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Sustainable Construction Platform
Rita Moura
TEIXEIRA DUARTE

SUSTAINABLE DEVELOPMENT GOAL 9
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SUSTAINABLE DEVELOPMENT GOAL 11
Make cities and human settlements inclusive, safe, resilient and sustainable
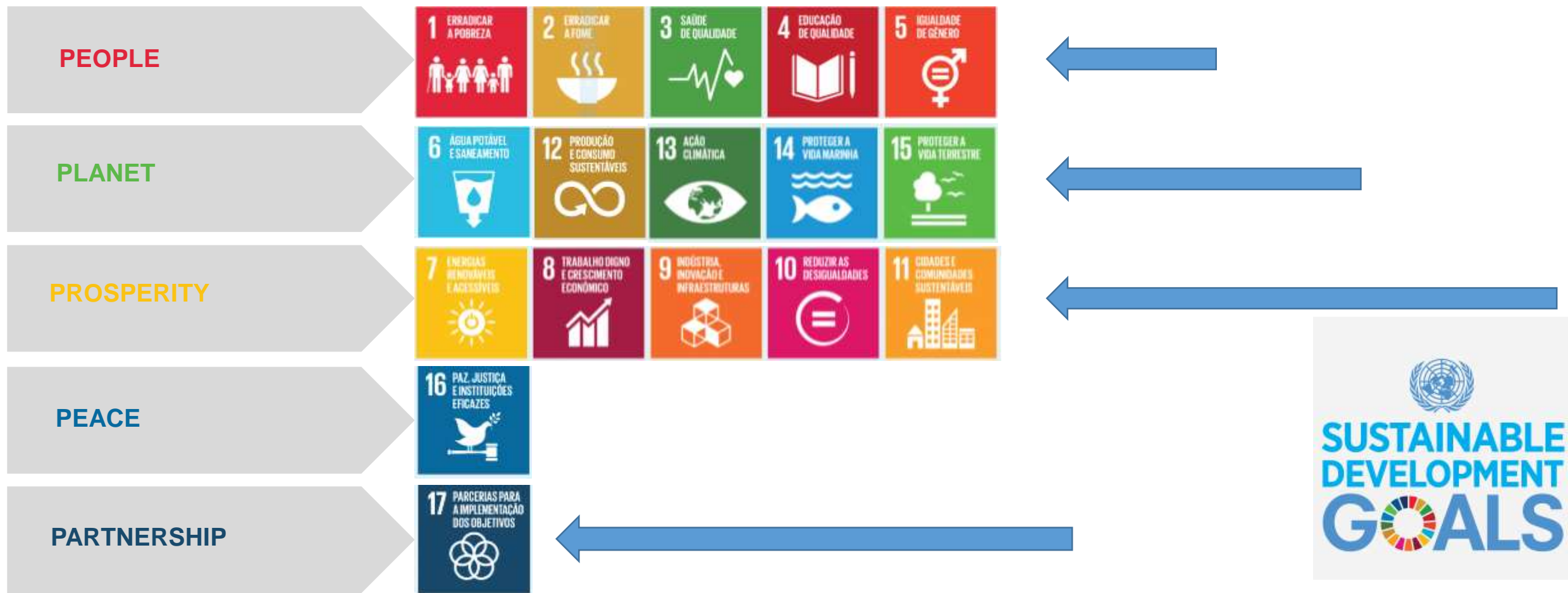
Construction represents **6%** of global GDP

By 2030, worldwide construction output is forecast to reach $17.5Tn ($2014), some 85% greater than 2014 levels

● INNOVATION   ● COMPETITIVENESS   ● SUSTAINABLE GROWTH
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Infrastructures

SUSTAINABLE DEVELOPMENT GOAL 6
Ensure availability and sustainable management of water and sanitation for all

SUSTAINABLE DEVELOPMENT GOAL 7
Ensure access to affordable, reliable, sustainable and modern energy for all

There are up to

180 million

construction workers worldwide

75%

are in developing countries

SUSTAINABLE DEVELOPMENT GOAL 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SUSTAINABLE DEVELOPMENT GOAL 8

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

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Today, our **built environment** utilises the world's:

Energy
40%

Carbon dioxide emissions
40%

Natural resources
50%
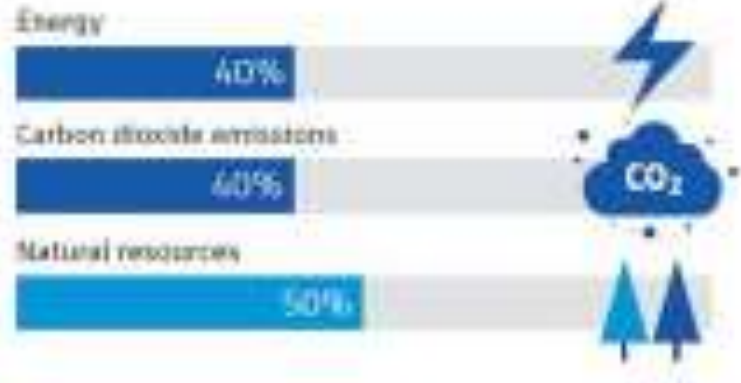
SUSTAINABLE DEVELOPMENT GOAL 12
Ensure sustainable consumption and production patterns

