

Innovations in Canada The Future of Construction

Presentation by:

Pierre Boucher
CCI President

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What is CCI?

CCI is a multi-stakeholder organization comprised of construction owners, architects, engineers, contractors, manufacturers and suppliers, and allied industries such as insurance, bonding, claims consultants, asset managers and financial institutions.

It would not be possible for CCI to deliver on its mandate without the full involvement of the construction value-chain. We do have some gaps in terms of membership, but we are working on it.

How do we define innovation

Improvement in such areas as procurement, construction management processes and procedures, HR, IT, product development, or anything else the industry needs to explore to increase its:

- productivity
- profitability
- market diversification

Industry Overview

While most other industries have undergone tremendous changes over the last few decades, and have reaped the benefits of process and product innovations, the Engineering & Construction sector has been hesitant about fully embracing the latest technological opportunities, and its labour productivity has stagnated accordingly.

This unimpressive track record can be attributed to various internal and external challenges: the persistent fragmentation of the industry, inadequate collaboration with suppliers and contractors, the difficulties in recruiting a talented workforce, and insufficient knowledge transfer from project to project, to name just a few.

World Economic Forum - Shaping the Future of Construction

What are the fact?

Despite all this, and the fact that Canada is a G8 country, here is how Canada ranks in areas that impact on its ability to reach much higher levels of economic performance. According to the World Economic Forum, Canada:

- Ranks 15th out of 144 countries for business competitiveness
- Ranks 17th in venture-capital availability
- Ranks 23rd in business sophistication
- Ranks 27th in corporate R&D spending
- Ranks 26th in its capacity to innovate (LEED)
- Ranks 30th in being an early adopter of technologies and processes (BIM)

What are the fact?

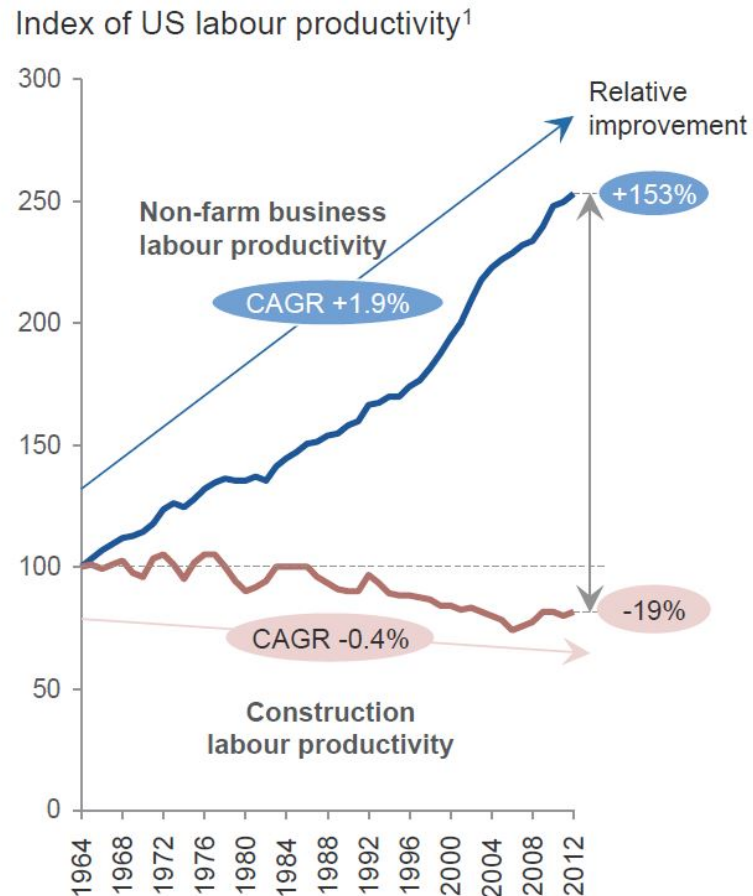
Statistical data indicates that, today, one hour of work in Canada produces \$13 less than in the United States, and \$29 less than Norway.

According to the U.S. Bureau of Labor Statistics, the construction industry is the only sector that has decreased in productivity since 1964.

The Chief Economist of the Conference Board of Canada states the following: *“If we continue to discount or dismiss the productivity issue, Canadians future incomes will be threatened, particularly if there is a sustained downward adjustment in the price of key natural resources. If there was ever a time to take poor productivity growth seriously, that time has arrived.”*

