION PRODUCTIVITY FLATLINED?

- **"fragmented transactional and risk transfer interfaces**, lack of early well-defined client briefs, a propensity for clients to change their requirements late in the process, design – procurement – construction process separation, and large scale industry re-working and defects rectification."
(**Farmer**, 2016)

- **Inertia** (industry culture still strongly contractual / adversarial / lowest price)

- **Lack of innovation** (low appetite for R&D)

- **Under-investment in IT** = low digitisation

- Result:

- Poor industry performance (time, cost, quality, fitness for purpose, reputation)

3 Service sectors with long tail of small firms having room to digitize customer transactions

5 Labor-intensive sectors with the potential to provide digital tools to their workforce

6 Quasi-public and/or highly localized sectors that lag across most dimensions

Mckinsey Global Institute (December 2015)
Digital America: A tale of the haves and the have-mores

The MGI Industry Digitisation Index for Europe

2015 or latest available data

Sector	Overall digiti-sation	Assets		Usage			Labour			Share of value added, 2013 %	Share of employ-ment, 2015 %
		Digital spending	Digital asset stock	Digital transactions	Digital interactions	Digitised business processes	Digital spend per worker	Digital capital deepening	Digitisation of work		
ICT										4.5	2.7
Media					1					1.2	1.1
Finance and insurance										5.4	3.0
Professional services										6.3	6.0
Wholesale trade										6.5	5.3
Advanced manufacturing										4.4	4.2
Chemicals and pharmaceuticals										1.9	2.3
Utilities		2								2.3	1.0
Oil and gas					4					0.2	0.1
Basic goods manufacturing										8.1	7.8
Mining										0.8	0.4
Real estate	●									12.1	1.0
Transportation and warehousing	●									5.0	5.2
Retail trade	●			3						4.4	8.8
Personal and local services										6.3	7.8
Government	●							5		6.5	7.1
Education	●									5.3	7.7
Health care	●									7.4	11.1
Entertainment and recreation	●									1.3	1.7
Hospitality										3.0	4.7
Agriculture		6								1.7	4.2
Construction										5.3	6.8

Relatively low digitisation — Relatively high digitisation

● Digital disruptors within relatively less-digitized sectors

3 Service sectors with long tail of small firms having room to digitize customer transactions

5 Labor-intensive sectors with the potential to provide digital tools to their workforce

6 Quasi-public and/or highly localized sectors that lag across most dimensions

Mckinsey Global Institute (June 2016)
Digital Europe: Pushing the Frontier, Capturing the Benefits.

Lower digitization in construction relative to other industries has contributed to the productivity decline

McKinsey Global Institute (2017) Reinventing Construction: A route to higher productivity.

The global construction sector is large and growing…

12% of world GDP in 2012

13.5% by 2025

Global construction software 2012 TAM
$6bn

… yet, it has among the lowest IT spending penetrations

Banking and financial services — 6.0%
Education — 4.7%
Professional services — 4.5%
Pharmaceuticals, life sciences and medical products — 3.3%
Insurance — 3.1%
Transportation — 3.1%
Industrial electronics and electrical equipment — 2.7%
Utilities — 2.5%
Consumer products — 2.0%
Retail and wholesale — 1.4%
Food and beverage processing — 1.2%
Construction, materials and natural resources — 1.2%
Energy — 0.7%

IT Spending as a % of Revenue by Industry

DIGITISING CONSTRUCTION

Moved from …	To…
Type-writer ➡	word processing
Postal correspondence, faxes ➡	email
Analog photography (film) ➡	digital photography
Audio/video tapes ➡	MP3/4s, .MOV, .WAV etc
Financial ledgers ➡	Excel, accounting software, ERP
Manual drafting ➡	CAD* ➡ BIM

*BS1192 first published in 1998

Online AEC collaboration (c. 2000s)

Online file management
- Single central repository
- Fewer interoperability issues
- Less paper
- Latest information
- Complete project record
- Full information audit trail
- Greater re-use of information

But ...
- nearly all still 2D
- email often used instead

'DISRUPTIVE' TECHNOLOGY TRENDS

- **Cloud – SaaS**

- **Mobile**

- **Web 2.0**

- **Reality capture**

- **Building information modelling (BIM)**

- Starting … **Web 3.0** – the semantic web
  - The 'internet of things'
  - Data – linked, open, 'Big'

ONGOING CHANGE
SINCE LATE 1990S

CLOUD –
PERCEPTIONS
CHANGING

Figure 5. DOES CLOUD COMPUTING POSE A GREATER RISK THAN ON-PREMISES IT?