SUSTAINABLE DEVELOPMENT GOAL 13
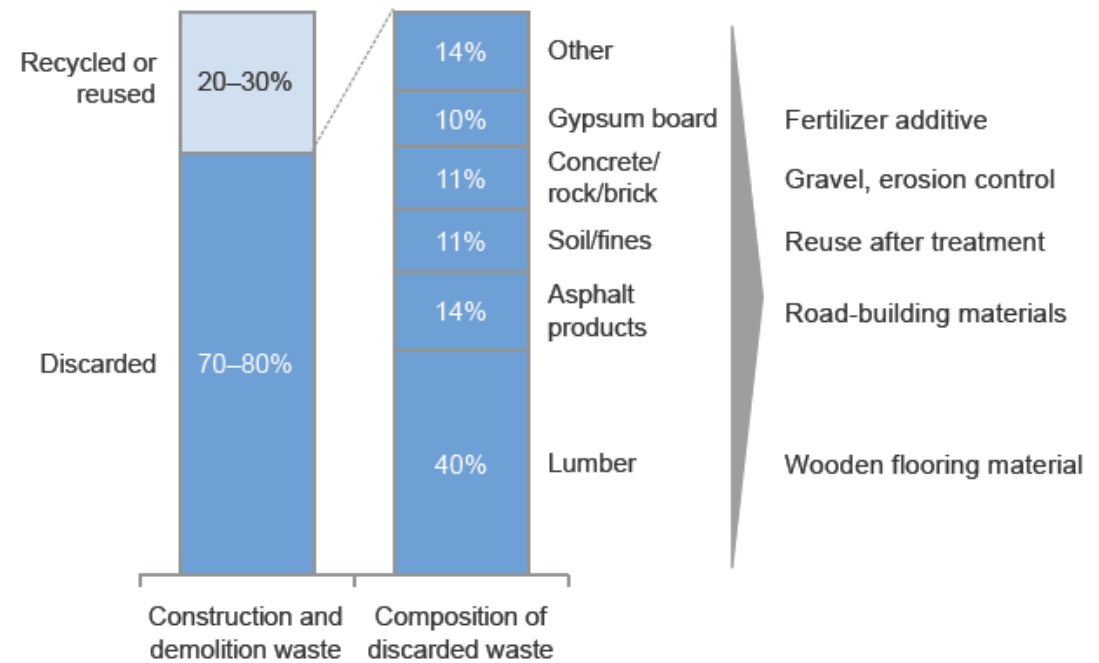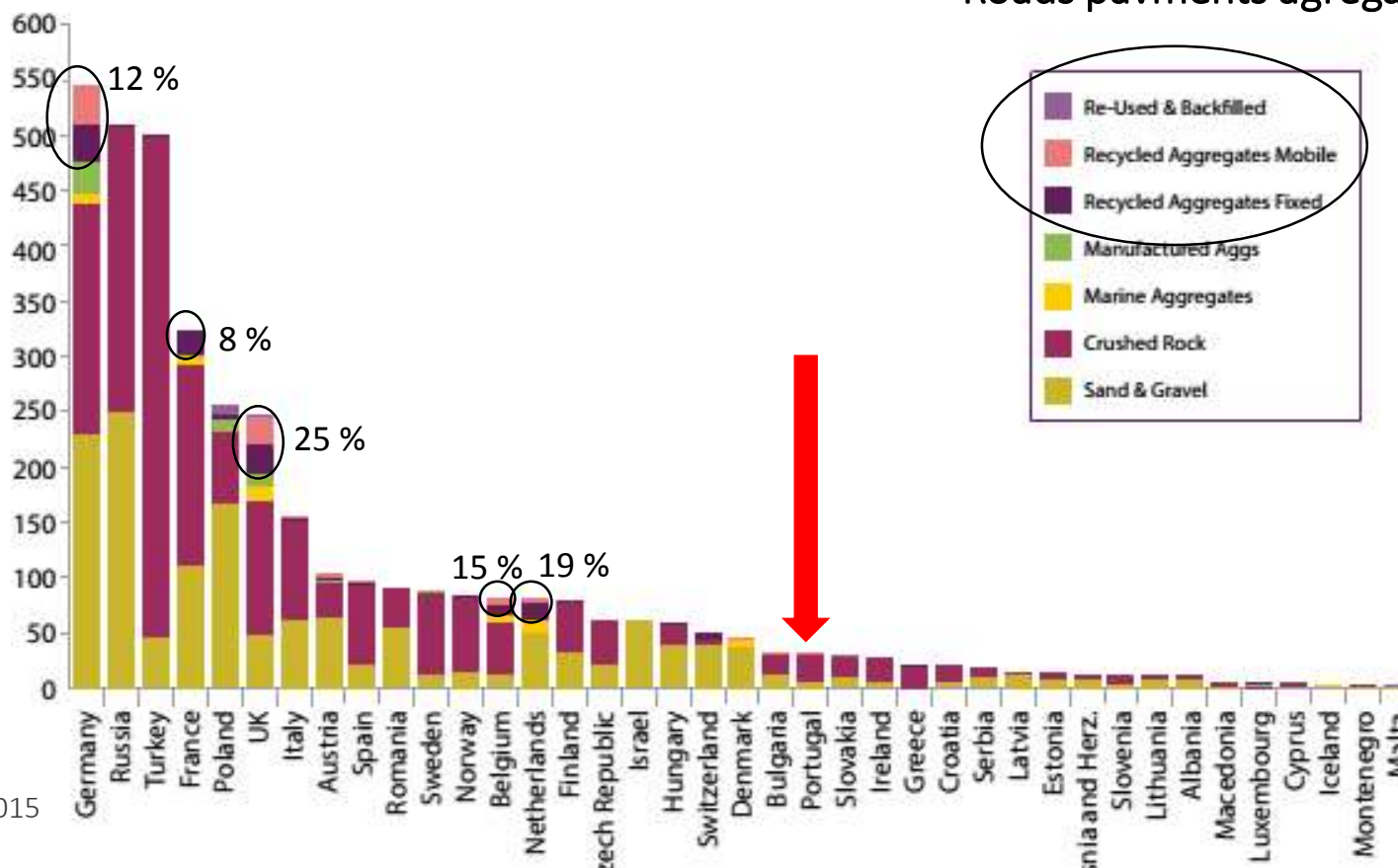Take urgent action to combat climate change and its impacts*

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● **COOPERATION | ENTREPRISSES | UNIVERSITIES | PUBLIC BODIES**

Less than one-third of construction and demolition waste is currently recovered

Much discarded material could be recovered – for purposes of

Recycled or reused — 20–30%

14% — Other
10% — Gypsum board — Fertilizer additive
11% — Concrete/rock/brick — Gravel, erosion control
11% — Soil/fines — Reuse after treatment
14% — Asphalt products — Road-building materials

Discarded — 70–80%

40% — Lumber — Wooden flooring material

Construction and demolition waste | Composition of discarded waste

Source: Ellen MacArthur Foundation; World Economic Forum; The Boston Consulting Group

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PTPC & Cluster AEC - Partners

SUSTAINABLE DEVELOPMENT GOAL 17

Strengthen the means of implementation and revitalize the global partnership for sustainable development

BUILT CoLAB

COLLABORATIVE LABORATORY FOR
THE FUTURE BUILT ENVIRONMENT

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CoLAB Motivation

a) Productivity and Competitiveness

- Portuguese construction sector shows a **lower productivity** when compared with other manufacturing industries (and other European construction companies).