WEF – Global Trends with E&C

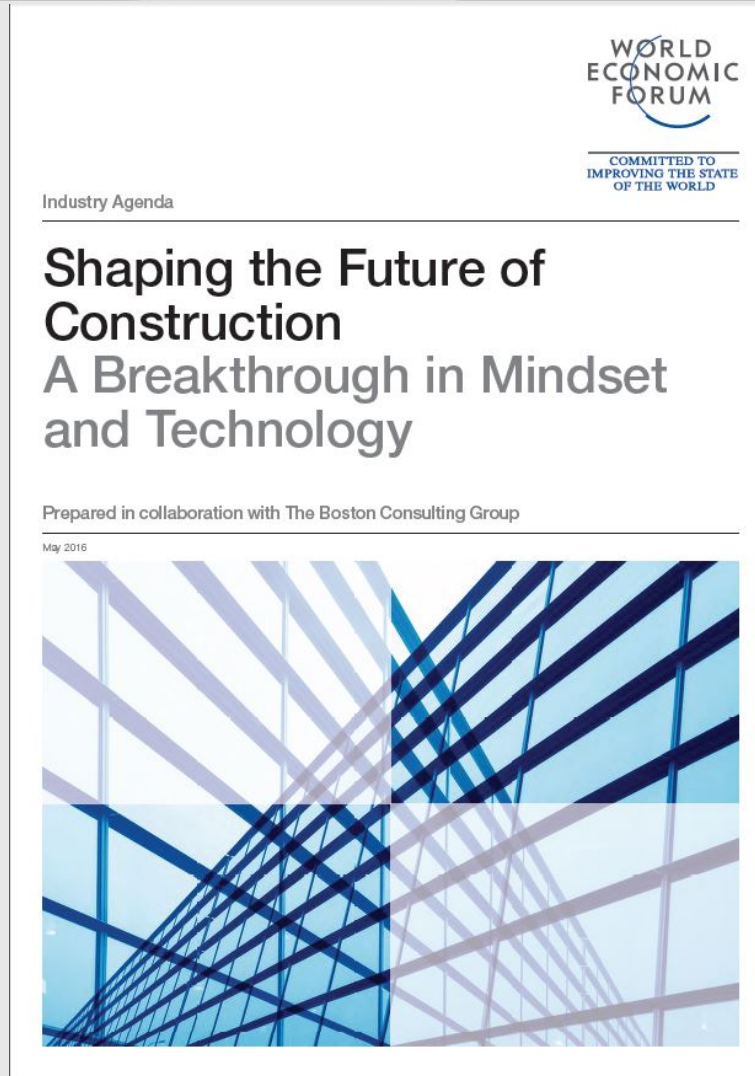
Figure 3: US Industry Productivity and Performance, 1964-2012²⁸



WEF – Global Trends with E&C

In May 2016, the World Economic Forum published a Document titled: Shaping the Future of Construction.

The report involved input from a great many companies from many regions of the world active along the construction value chain: suppliers of building materials, chemicals and construction equipment; contractors; and engineering, architecture and planning firms – as well as project owners and developers, academics, and leaders from government, civil society, and industry organizations.



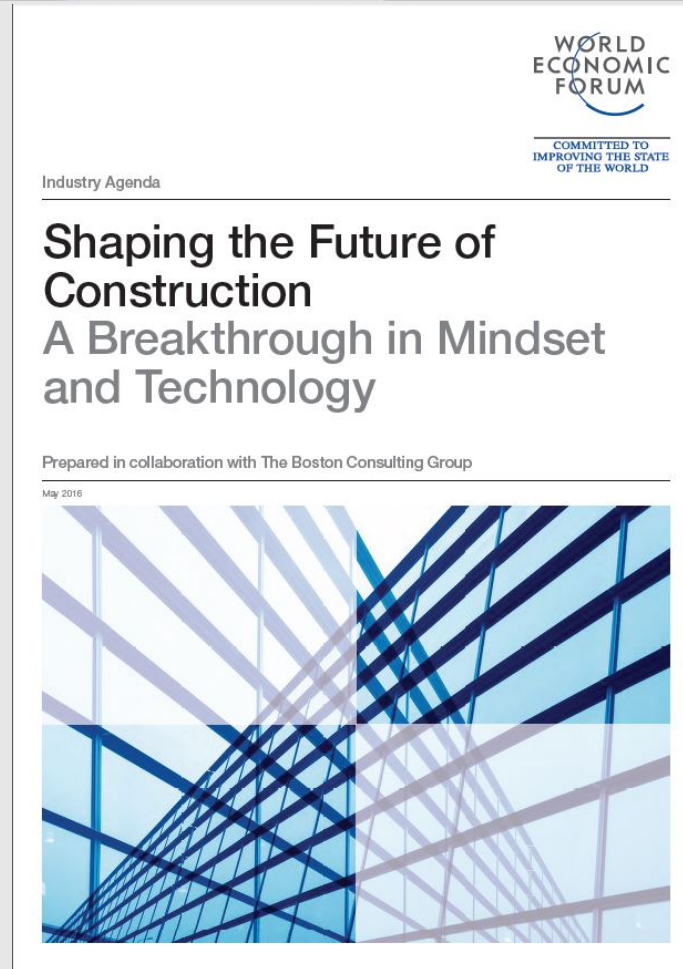
WEF – Global Trends with E&C

Two Canadians were members of the
WEF Steering Committee:

