



Accelerating the clean energy transition: the strategic contribution of zero-emission buildings and neighbourhoods

EUROPEAN PARLIAMENT – Room 5F385

27 JUNE 2018 – 16:00-18:00

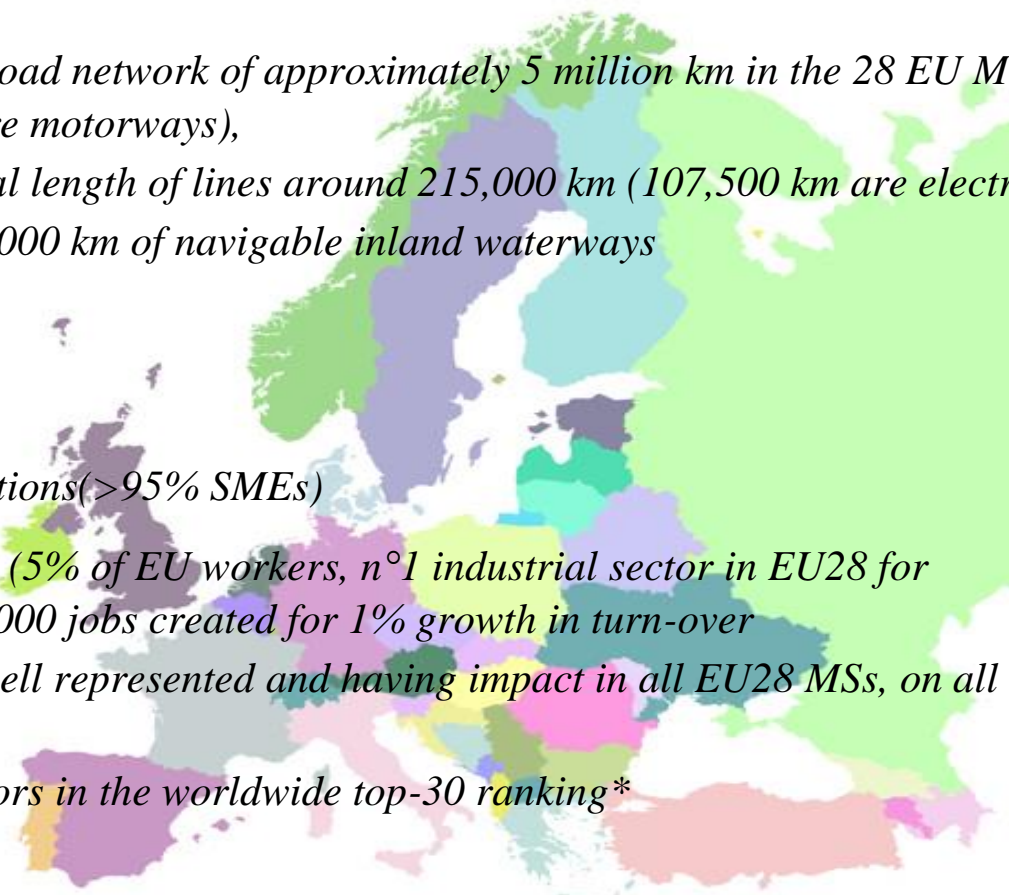
***Future R&I developments
& needs from the
Construction sector***