Source: INESC TEC - WIOT

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CoLAB Motivation (cont.)

a) Productivity and Competitiveness

By 2025, "full-scale digitalization...
will lead to annual global cost savings
of 13% to 21% in the design, engineering
and construction phases and 10%
to 17% in the operations phase"

BCG (The Boston Consulting Group)
Digital in Engineering and Construction:
The Transformative Power of Building
Information Modeling 2016

Source: BCG Boston Consulting Group (2016)

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

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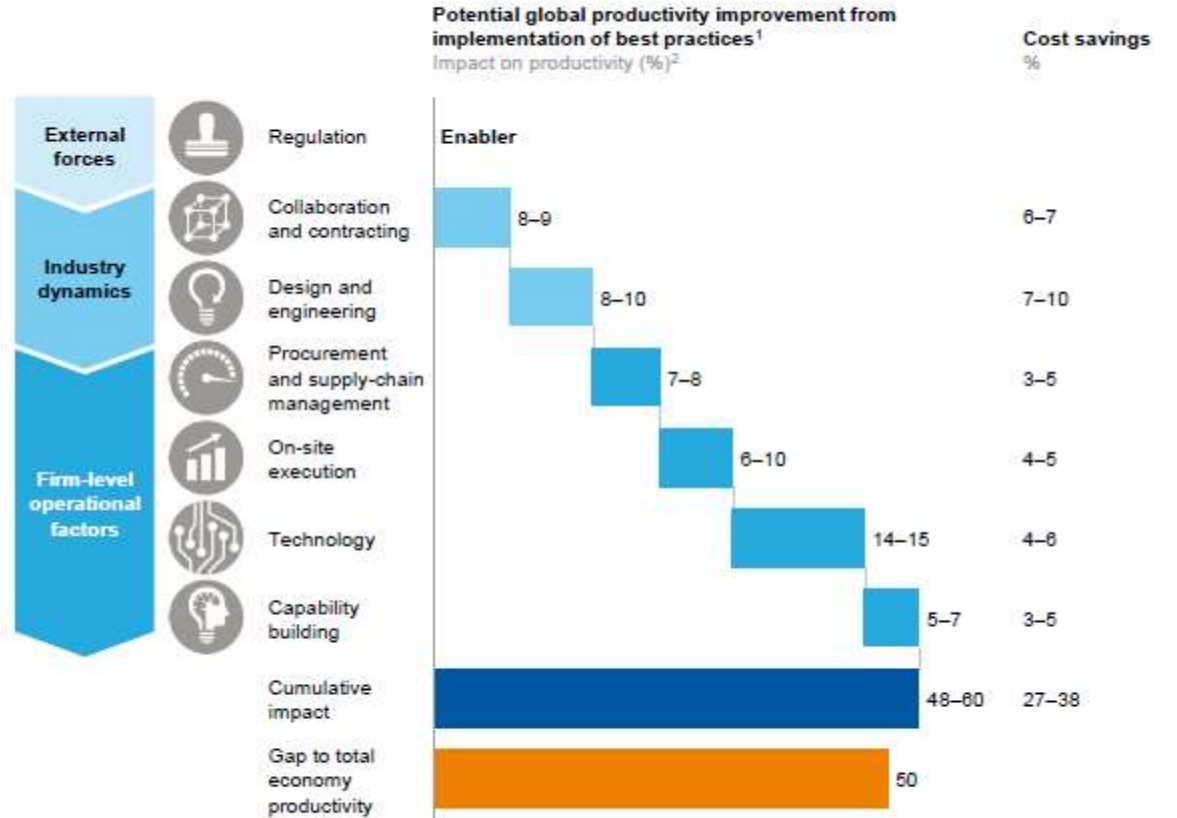Regulation changes facilitate shifts in industry dynamics that enable firm-level levers and impact

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
	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	

1 The impact numbers have been scaled down from a best case project number to reflect current levels of adoption and applicability across projects, based on respondents to the MGI Construction Productivity Survey who responded "agree" or "strongly agree" to the questions around implementation of the solutions.
2 Range reflects expected difference in impact between emerging and developed markets.

SOURCE: McKinsey Global Institute analysis

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CoLAB Motivation (cont.)
a) Productivity and Competitiveness – Impact & likelihood of new technologies
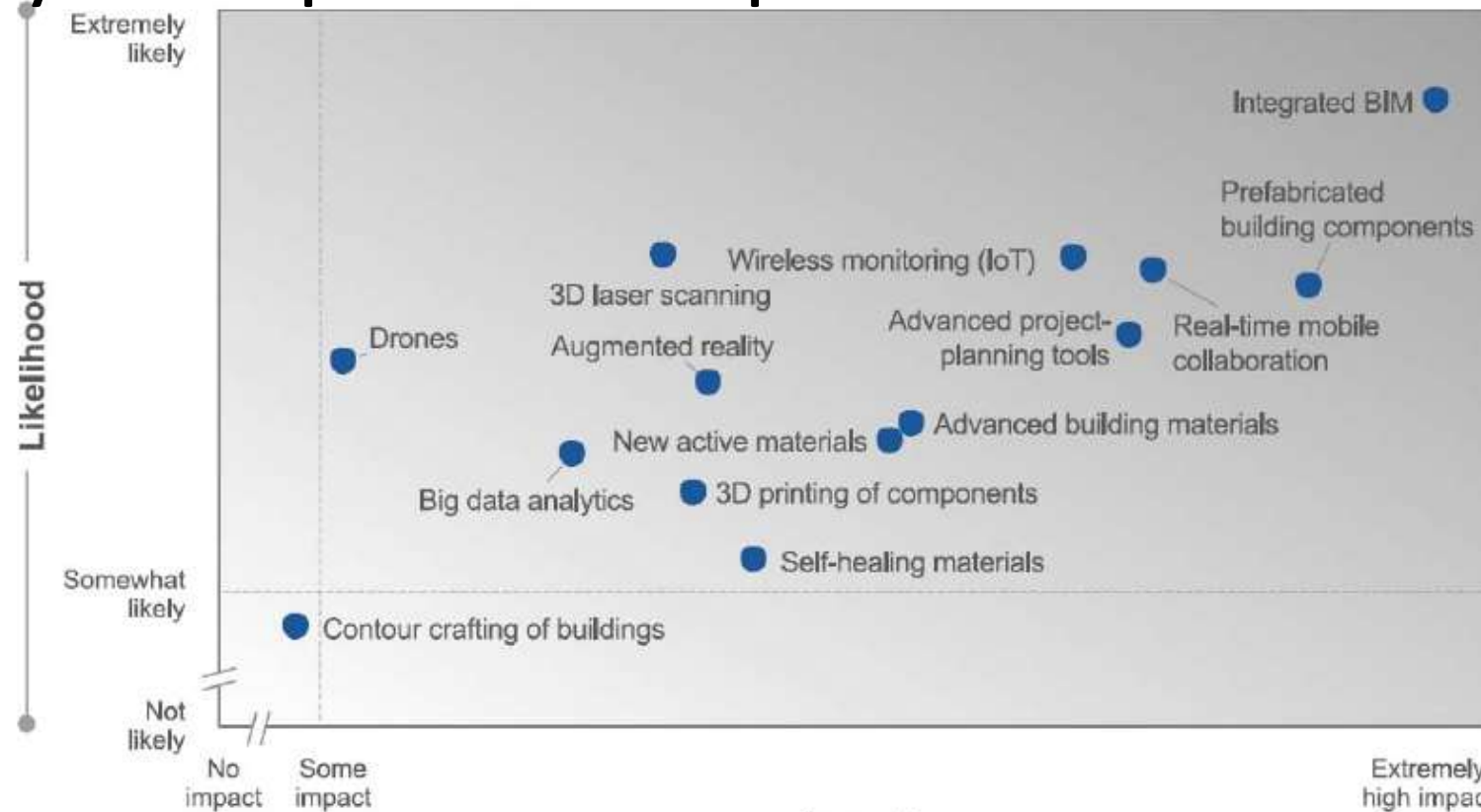
WHITE - WEF – Shaping the future of Construction (May 2016)

