The Digital transformation process and the Energy Efficiency factor

Stefano Nativi, National Research Council of Italy

The Europe's Digital Decade

Digital targets for 2030

To **empower businesses** and people in a **human-centred**, **sustainable** and more prosperous **digital future**

Skills
ICT Specialists: 20 million + gender convergence
Basic Digital Skills: min 80% of population

Secure and sustainable digital infrastructures
Connectivity: Gigabit for everyone, 5G everywhere
Cutting edge Semiconductors: double EU share in global production
Data - Edge & Cloud: 10,000 climate-neutral highly secure edge nodes
Computing: first computer with quantum acceleration

Digital transformation of businesses
Tech up-take: 75% of EU companies using Cloud/AI/Big Data
Innovators: grow scale-ups & finance to double EU Unicorns
Late adopters: more than 90% of SMEs reach at least a basic level of digital intensity

Digitalisation of public services
Key Public Services: 100% online
e-Health: 100% of citizens having access to medical records
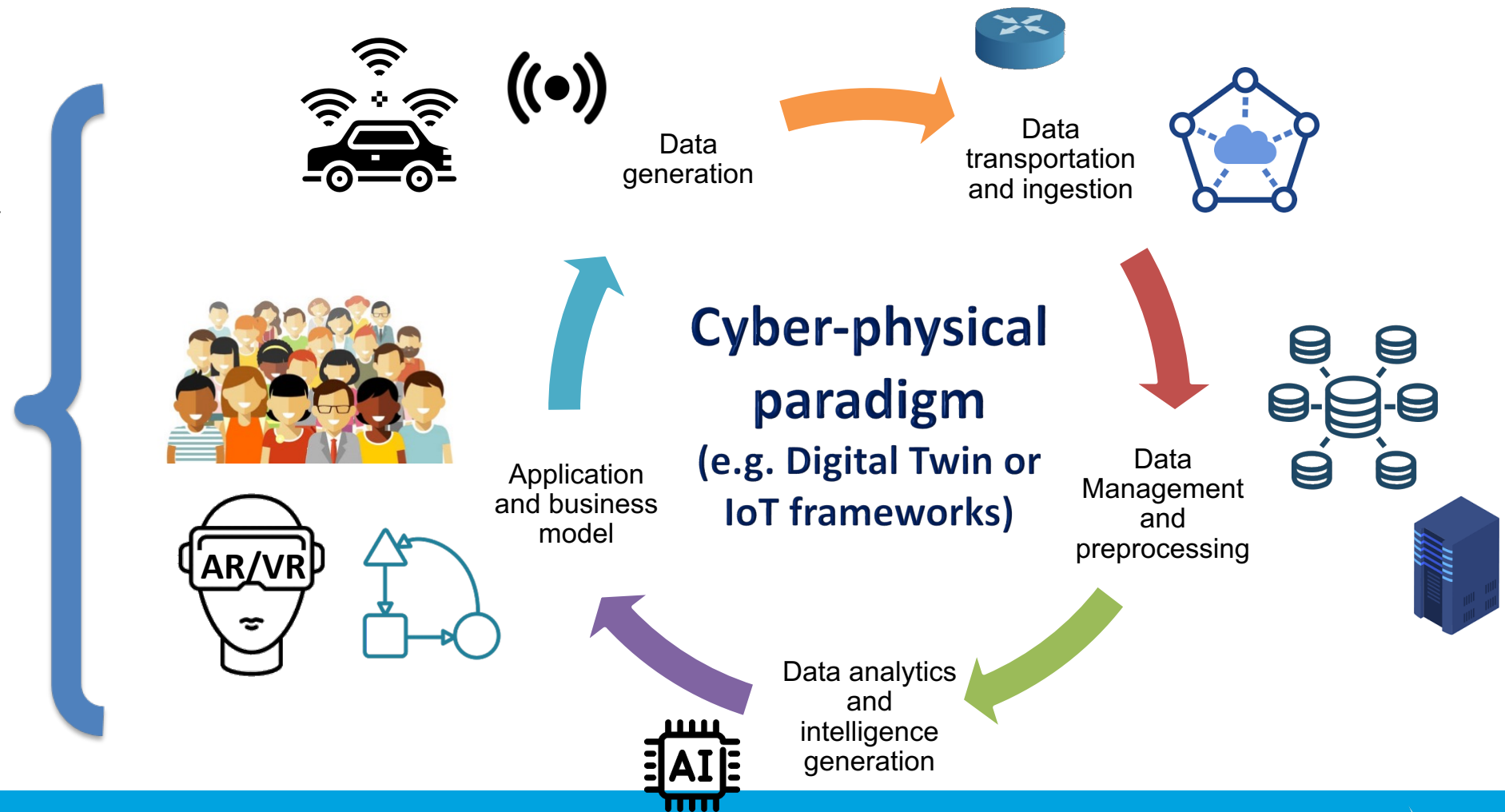**Digital Identity**: 80% of citizens using digital ID

The Digital Transformation Process and the EE

Datafication factors

Ubiquitous Connectivity & Ultra-wide band networks

(Computing) Virtualization

Data-driven modeling

Data generation

Data transportation and ingestion

Cyber-physical paradigm
(e.g. Digital Twin or IoT frameworks)