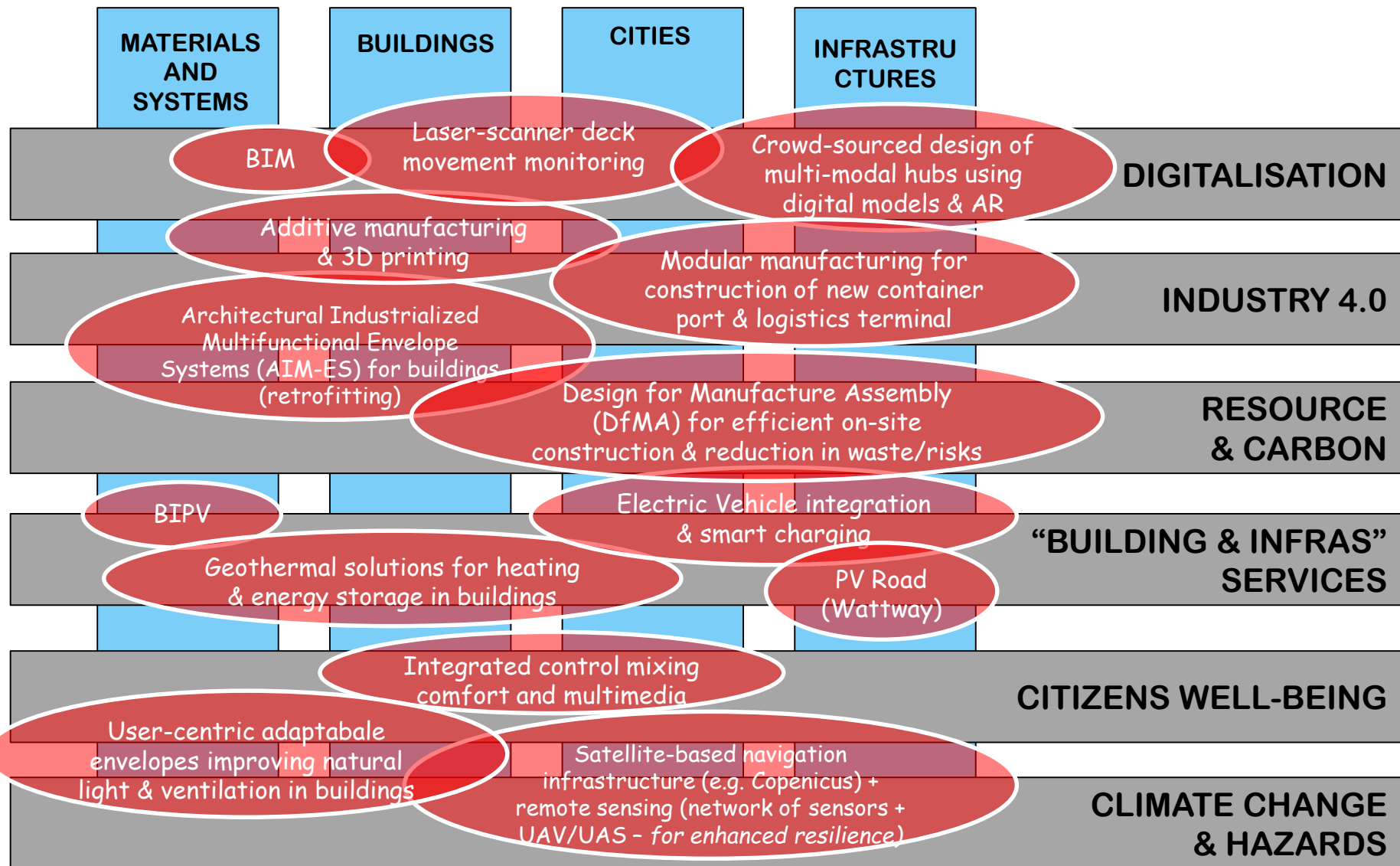
ECTP
**INNOVATIVE BUILT
ENVIRONMENT**

Construction: A key EU industrial sector

- > 80% of time spent in buildings, while > 75% of EU citizen live in cities
- 78% of the overall construction sector dedicated to buildings
- Infrastructures:
 - Roads, with a total road network of approximately 5 million km in the 28 EU Member States (60,000 km are motorways),
 - Railways, with a total length of lines around 215,000 km (107,500 km are electrified)
 - Waterways, with 41,000 km of navigable inland waterways
- Industry
 - ~9% GDP
 - 3.1 million organizations (>95% SMEs)
 - 18 M jobs in Europe (5% of EU workers, n°1 industrial sector in EU28 for employment), +200,000 jobs created for 1% growth in turn-over
 - An industry sector well represented and having impact in all EU28 MSs, on all European citizens
 - 40% of EU contractors in the worldwide top-30 ranking*
- Climate
 - 34% CO2 emissions' reduction compared to 1990 level, **overall positive contribution to climate goals**