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CoLAB Motivation (cont.)

b) Intelligent & Resilient Buildings and Infrastructures

- Improved and **intelligent and integrated LCA** (Life-Cycle Analysis), using new models of **Building Information Management.**
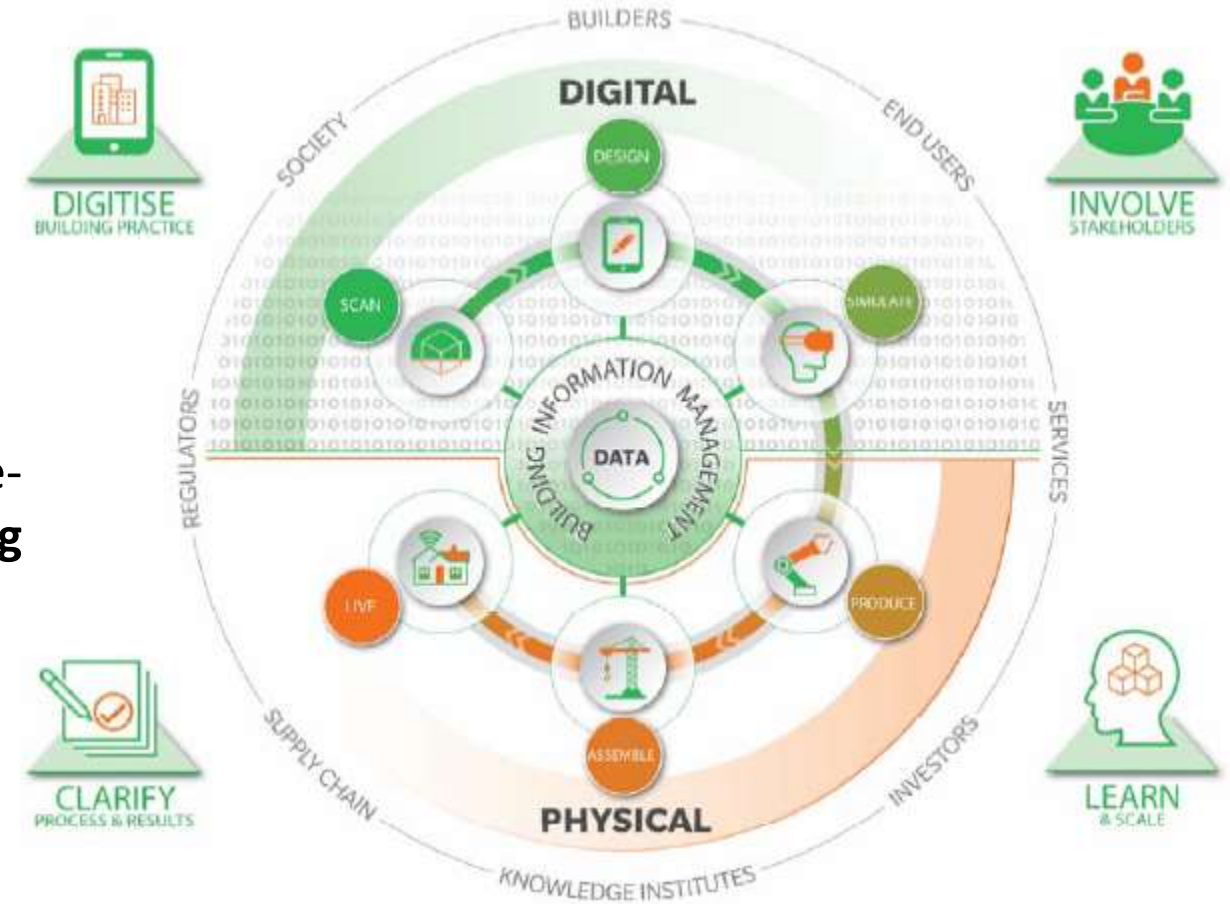
Source: Royal BAM Group 2018

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CoLAB Main Goals

- Bring together key **academia, companies and owners;**

- Promote the construction paradigm change to the **Digitalization Technologies,** using the **Key Enabling Technologies** (KET), such as: BIM, IoT, cloud infrastructure, data analytics, machine learning, AI, etc.;

- Promote the **professionalization of R&I in all construction industry chain**;

- Maximize the **added value of R&I** in construction chain;

- **Create high qualification and scientific jobs**, move it into the companies and **reskill the workforce**;

- Enhance **cross sectorial R&I** with other relevant CoLAB's;

- **Increase the capacity to access to** international funds and investments;

- **Create the perfect ecosystem to enhance the technological development** of the Portugal's infrastructure and building companies, towards a competitive, intelligent, resilient and sustainable **Construction Industry Worldwide.**

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CoLAB Strategic Activities to Generate Innovation-to-Market

Training, Mentoring & Services

Advanced training programs - Resikll Workforce

Managing innovation

Hi-tech internationalisation

Start-up mentoring

Fund pursuing and gathering

Promoting participation in international forums and networks

Design decision support policies

Technology Commercialisation

Creating spin-offs

Licensing support

After-licensing support

Design support and scale-up industrialization

Innovation & Development Research | Infrastructures | Strategy Planning

R&I Roadmaps
Oriented research programs and activities
Innovation ecosystems
Access technologic infrastructures
Collaborative network with other knowlege areas
Living Labs
NZEB technologies
Improve knowledge - from R&I to Market (companies)

Technology Transfer & Management

Market analysis and commercial strategy support

Scientific dissemination and brand enhancement

IP advisory and support

Incubator development and support

Finding of licencees and sales partners

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CoLAB - Research and Innovation Agenda