MOBILE DISRUPTION

- Gradual change since mid 2000s

- Gathered momentum since 2007

  - Apple iPhone, Android, Blackberry

  - Smartphone to tablet (c. 2010)

  - Move from stand-alone apps to mobile tools integrated with enterprise solutions

  - Growing demand for 'Cloud' (public and private), and for corporate mobile access to real-time business data (BI)

Social Disruption

REALITY CAPTURE DISRUPTION

- Laser-scanning (static + drones)
  - Point clouds (with cloud-based management)

- Photogrammetry

- 360-degree photography (eg: Holobuilder, Matterport)

- 2D data transformation ("RetroBIM")

- Virtual Reality

- Augmented Reality
  - eg Google ARCore (formerly Tango)

GEOSPATIAL DISRUPTION

- Location intelligence

- *"Integration of BIM and GIS is a good place to start connecting BIM and Smart Cities"*

Impact-likelihood matrix of new technologies

from *Shaping the Future of Construction*, World Economic Forum/The Boston Consulting Group (2016)

Nov 2010

Spring 2011

BIM IS NOT A TECHNOLOGY - IT IS A COLLABORATIVE PROCESS SUPPORTED BY PEOPLE AND TECHNOLOGY

- Stage 0: Strategy

- Stage 1: Brief

- Stage 2: Concept

- Stage 3: Definition

- Stage 4: Design

- Stage 5: Build and commission

- Stage 6: Handover and close-out

- Stage 7: Operation and end-of-life

BIM IS A PROCESS SUPPORTED BY PEOPLE AND TECHNOLOGY.

THEREFORE, CHANGE IS NEEDED IN INDUSTRY STRUCTURES AND PROCESSES

Construction can catch up with total economy productivity by taking action in seven areas

Cascading effect
Regulation changes facilitate shifts in industry dynamics that enable firm-level levers and impact

			Potential global productivity improvement from implementation of best practices[1] Impact on productivity (%)[2]	Cost savings %
External forces		Regulation	Enabler	
Industry dynamics		Collaboration and contracting	8–9	6–7
		Design and engineering	8–10	7–10
		Procurement and supply-chain management	7–8	3–5
Firm-level operational factors		On-site execution	6–10	4–5
		Technology	14–15	4–6
		Capability building	5–7	3–5
		Cumulative impact	48–60	27–38
		Gap to total economy productivity	50	

Digital Built Britain (February 2015)

Actions needed to address:

- Delivery mechanisms

- Commercial

- Technical

- **Cultural**

- Research requirements

- "a ten-year programme" – Mark Bew

Digital Built Britain (February 2015)

Figure 2 – Business Change Model

CONSTRUCTION 2025 (JULY 2013)

INDUSTRIAL STRATEGY (NOVEMBER 2017)

Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

"work to ensure construction projects ... are procured and built based on their whole life value, rather than just initial capital cost."

INTEGRATED PROJECT TEAMS – PROCUREMENT

- Project partnering

- Strategic partnering (alliancing)

- Prime contracting / Building Down Barriers

- New models of procurement
  - Two Stage Open Book
  - Cost Led Procurement
  - Integrated Project Insurance (insurance-backed alliancing)

INTEGRATED PROJECT TEAMS – ALLIANCING

- In complex delivery environments, many alliances have been shown to deliver significantly better outcomes than more traditional contractual arrangements.

- To ensure success an emphasis has to be placed on the **behavioural** aspects of both the organisations and individuals involved.

- The organisations involved in an alliance need to be highly **integrated**, including the client.