Construction & Built Env. - Samples of innovations



- *Societal challenges*

- **Resource efficiency / carbon neutrality**

- Reducing energy consumption, integrating sustainable heat and PV, circular building materials

- **Human centric design / mass customisation**

- User-centric features, reduced discomfort, individualized comfort, health for ALL citizens

- **Conservation, maintenance, renovation**

- Existing built environment, ageing infrastructures, cultural heritage, natural / man made hazards

- **Adaptation for aging population**

- Life-long flexible housing, design for all

- *Policies*

- **EPBD Directive, national building performance regulations...**



- *Industrial & Business trends*

- **Industrial (r-)evolution**

- Reduce time “on-site”, BIM, additive manufacturing, rapidly evolving skills & competencies

- **Innovative business models**

- Performance-based models, “building as a service”, “infrastructure as a service / HLSI”...

- *Scientific & technological trends*

- **Digitalization**

- digital twins of structures, advanced inspection & monitoring, machine learning & AI, big data

- **Fast and valid prediction of long term material performance**

- Degradation modelling, model-based non-destructive testing, in situ testing

- **Multi-scale, multi physics probabilistic modelling**

- Advanced reliability assessment and service life prediction

- **Material, installation and equipment innovation**

- New materials (heat storage, insulation, secondary materials, repair), energy system components, robotics

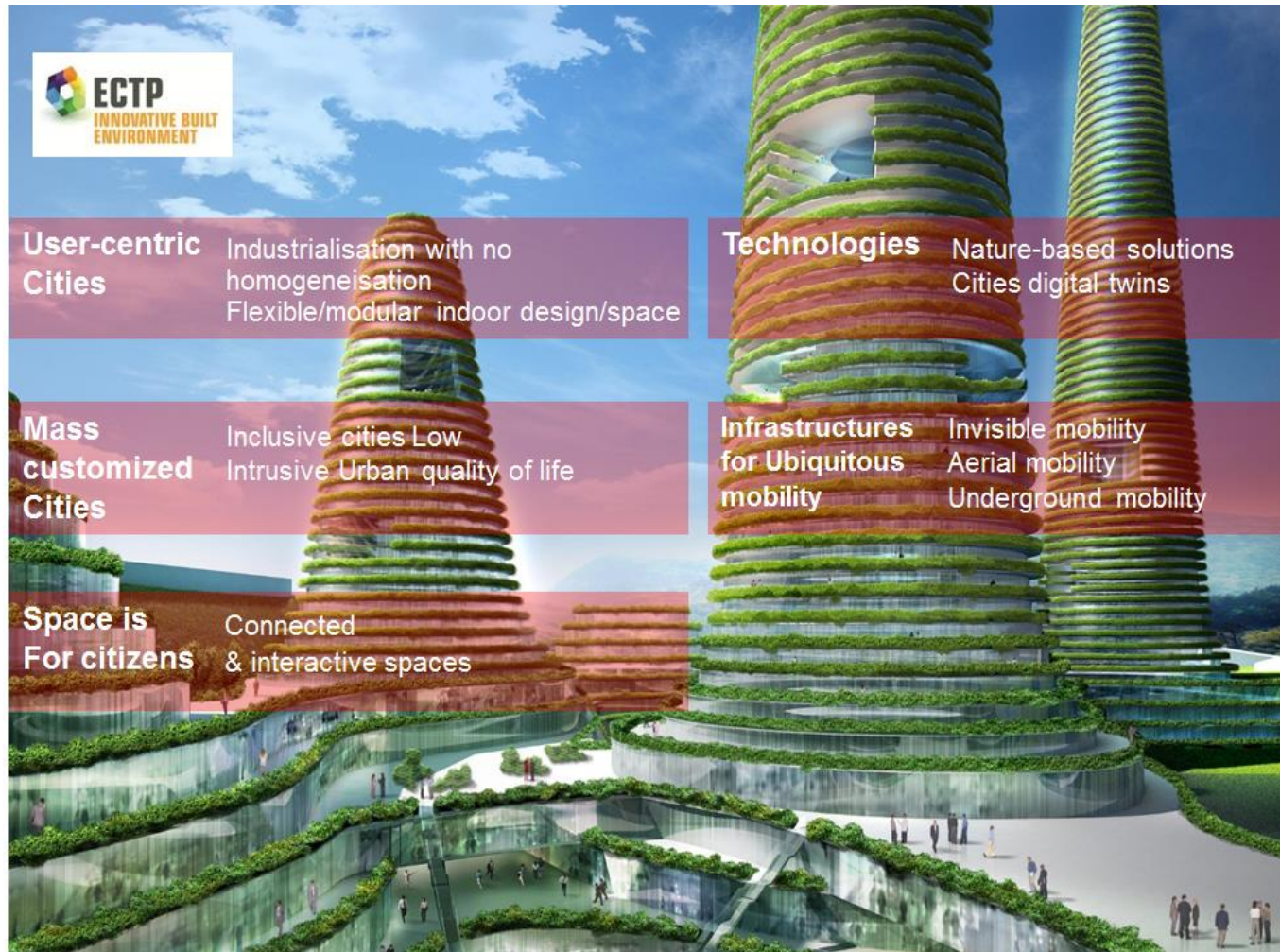
The ECTP vision of Construction as a (r)evolutionary industrial sector (1/2)