1. **Productivity and Competitiveness**

Increase productivity and competitiveness of Companies by delivering new processes and materials, and exploiting Digital Technology in design and delivery, to enable faster, less disruptive and more efficient manufacturing and construction techniques;
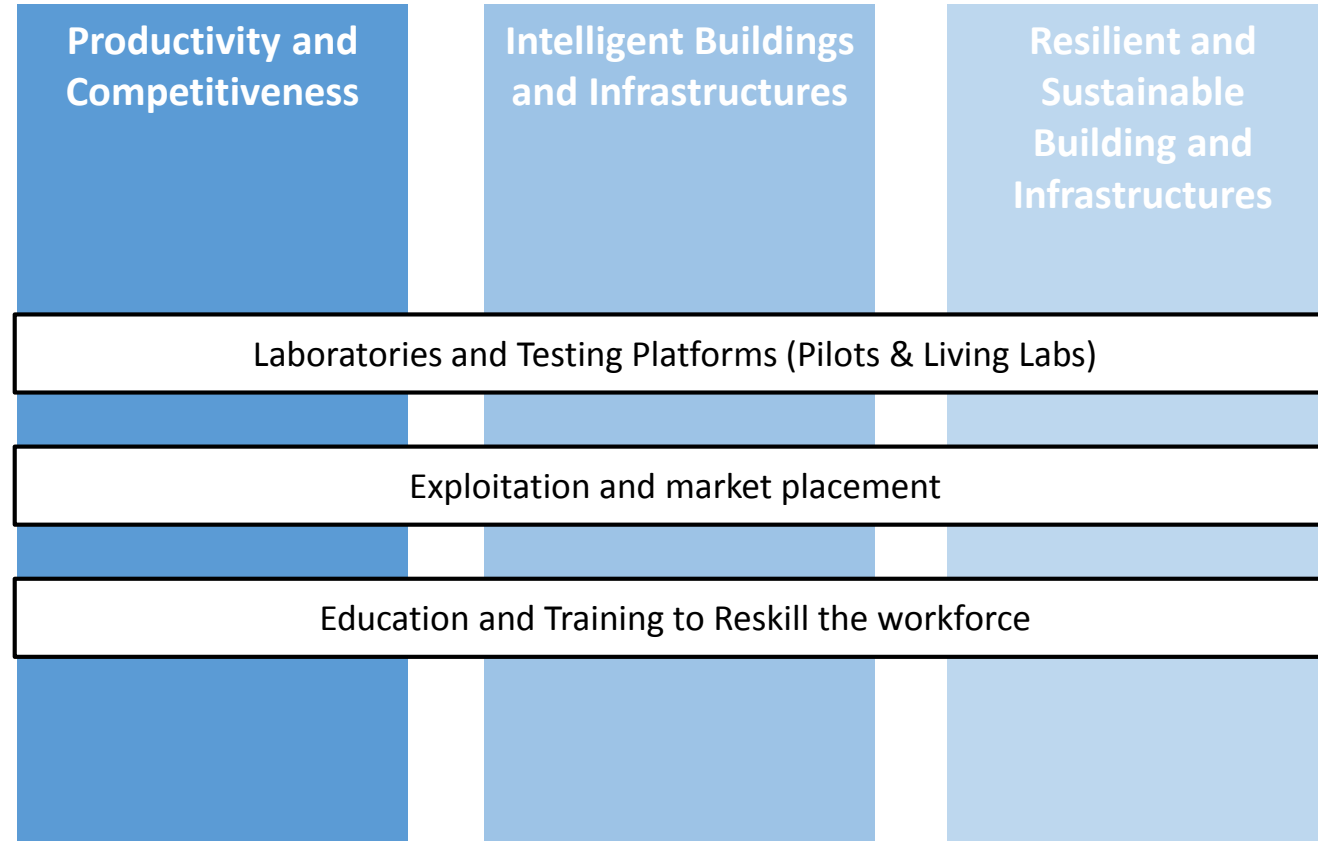
2. **Intelligent Buildings and Infrastructures**

Promote the use of Key Enabling Technologies, which include BIM, IoT, cloud infrastructure, data analytics, machine learning and artificial intelligence, allow for the creation of intelligent buildings and infrastructures that provide more accurate and useful information to the infrastructure managers;

3. **Resilient and Sustainable Buildings and Infrastructures**

Develop new construction and management models that are efficient in the use of energy and resources, that rely on the use of sustainable and resilient materials that increase the life-cycle of buildings and infrastructures.

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6 - Research and Innovation Agenda (cont.)

4. **Cross Areas**

Productivity and Competitiveness	Intelligent Buildings and Infrastructures	Resilient and Sustainable Building and Infrastructures

Laboratories and Testing Platforms (Pilots & Living Labs)

Exploitation and market placement

Education and Training to Reskill the workforce

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Key R&I Areas

1. **Productivity and Competitiveness**
   - WP 1.1 – Future Construction Factories
   - WP 1.2 – Design for Manufacture and Assembly
   - WP 1.3 – Integration of Innovative technologies
     for Intelligent Construction Sites
   - WP 1.4 – Digital Twin Mobile Lab

DIGITAL TWIN
IN CONSTRUCTION

Source: Intellectsoft 2018

2. **Intelligent Buildings and Infrastructures**
   - WP 2.1 – Sensing for Motorways and Railways
   - WP 2.2 – BIM for Intelligent Buildings & Intelligent Infrastructure Management models
   - WP 2.3 – Applications for Intelligent Infrastructures and Buildings
   - WP 2.4 – Inductive Charging Infrastructures

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3. **Resilient and Sustainable Buildings and Infrastructures**
    - WP 3.1 – Adaptability and Resilience for Climate Change
    - WP 3.2 – Materials for the Future Construction
    - WP 3.3 – Future Construction LCA

4. **Cross Areas**
    - **NZEB "_Nearly Zero Energy Buildings_"** in Portuguese Climate integrated in AEC Living Labs
    - Reskill of the workforce for the Future Built Environment

CoLAB - Human Resources

Staff	Years									
	1	2	3	4	5	6	7	8	9	10
Managing Director	1	1	1	1	1	1	1	1	1	1
Research Manager	1	1	1	1	1	1	1	1	1	1
Innovation Manager	0	1	1	1	1	1	1	1	1	1
Education and Training Manager	0	1	1	1	1	1	1	1	1	1
CoLAB Project Manager	2	3	5	7	9	11	13	14	15	17
CoLAB Researcher	4	6	10	14	18	22	26	28	30	34
CoLAB Assistant Researcher	2	3	5	7	9	11	13	14	15	17
CoLAB Research Technician	1	2	2	4	4	4	6	6	8	10
Administration Manager	0	1	1	1	1	1	1	1	1	1
Financial Controller	0	1	1	2	2	2	3	3	3	3
Administration Assistant	1	1	2	3	4	5	6	7	7	8
Grand Total	12	21	30	42	51	60	72	77	83	94