John Beck
Executive Chairman
Aecon



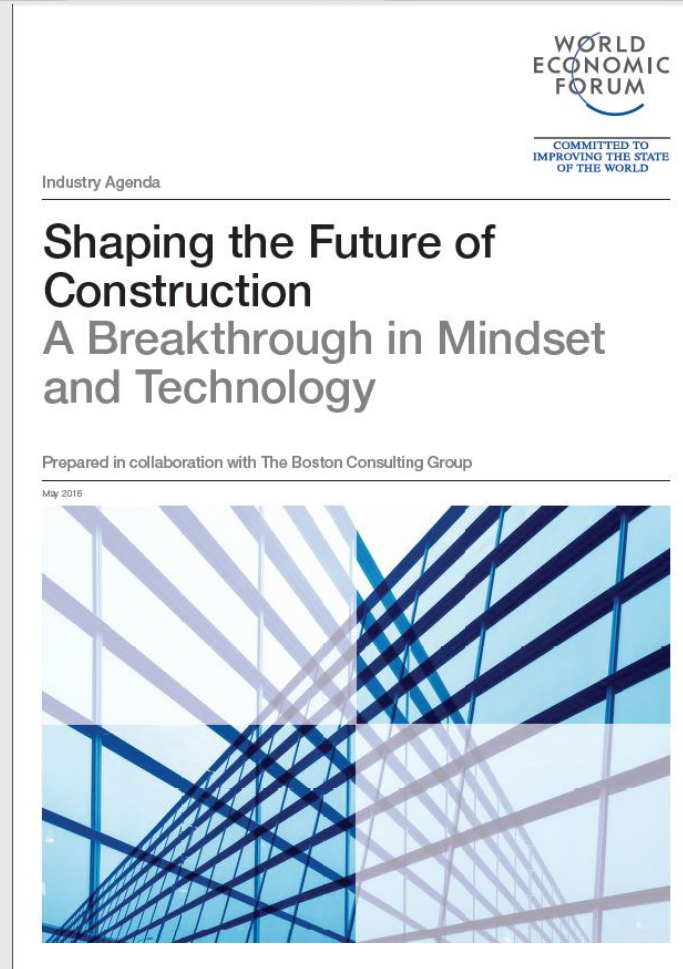
Neil Alexander Bruce
President and Chief Executive Officer
SNC-Lavalin



WEF – Global Trends with E&C

This report provides assessment of the state of the industry state and the global trends that will impact on the industry. It introduces a conceptual framework transforming the industry, listing a number of measures, grouped in eight areas. They are:

- Technology, materials and tools
- Processes and operations
- Strategy and business model innovation
- People, organization and culture
- Industry collaboration
- Joint industry marketing
- Regulation and policies
- Public procurement

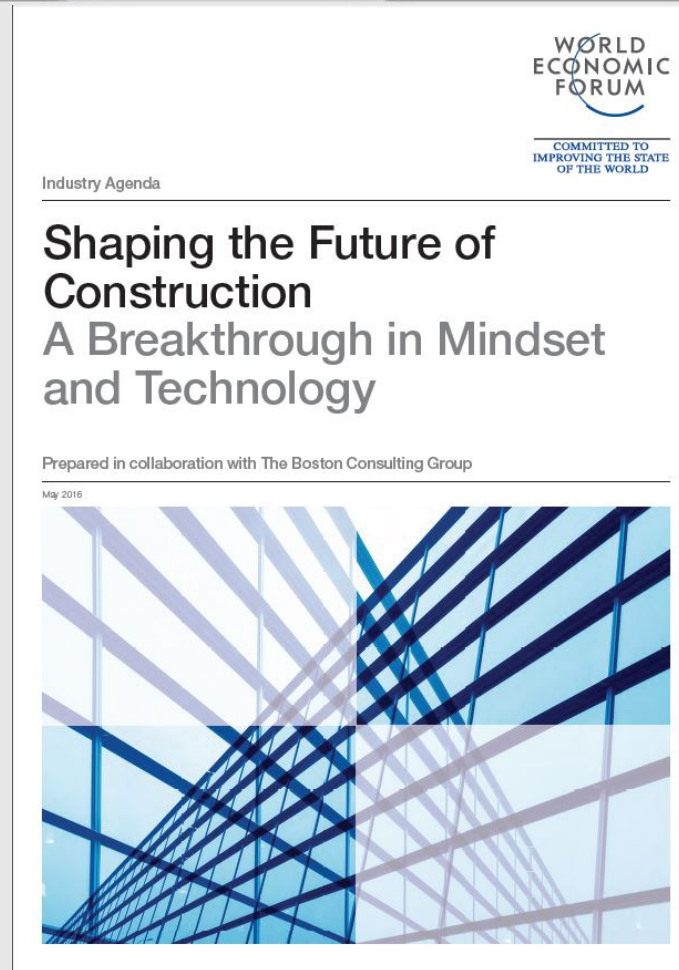


WEF – Global Trends with E&C

These measures are classified into three groups:

- Measures taken by private companies on their own;
- Measures taken by companies in collaboration with their peers – or by the industry as a whole;
- Measures taken by the government, acting both as the regulator and as a major project owner.

For each of the areas, the report identifies current best practices, and provides illustrative case studies of innovative approaches, to prepare for the industry's transformation.