- By 2040, the construction sector will be a *service-oriented* business following a *User-centric* approach – offering:
 - *flexible & connected spaces*
 - *inclusive cities with a high quality of life for all citizens.*
 - *Infrastructure interacting with citizens and featuring embed self-healing capabilities.*
- Most of urban areas will be **carbon neutral** and produce on site at least 25% up to 50% of their energy needs from **renewable sources**.
- The construction sector will continue providing:
 - *10% of total EU-local jobs*
 - *supporting EU-identities thanks to its 99% share of SME companies*
 - *while representing by far the most integrative industrial sector regarding society.*
- **Innovative business-models delivering value over long life time** will be developed to crowd-in private investors
 - *If not, EU's huge infrastructure regeneration and building refurbishment needs in Europe can't be addressed!*

The ECTP vision of Construction as a (r)evolutionary industrial sector (2/2)

- Technologies will reduce investors' risk while providing construction companies with innovative solutions:
 - ***Digitalization for mass-customization and industrial efficiency, from design to end-of-life***
(e.g. resource-efficient recyclable pre-fabricated modules, 3D printed construction products)
 - ***Real-time assistance & monitoring, improving quality of work and reducing environmental impacts***
(ex. augmented reality to assist workers, better execution in a safer environment)
(e.g. advanced operation and maintenance, life-time operation being by far the most impactful phase)
 - ***New materials & processes for sustainability, circular economy and nature-based solutions***
(e.g. Multi-functional materials encapsulating active components for improved ageing properties, resource-efficient cement using mineral waste materials like sediments,...)
- E.g. the 100% BIM approach will guarantee
 - *low intrusive work sites lasting 50% less than in 2020*
 - *while turning buildings into banks of materials that are 100% reusable or recyclable.*