- Effective alliances depend on committed and visible client and delivery team **leadership** to drive change and performance.

- **Commercial** models that reward the delivery of agreed outcomes and drive the required behaviours deliver the best results.
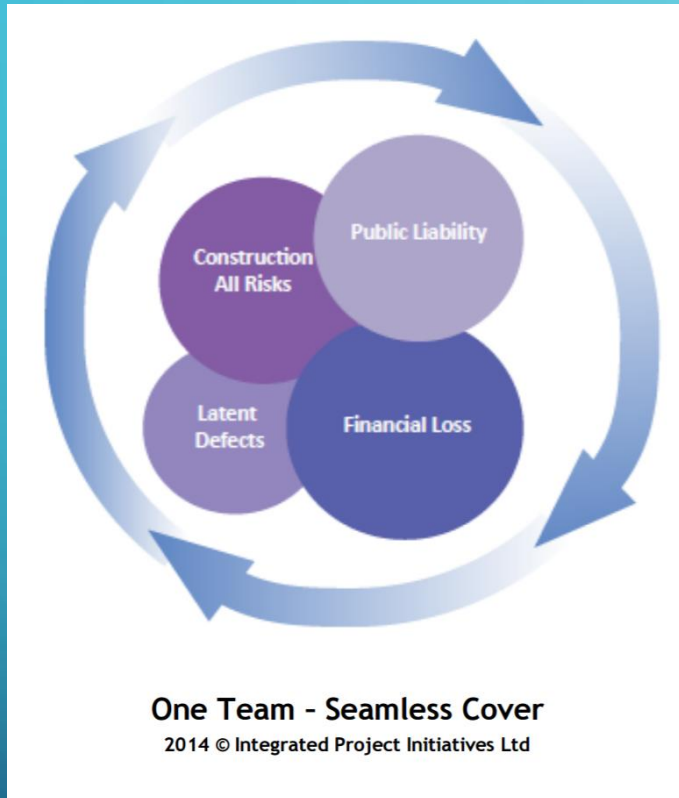
INTEGRATED PROJECT INSURANCE

One Team – Seamless Cover

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INTEGRATED PROJECT INSURANCE

- collectively insures the client and all other Alliance partners: consultants, specialists, manufacturers, construction managers and their supply chains.

- replaces liability-driven professional indemnity insurance with financial loss cover where the outturn cost above the target cost plus pain-share is insured.

INTEGRATED PROJECT INSURANCE

- Cost savings targeted: 15% - 20%

- Other key success criteria:

  - Programme certainty at below Target Cost

  - Highly efficient methods, including off-site manufacturing where best for project, and new methods of construction, eliminating waste in materials, processes and procedures

  - Leading BIM methods and technologies from commencement

  - Flexibility of the facility to be remodelled to meet future changes in demands and training methods

GROUP WORK

COMPETENCE =
KNOWLEDGE + SKILL + BEHAVIOUR

- For example, sales competence is made possible by knowledge of the industry, the customer and the company, together with the skills of listening and communicating, and the behaviours of professionalism and initiative.

FIGURE 7.10 Key sales attributes

Knowledge	Skill	Behaviour
Market Environment	Listening	Professionalism
Company Proposition	Questioning & Probing	Commitment
Competitive Positioning	Communicating & Presenting	Initiative
Company Procedures	Trading Value & Negotiating	Tenacity
	Closing	Self-motivation
	Analysing & Planning	Diligence
		Desire
		Energy & Enthusiasm