CCI Canadian
Construction
Innovations

Importance of Different Transformation Areas Scale from 1-unimportant to 5-important

❖ People	4.6
❖ Adoption of new technologies	4.5
❖ materials and tools	
❖ Industry collaboration	4.2
❖ Business models	4.1
❖ Corporate strategies	4.0
❖ Maturity of business processes	4.0
❖ Maturity of construction operation	4.0
❖ Corporate cultures	3.8
❖ Corporate organizations	3.7
❖ Creation of intellectual properties	3.6

Mega Trends

Best Practices

Technology

Incremental Innovation

Megatrends driving change

Figure 2: Megatrends Shaping the Construction Industry's Future



Market and customers

Demand in developing countries

65% of the next decade's growth in construction will happen in emerging countries

Globalized markets

1 in 2 E&C companies plan to move into new geographies

Bigger, more complex projects

123km (76 miles) is the length of the Undersea tunnel that will connect Dalian and Yantai in China

Ageing infrastructure

1 in 3 German railway bridges are more than 100 years old

Massive financing need

\$1tn annual investments are needed to close the global infrastructure gap



Sustainability and resilience

Resource scarcity

No. 1 consumer of global raw materials is the construction industry

Sustainability requirements

50% of the solid waste in the United States is produced by the construction industry

Energy and climate change

30% of global greenhouse gas emissions are attributable to buildings

Resilience challenges

3x as many disasters were reported last year as in 1980

Cyberthreats

90% of firms agree that information controls have an impact on front-line employees



Society and workforce

Urbanization and housing crisis

200k people are added daily to urban areas and need affordable and healthy housing

Health/comfort needs of citizens

2-5x higher than outside are the levels of volatile organic compounds found inside US homes

Talent and ageing workforce

50% of general contractors are concerned about finding experienced crafts workers for their workforce

Stakeholder pressure and organization

67k signatures were collected opposing the construction of the Stuttgart train station

Politicization of construction decisions

In 2011 the Portuguese government cancelled a 165km (103 mile) high-speed train line project as an austerity measure



Politics and regulation

Complex regulatory requirements

25 different procedures are required for a typical warehouse construction permit in India

Stricter HSE and labour laws

10% of the workforce in a public project in California had to come from the "otherwise unemployable"

Slow permit and approval process

\$1.2tn of infrastructure could be added by 2030 if all countries committed to specific time limits for approvals

Geopolitical uncertainty

18 Turkish construction workers were kidnapped by militants in Baghdad in September 2015

Corruption

49% of survey respondents believe corruption is common in a Western European construction market