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BUILT CoLAB and Sustainable Development

United Nations 2030 Agenda for Sustainable Development Main Goals:

BUILT CoLAB is clearly in-line with these goals, namely the following:

9 – Industry, Innovation & Infrastructure

11 – Sustainable Cities & Communities

12 – Responsible Consumption & Production

13 – Climate Action

17 – Partnerships for the Goals

Source: UN's Sustainable Development Goals 2030 Agenda

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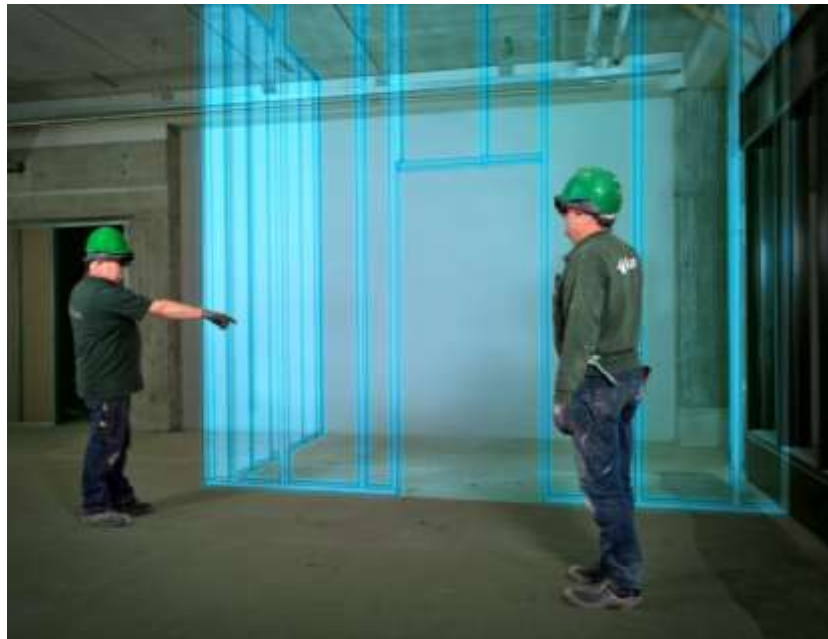
● INNOVATION   ● COMPETITIVENESS   ● SUSTAINABLE GROWTH
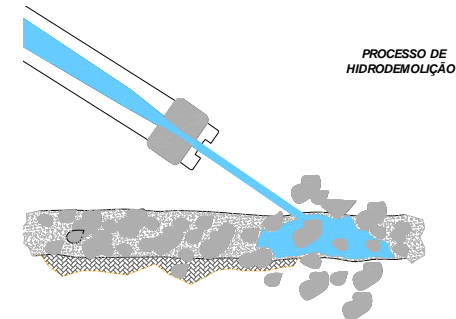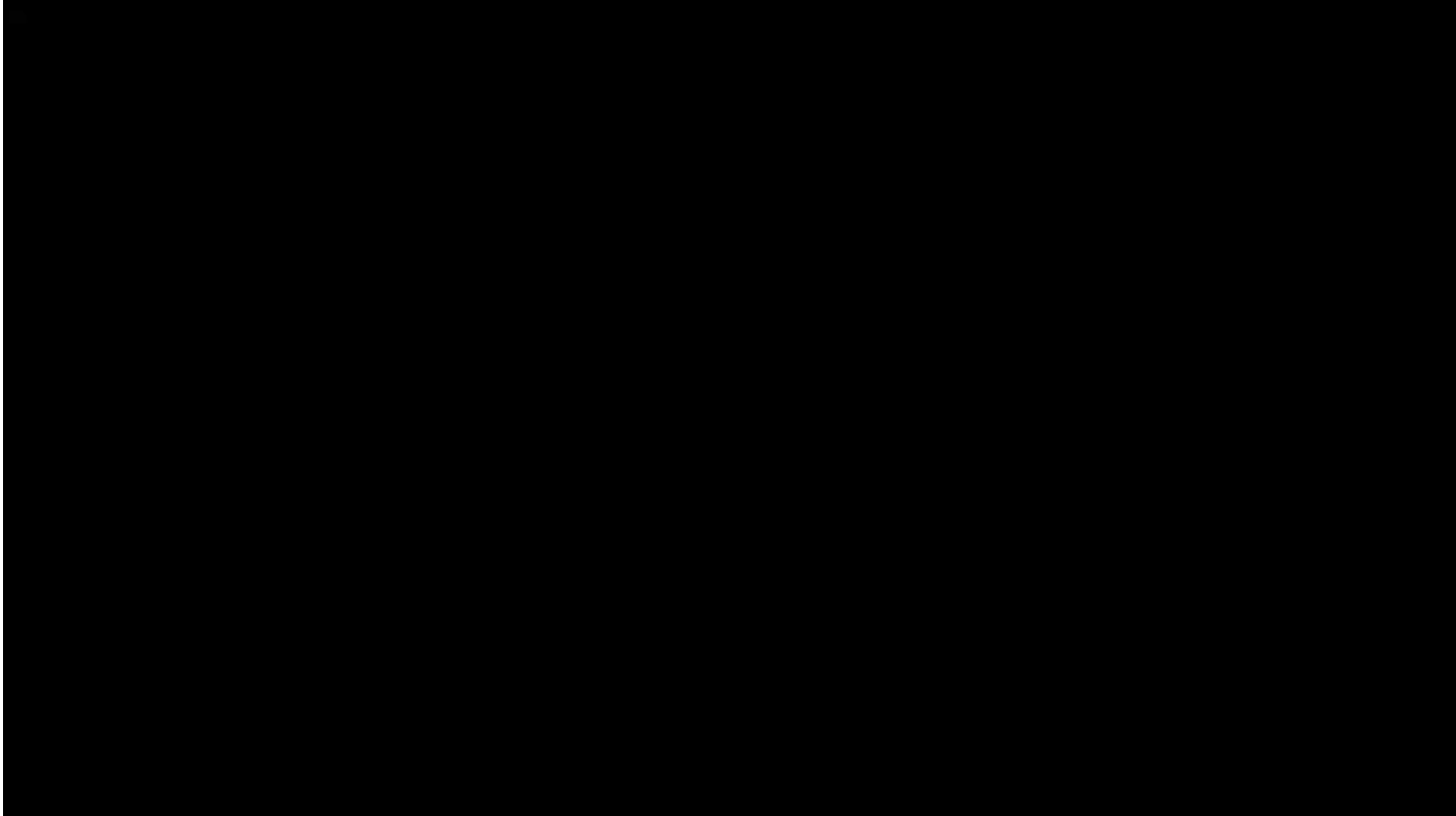● COOPERATION | ENTREPRISSES | UNIVERSITIES | PUBLIC BODIES