The ECTP vision towards 100 carbon-neutral cities in Europe - 2020-2030



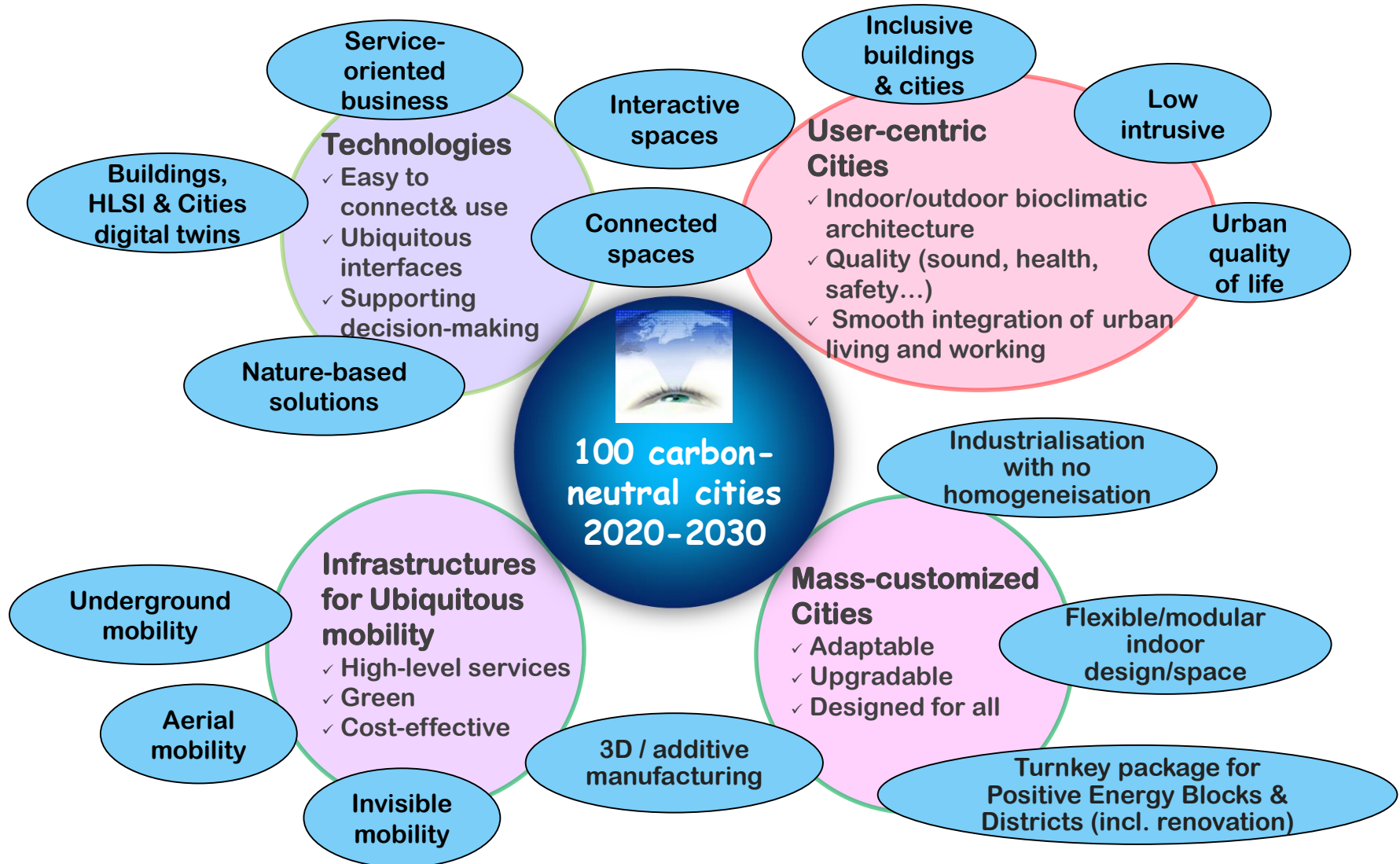
5 key topics areas

- EU identity
- Working
- Upgrading
- Low environmental footprint
- EU connectivity

3 levels

- Local
- City
- EU

Built environment – Vision 2018-onward



Post-2020 potential scope evolution/delta

H2020

FROM...

TO...

**Horizon
Europe**

Building sector,
Infrasector
(focus)

Construction sector

*Embracing larger built environment, other (ageing)
infrastructure... over the whole life-cycle process*

Single Building
/ Isolated
Infras (scale)

Building block / Neighbourhood

*Optimization sources to be found when scaling up at level of
the Built Environment*

Traditional
passive building
/
Infrastructure

Active utility node

*Integration of more Renewable and resource-efficient
components/systems, electricity market, circular economy...*

Energy
efficiency

Sustainability

*Net zero carbon emissions, Resource efficiency, resilience
(extreme events...)...*

Global Approach: the Built environment on its way to full energy/decarbonisation & digital transitions

 The **Construction Industry** is to support the future European way of living by generalising the delivery of **Smart Low-Carbon Buildings, Infrastructures and Districts**

Pooling forces for EU policy integration & benefits to ALL parties



e.g. LOW-CARBON BUILDINGS



e.g. SMART BUILDINGS & BLOCKS

Meeting the Energy & Decarbonisation transition

SC1: Energy Transition (rapid decarbonization of the energy systems) & Adaptation to Climate Change