Global trends importance matrix

Figure 21: Global Trends – Their Importance for and Impact on the E&C Industry

Impact-likelihood matrix of global trends

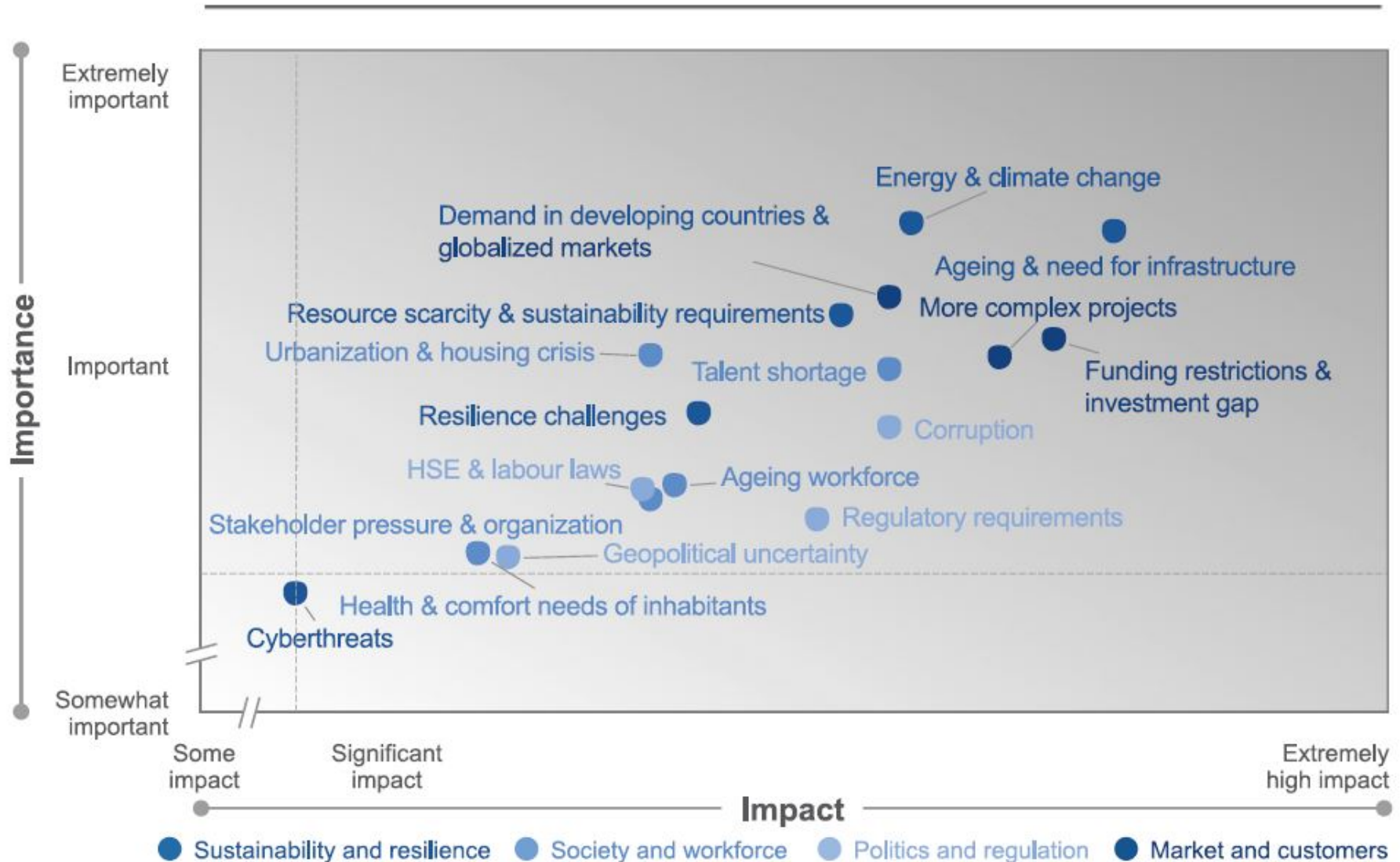
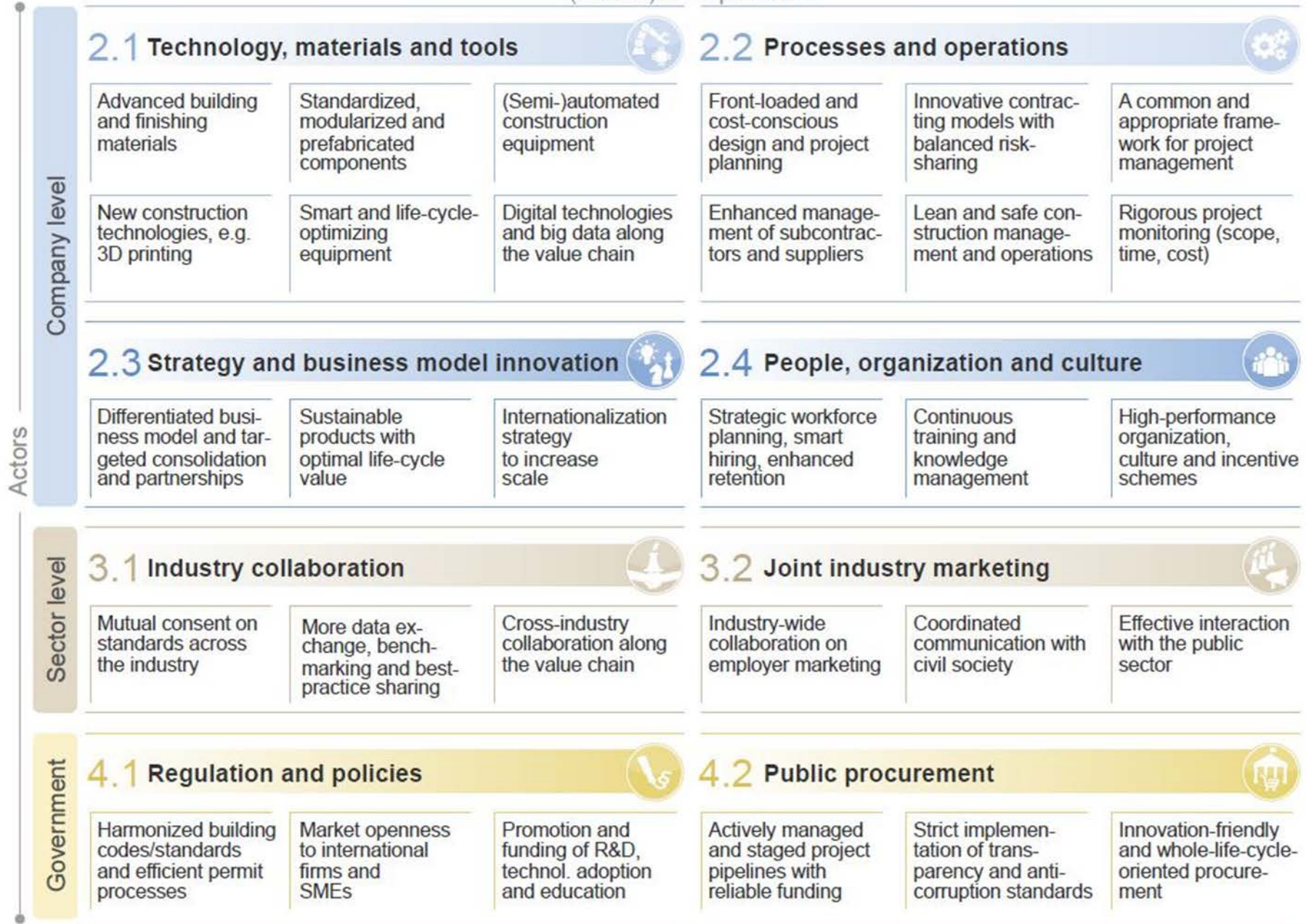