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Augmented Reality

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Laser scanning - drones

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3D Printing

Concrete

Steel

Concrete (Source: BAM/Netherlands)

Steel

Robotics

Teixeira Duarte - 1998
Hidrodemolition - Lisnave

PROCESSO DE HIDRODEMOLIÇÃO

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BIM - Chlef - Argélia

Internet of Things, Big Data, Artificial Intelligence

Regulating the internet giants

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules

The Economist. May,6th 2017
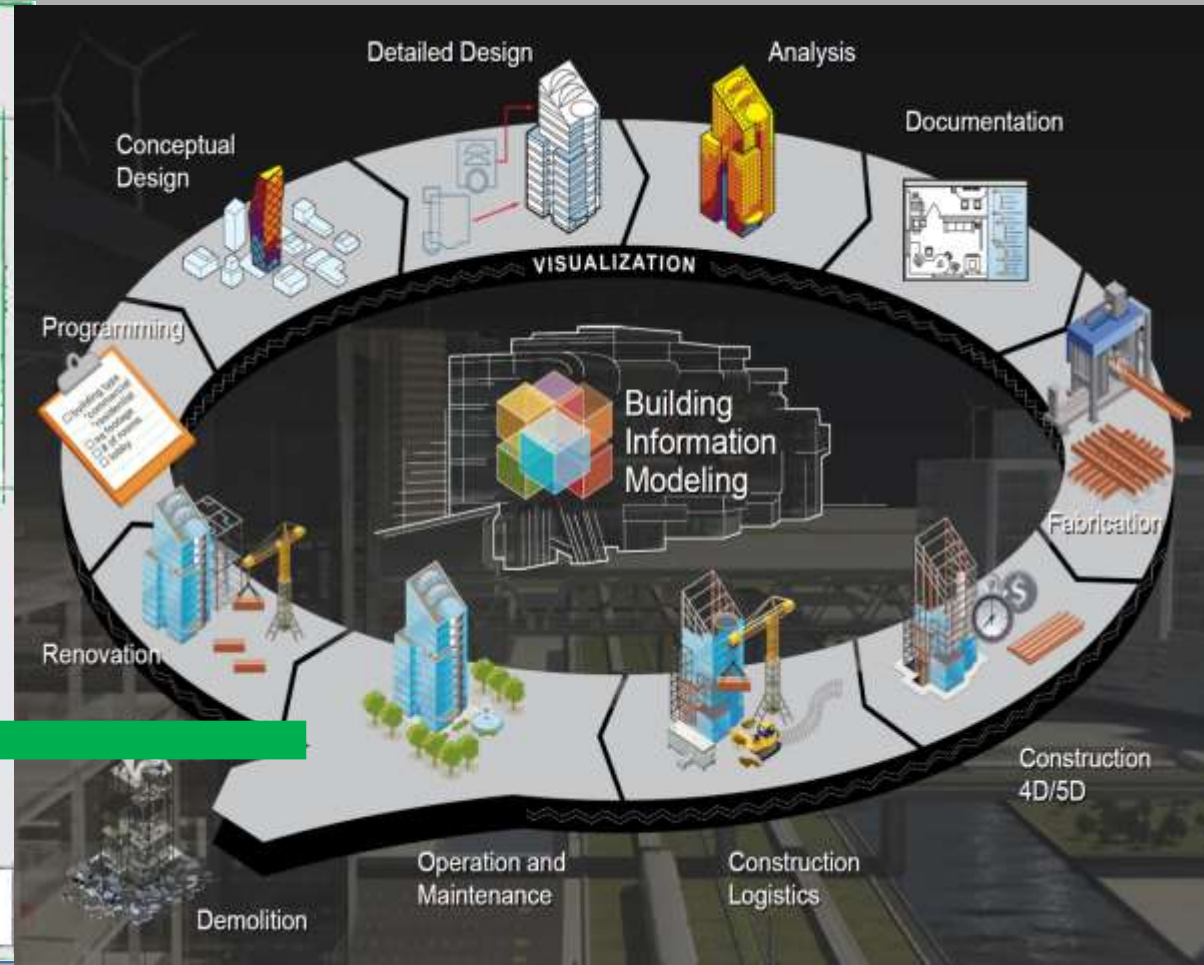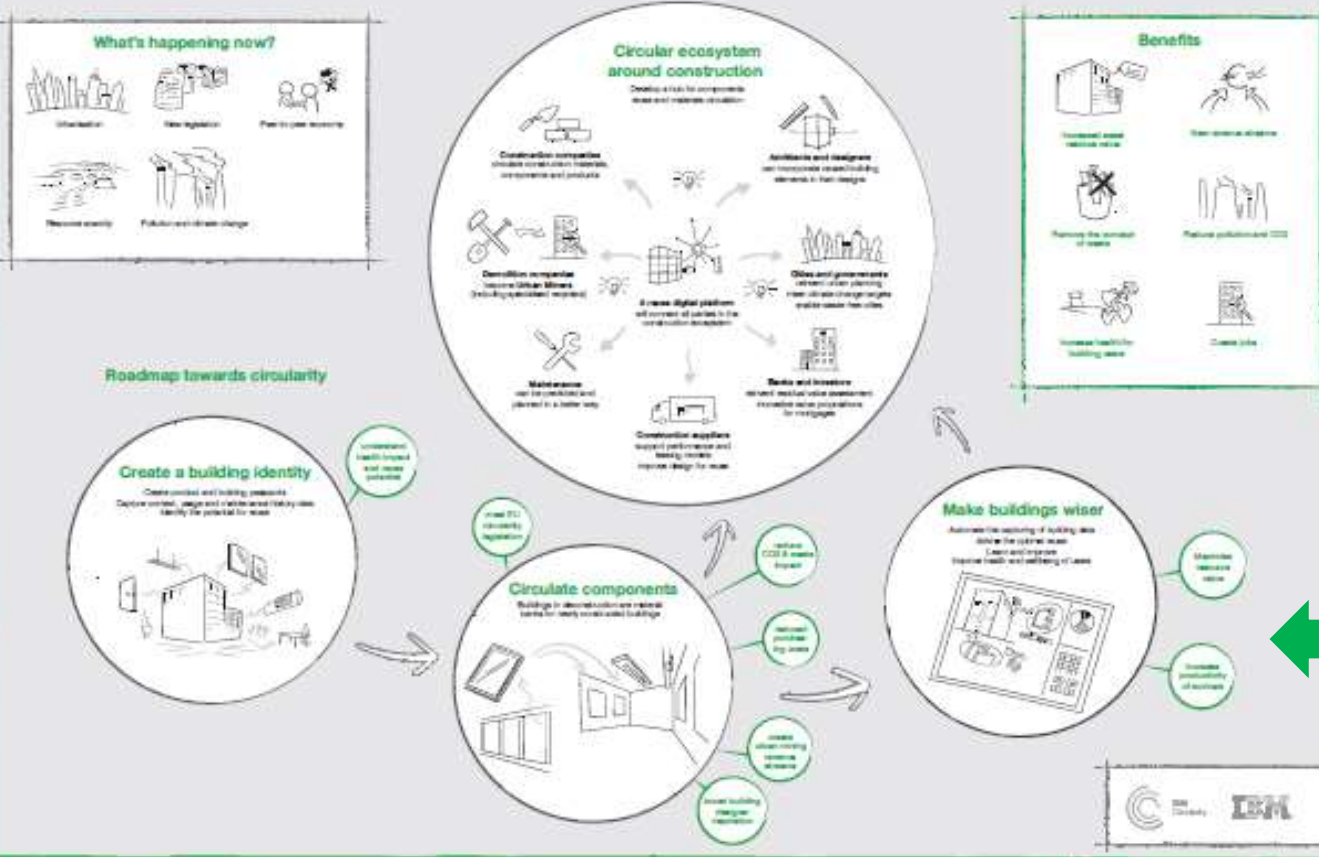
Construction & Built environment