Materials & Nanotech

Biotech & Bioeconomy



Citizen centric



PEOPLE



PROCESS

Circular Economy & Industrialisation

SC3: Resource preservation & waste reduction

SC4: Quality & value for customers



Meeting the Digital transition

SC2: Digital Construction in an era of knowledge capitalisation, automation and artificial intelligence

ICT Inside
(Digital transformation thru BIM, Big Data, IoT, Automation & AI)

Business Models & Blockchain



Systemising Sustainable Innovation uptake
in the construction sector

Key targets in industrialisation (Mass-customisation)

Developing smart & resilient buildings and HLSI*

Increasing the renovation of buildings & HLSI
with Smart-readiness & enhanced resilience



Generalising a user-centric approach



Innovation



Industrialization
of production



Integration
process for
buildings & HLSI

Towards an overall cost & quality approach



Digitalizing practices

Networking information,
objects & stakeholders

Generalising cyber
innovative services

Improving the quality of construction, use and wellbeing

Strengthening integrated
approach (e.g. in renovation)
& guaranteeing performance
(with methods)

Supporting the
improvement & expansion
of innovation-related skills
in the construction sector

Linking smart buildings with
a sustainable way of life

Axes of progress & main challenges for transformation



Systemising Sustainable Innovation uptake in the construction sector

- **From LAB to APP**
 - Up scaling and industrialization
 - Mass manufacturing
 - Cost efficiency
 - Sustainable manufacturing
- **Increasing user's confidence**
 - Living labs
 - Innovation Public procurement
 - Evidence based decision making
- **Codes & standards**
 - Process
 - Components & Interfaces
 - Adapting codes
- **Business models**
 - Incentives
 - Partnerships
 - Risk management
- **User centric**
 - User behavior & perception
 - Social leadership
- **Skills**
 - Academic & Professional

Main questions/Challenges:

- How to push towards TRL 8/9?
- How to generate reliable evidences (qualitative and quantitative)?
- How to remove barriers to uptake innovation in construction? (public, private and citizens)
- How to speed up the adaptation of EU regulations to new scenarios (including issues related to complex legislation or imprecise regulatory framework...)?
- How to improve the ROI (financial, and functional too)?
- How to finance/manage large scale operations?
- How to assess the risks?
- How to ensure better stakeholders engagement / Citizens engagement ?
- How to assure continuous learning and adaptation to new scenarios?
- ...

Construction Industry - New Value Chain

Main enablers for a competitive Construction eco-system



Generalised Digitalised platforms and Apps for construction projects



Seamless integration of innovation (materials, components, systems)