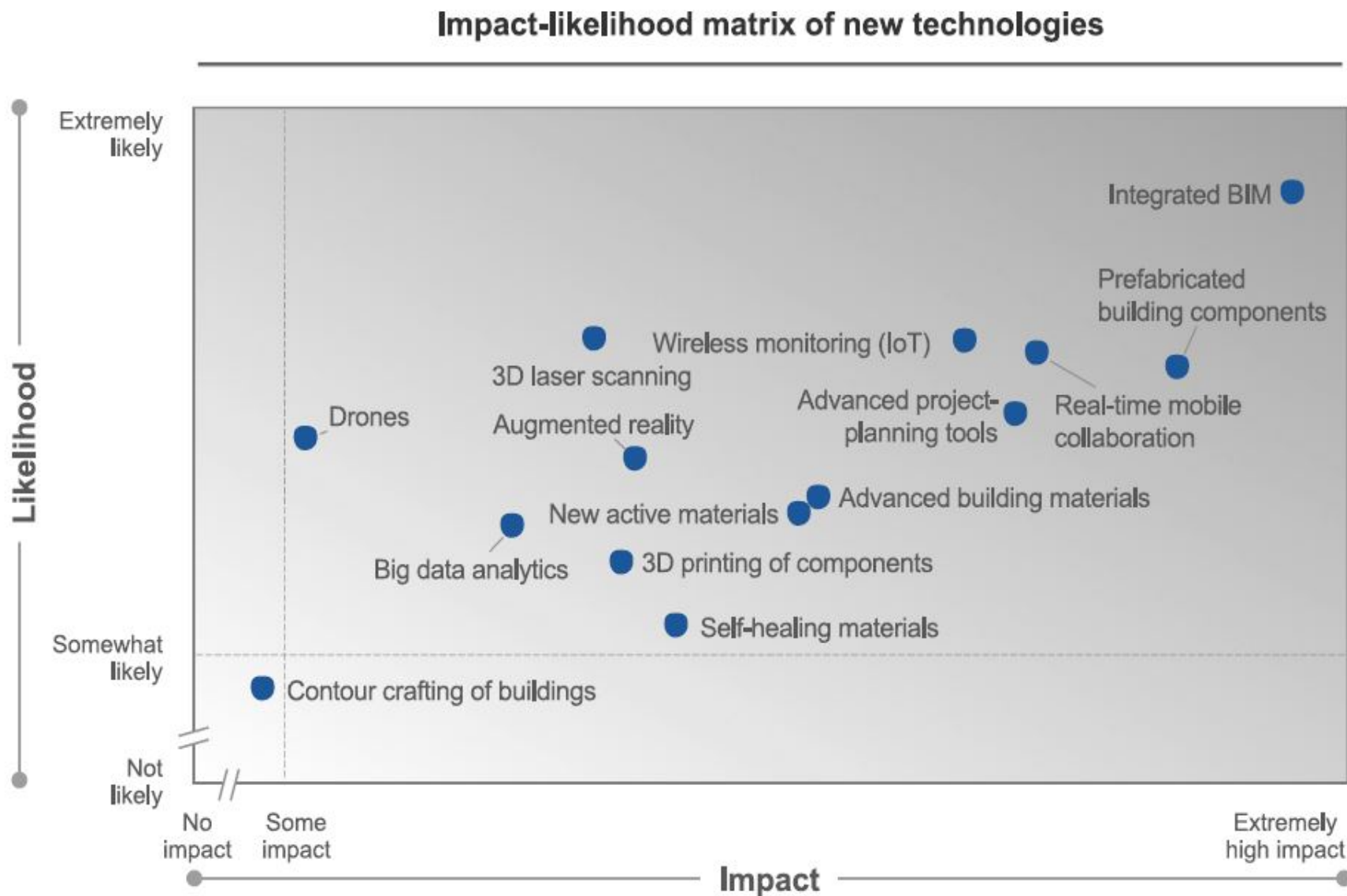
Figure 1: Industry Transformation Framework