We shape our buildings and, afterwards, our

buildings shape us.

Winston Churchill

Built environment is a determinant of where and how almost everyone lives, works and plays.

Indeed, Europe was born under the city concept, and history of these cities conform the European identity and singularity.

People on average spend nearly 90 % of their time indoors.

Transport infrastructure makes possible an interconnected and integrated Europe..

All business and social activities rely on the built environment

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More investors are interested in **sustainable investing** and adopting its principles as part of their strategy, but **Millennials are leading the charge**
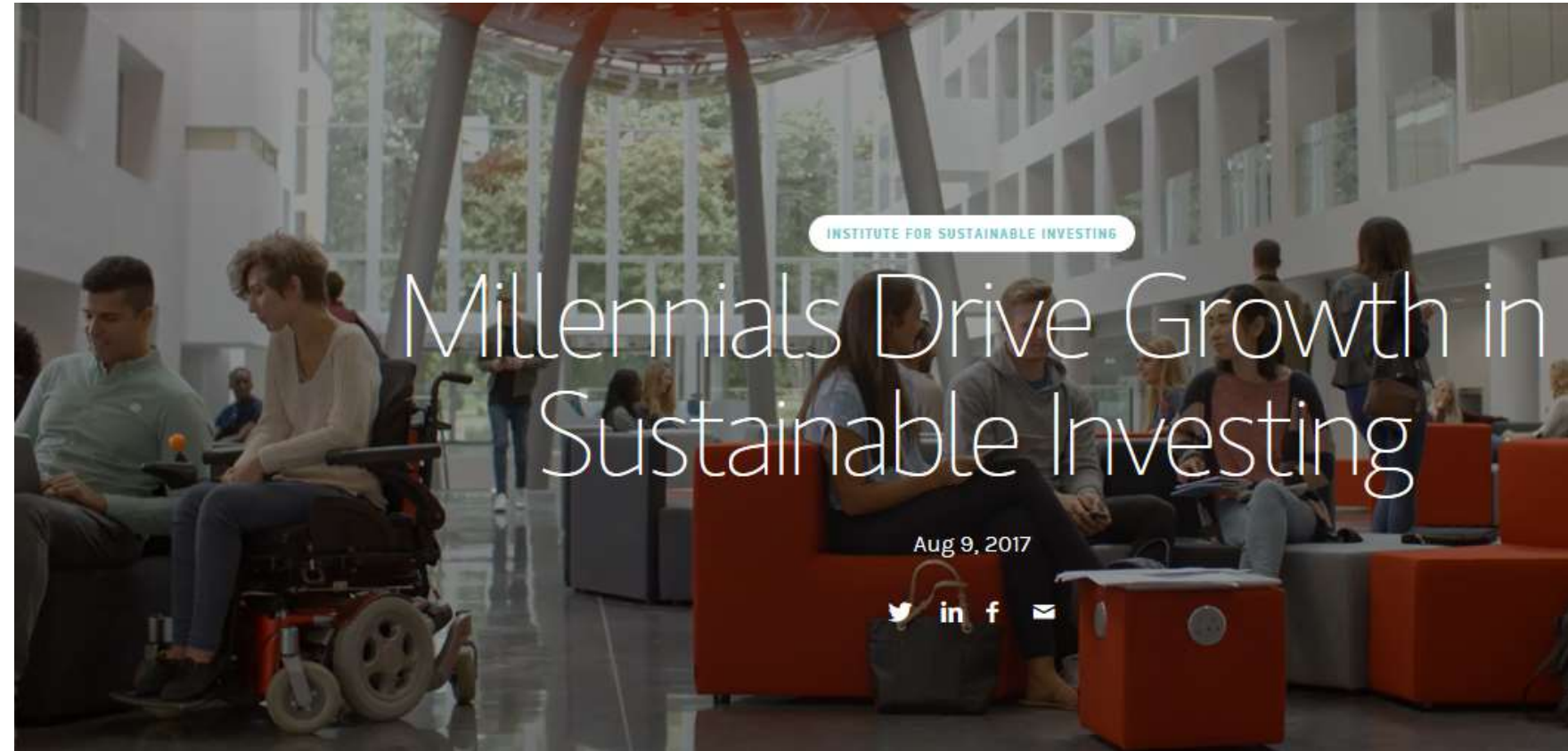
Millennials are **2X as likely** as the overall investor population to invest in companies targeting **social or environmental goals**

Millennials believe their **investment can create positive change:**

75 %

say their investments **can influence climate change**

84 %

say their investments **can help lift people out of poverty**

(*) - Millennials - Peaple born 1981 – 1996
(Source: Morgan Stanley)

INSTITUTE FOR SUSTAINABLE INVESTING

Millennials Drive Growth in Sustainable Investing

Aug 9, 2017

The GSD Agenda may represent

12.000 Bilion $ / year in Market Oportunities

= 63% of EUA GDP

Create 380 Milion new employees till 2030

+ 50% emploeyees in EU

THE FUTURE
IS NOW
SCIENCE FOR ACHIEVING
SUSTAINABLE DEVELOPMENT

GLOBAL SUSTAINABLE
DEVELOPMENT REPORT 2019

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"The world's **biggest business opportunities** come from **solving** its **biggest challenges**."

Rita Moura

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