DEFINE…

- **Knowledge** – what information I have about a subject

- **Skills** – using what I know in a situation

- **Behaviours** – the way I use my skills - what you see me do

SOME DESIRABLE BEHAVIOURS

- **Co-ordination**

  - avoid gaps and overlap in team members work

- **Co-operation**

  - obtain mutual benefit by sharing work

- **Collaboration**

  - achieve results which could not be accomplished alone

COLLABORATIVE LEADERSHIP
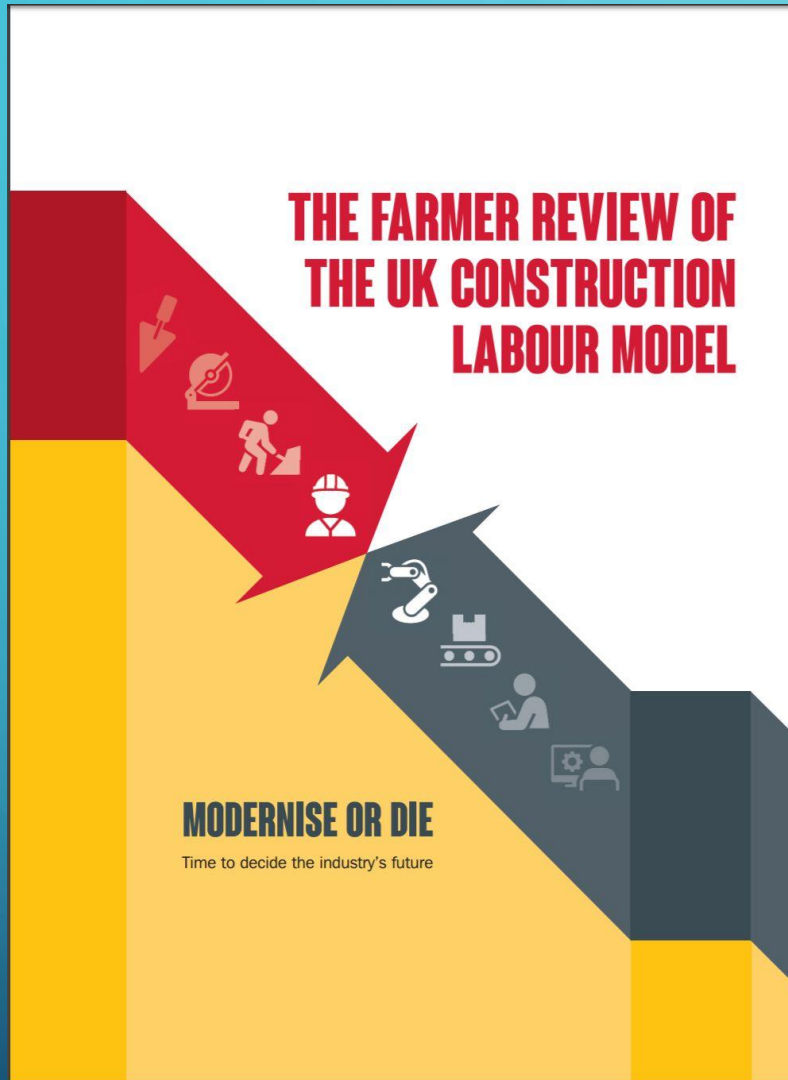
- **Behaviour**

  - **Redefining success**. From narrow agendas to bigger goals

  - **Involving others.** From autocratic to inclusive decision making

  - **Being accountable.** From blaming to taking responsibility

- **What it means**

  - Collaborative leaders redefine success and **focus on goals bigger than their own narrow agendas**. They seek common ground, look for pragmatic solutions, and compromise

  - Collaborative leaders involve others in decision making and **exhibit an open mind** to alternative divergent views, dialogue and working with others

  - Collaborative leaders **hold themselves accountable** and also demand accountability from others

NEW WAYS OF WORKING?

- Suppliers increasingly focus on value-adding business outcomes: '**assets-as-a-service**' backed by data (eg: 'illumination', not light fittings)

- More 'whole asset life-cycle' data-connected approaches (the '**digital twin**')

- Rationalised, more integrated and collaborative supply chain organisations (vertical industry specialists – joined by data)

- Construction = data-driven, leaner, safer, lower carbon ... more automated, more 'sophisticated manufacturing'

IT'S NOW OR NEVER….

• "The current pace and nature of technological change and innovation in wider society is such that unless the industry embraces this trend at scale, it will miss the greatest single opportunity to improve productivity and offset workforce shrinkage." *(p.09)*

'*Experience in other industries suggests that failure to understand and adapt human behaviour, rather than technology, is the biggest impediment to collaborative working.*'

Sir Michael Latham