(Future) Best practices



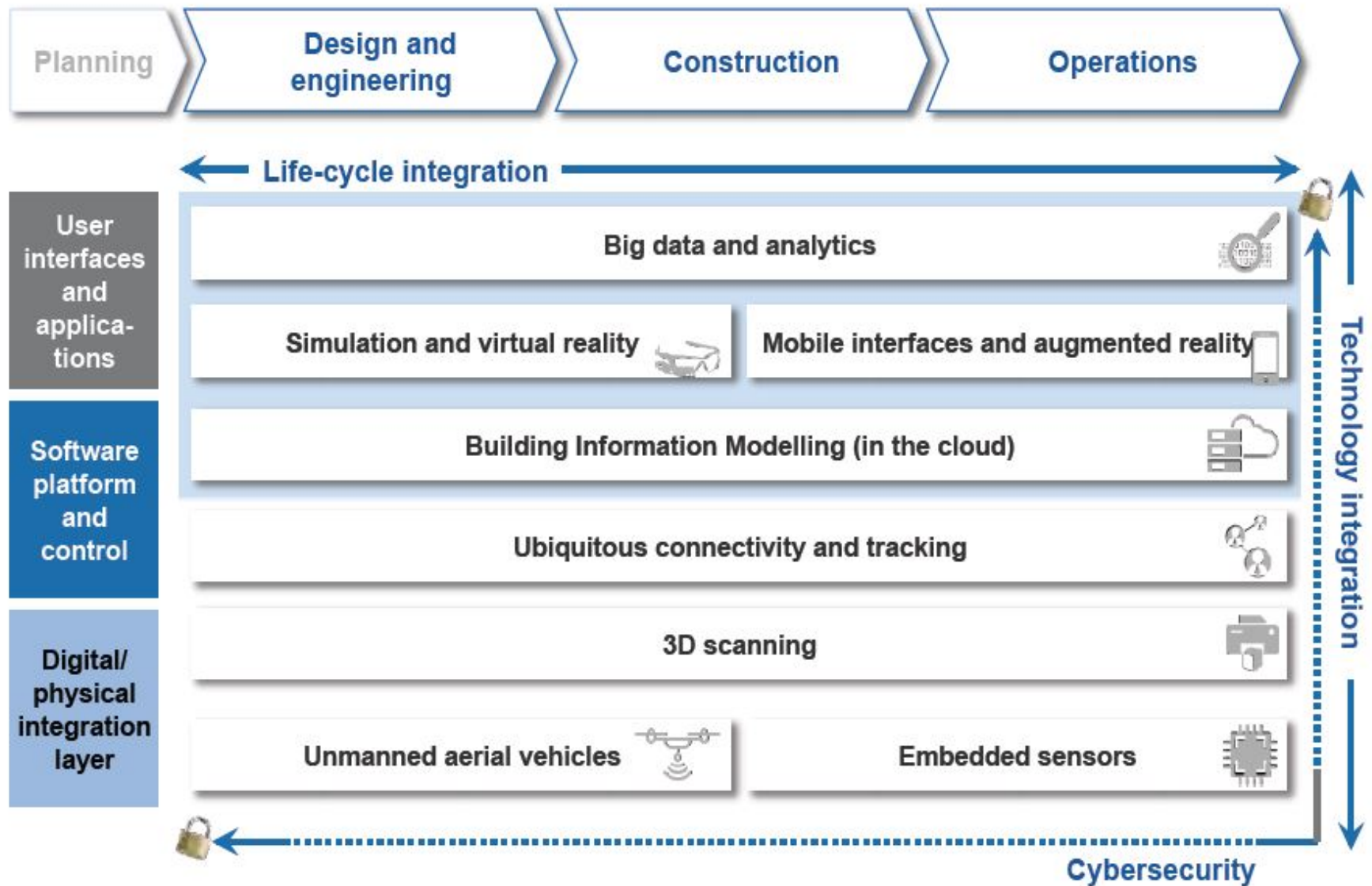
Potential impact of new technologies

Figure 20: Future Impact and Likelihood of New Technologies



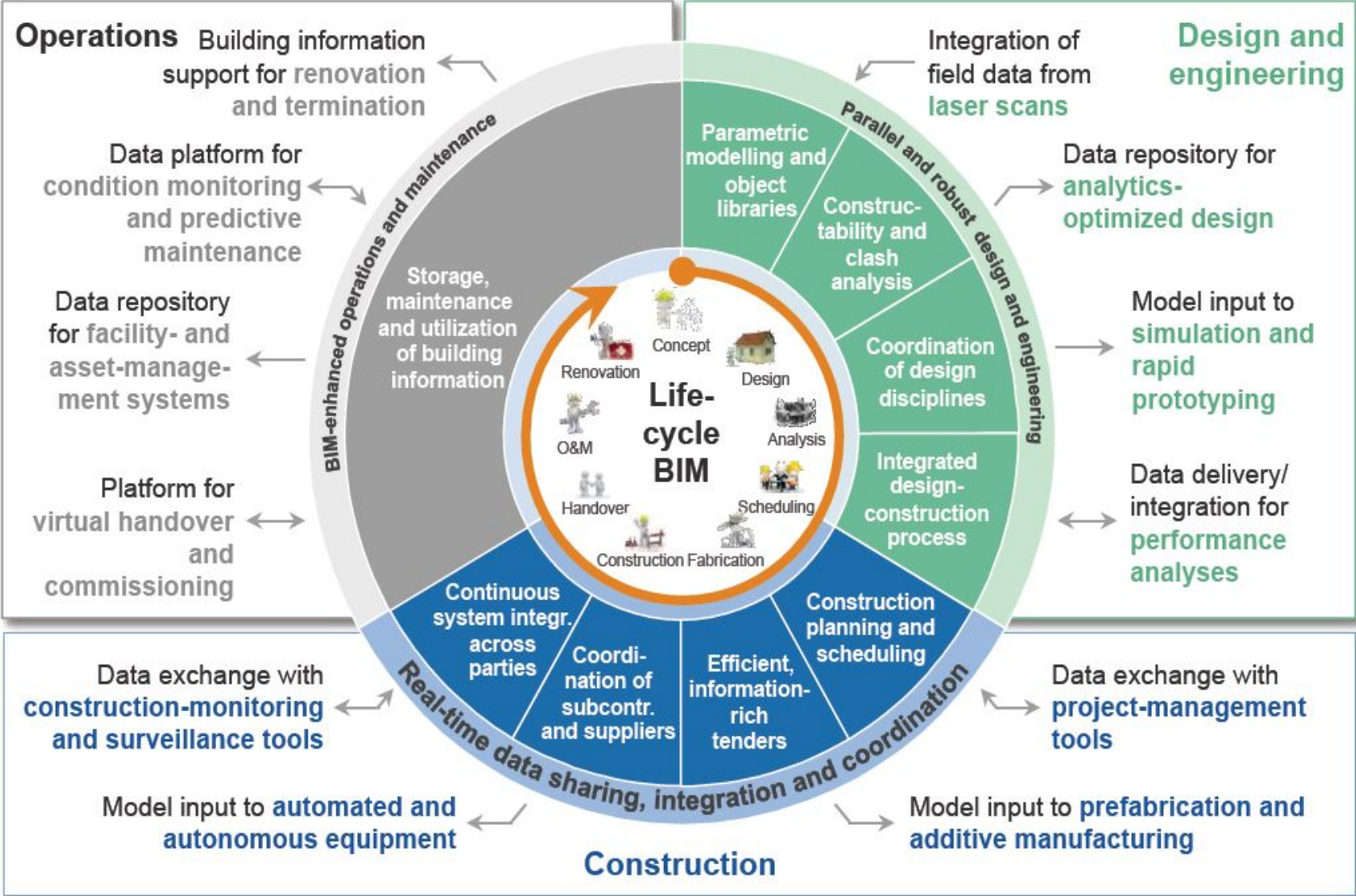
The Value of other IT Enablers

Figure 8: Digital Technologies Applied in the E&C Value Chain⁴⁸




























The Full Lifecycle Value of BIM

Figure 9: Applications of BIM along the E&C Value Chain⁵⁰



Value of Advanced Building Materials (ABM)

Figure 6: Examples of Advanced Building and Finishing Materials

Incremental innovation			Radical innovation
Advances on traditional materials and existing characteristics	New material combinations and multi-functional characteristics	Innovative materials with entirely new functionality	
<div>— <i>iQ Natural</i>, an advanced vinyl flooring, is 100% recyclable, using a bio-based plasticizer. The product has TVOC¹ values 100 times below the strictest European standards.</div> <div></div>	<div>— <i>Lixil's</i> super-lightweight ceramic sidings combine fast-hardening cement with organic fibre to meet the required performance at half the weight</div> <div></div>	<div>— Rain-absorbing roof-mats, imitating the process of perspiration, considerably reduce air-conditioning costs</div> <div></div>	
<div>— <i>Neopor</i> is an enhanced styropor, offering up to 20% efficiency improvement in insulation</div> <div></div>	<div>— Self-healing concrete, generated through the addition of bacterial spores, is estimated to reduce lifetime costs by up to 50%</div> <div></div>	<div>— <i>Micronal</i>, a micro-encapsulated phase-change material incorporated into building materials, enables intelligent temperature management</div> <div></div>	
<div>— <i>ArcelorMittal</i> has launched organically coated steel that achieves 30-year guaranteed durability and does not contain genotoxic, hexavalent chromium</div> <div></div>	<div>— Concrete admixed with special construction chemicals achieves 50% faster curing times</div> <div></div>	<div>— Slippery liquid-infused porous surfaces constitute super-repellent surfaces inspired by the carnivorous nepenthes pitcher plant</div> <div></div>	