Engaging all actors in sustainable development and impact



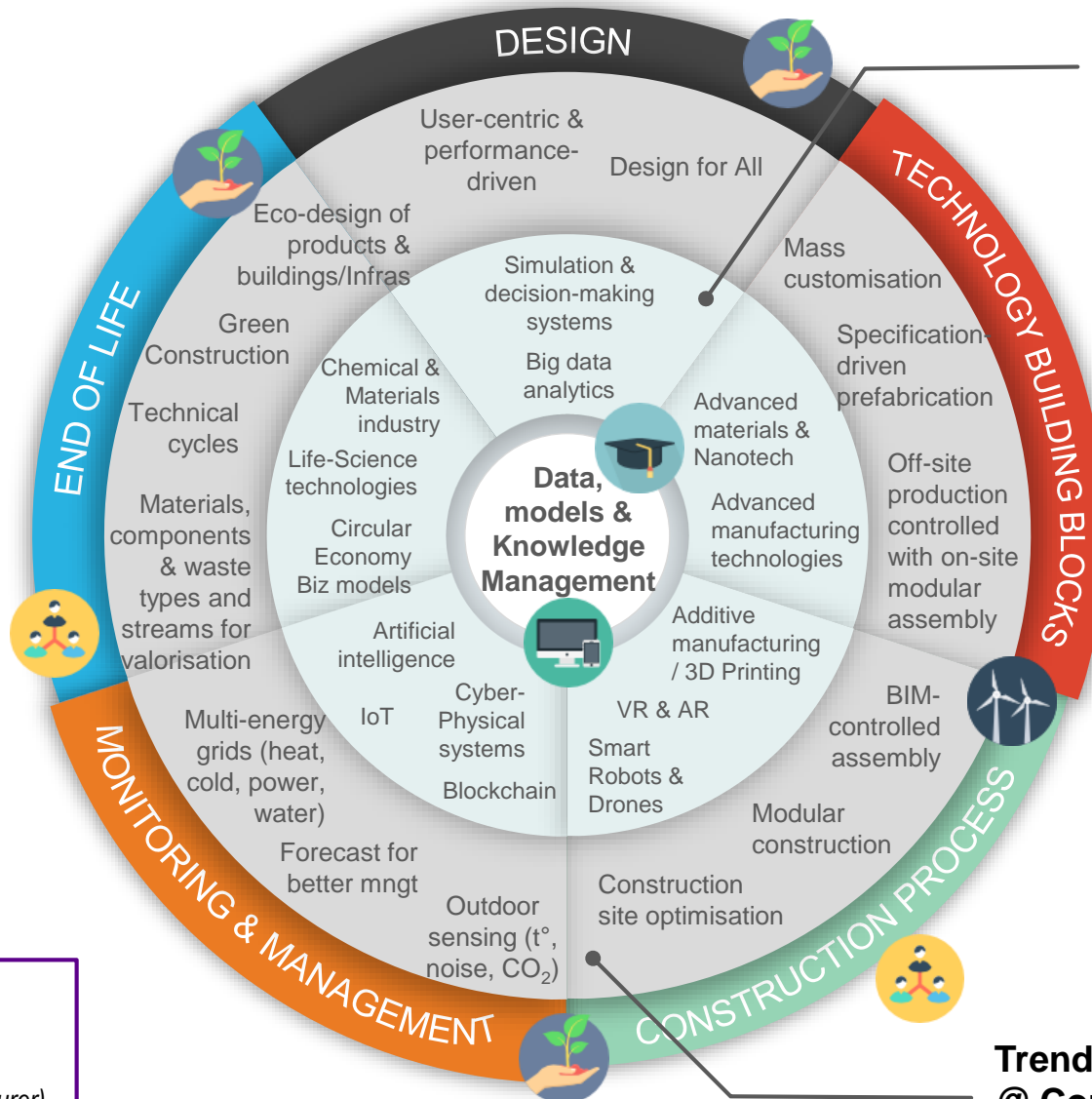
Trained and skilled labour force & high quality employment and working environment



Mobilising the financial resources for massive investments in knowledge

Technical cycles

- Maintain (Customer)
- Refurbish / Remanufacture (Provider)
- Reuse / Refurbish (Product Manufacturer)
- Recycle (Part Manufacturer)



Advanced innovative systems & KETs

Trends and drivers @ Construction level

Towards a global multi-scale BIM-Based Management...

SIG / 3D

CIM / urban mock-up

BIM

... > **Region** > Territory > City > District > Building/Infra > Component > ...



Trends of IT integration in Construction in the context of Districts & Cities

Information systems

- *Systemic approach: system-of-systems, Holonic systems, ...*
- *Models & frameworks: BIM & CIM, CityGML, IoT, ...*
- *Information: massive data storage and manipulation, Open data, ...*
- *Technologies: Cloud, Urban monitoring, Serious gaming, ...*
- *Algorithms: AI, sensitivity, global optimisation methods, multi-criteria simulations...*

Need for integration & experimentation

- *Experimentation of innovative tools & systems by Local Authorities – in the context of the enhancement of activities, missions & services provided by cities*
- *Live large-scale experimentations – with front runners cities / urban areas as potential (“in-vivo”) living labs*

Key game changing actions / radical innovation

- *Data models interoperability (integration) and aggregation (levels of districts, communities, cities, regions, region clusters, etc.)*
- *Data models transformation for visualisation with a citizen value*

INNOVATIVE BUILT ENVIRONMENT

рахмат
danke