<div> Higher recyclability/reusability</div> <div> Reduced life-cycle costs</div>	<div> Reduced material costs</div> <div> Faster construction process</div>	<div> Higher energy efficiency</div> <div> Improved health/well-being</div>	<div> Early development/pilot phase²</div> <div> Market-ready²</div>

Final world from The world Economic Forum...

The industry as a whole should enhance coordination and cooperation across the value chain, and agree on common goals and standards. And to gain the support of society at large, the industry needs to work collectively with all stakeholders, along multiple dimensions.

The recommendations contained in our report - “Shaping the Future of Construction” - require the commitment and encouragement of many active participants in the industry – people who believe in a modern E&C industry that will benefit all.

Solutions!

Former President and CEO of Mitacs and former president of the University of British Columbia Arvind Gupta states the following:

- Our ecosystem is not as developed as other countries.
- In some countries, we see cluster development where companies support one another.
- In other countries, we have seen an innovation supply chain develop, where companies farm things out to smaller companies.
- In some countries, we see much richer connections with government labs.

Solutions!

Former President and CEO of Mitacs and former president of the University of British Columbia states the following:

- Other countries have adopted different strategies.
- We need to link academia with business and increase the success rate well above what it is today
- We want to just get people working together so than help one another.

WEF – Global Trends with E&C

Our strategy: Three pillars!

- Idea Generation Pillar: Smart, Targeted Networks
- Pre-Commercialization Pillar: Pilot Projects Fund
- Commercialization Pillar: Procurement Set Aside

Thank you!