Data Management and preprocessing

Data analytics and intelligence generation

Application and business model
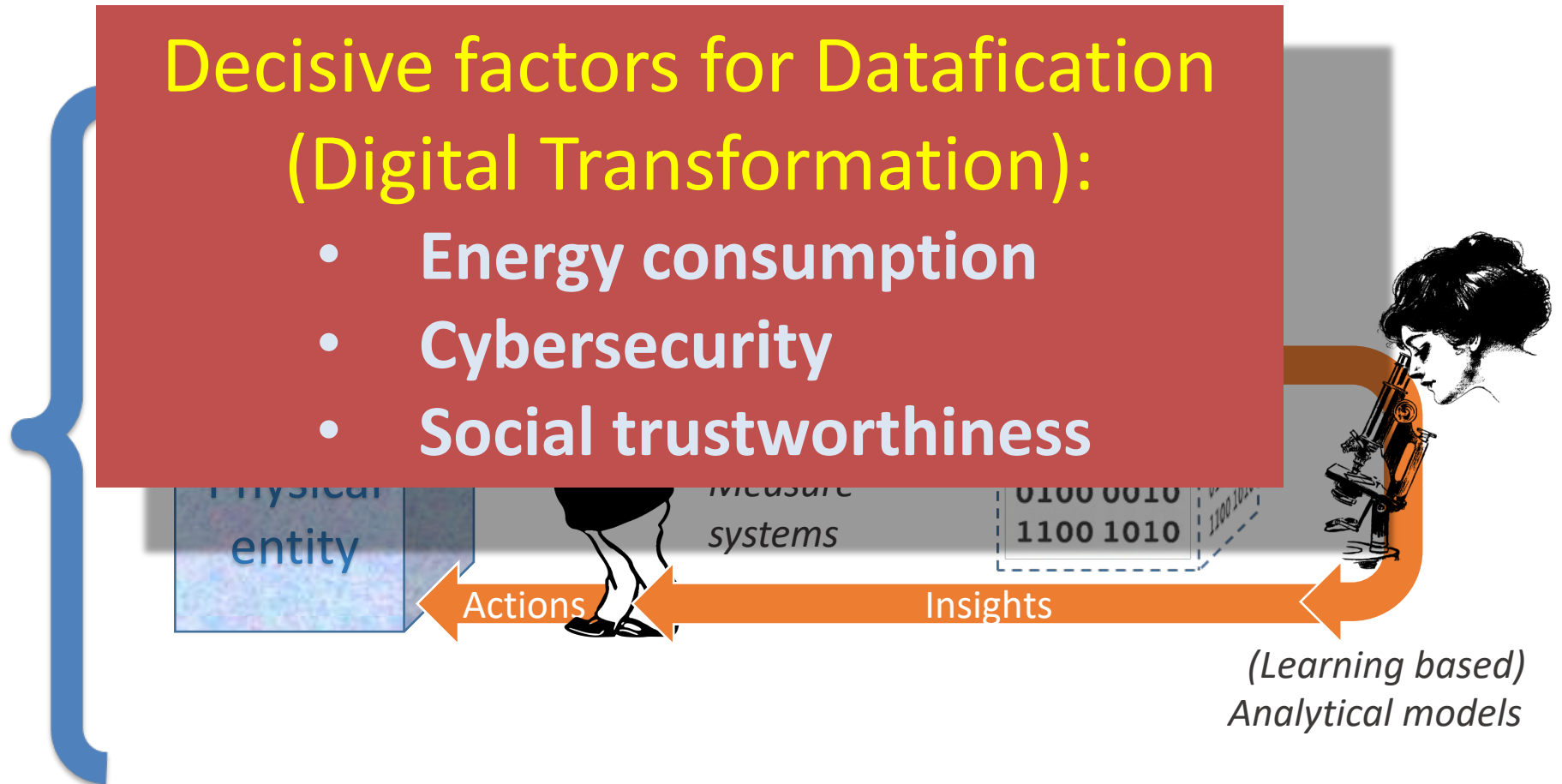
AR/VR

Example: the Digital Twin pattern and EE

A Digital Twin is different form a Digital Model and a Digital Shadow

The physical-digital interconnections make the difference

- Continuity
- Autonomy
- Bi-directionality

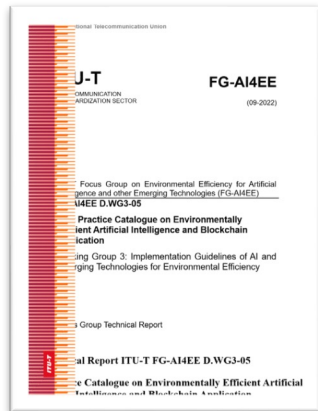Decisive factors for Datafication (Digital Transformation):

- **Energy consumption**
- **Cybersecurity**
- **Social trustworthiness**

Physical entity

Measure systems

0100 0010
1100 1010

Actions

Insights

(Learning based) Analytical models

Computer processing, data management and energy perspective
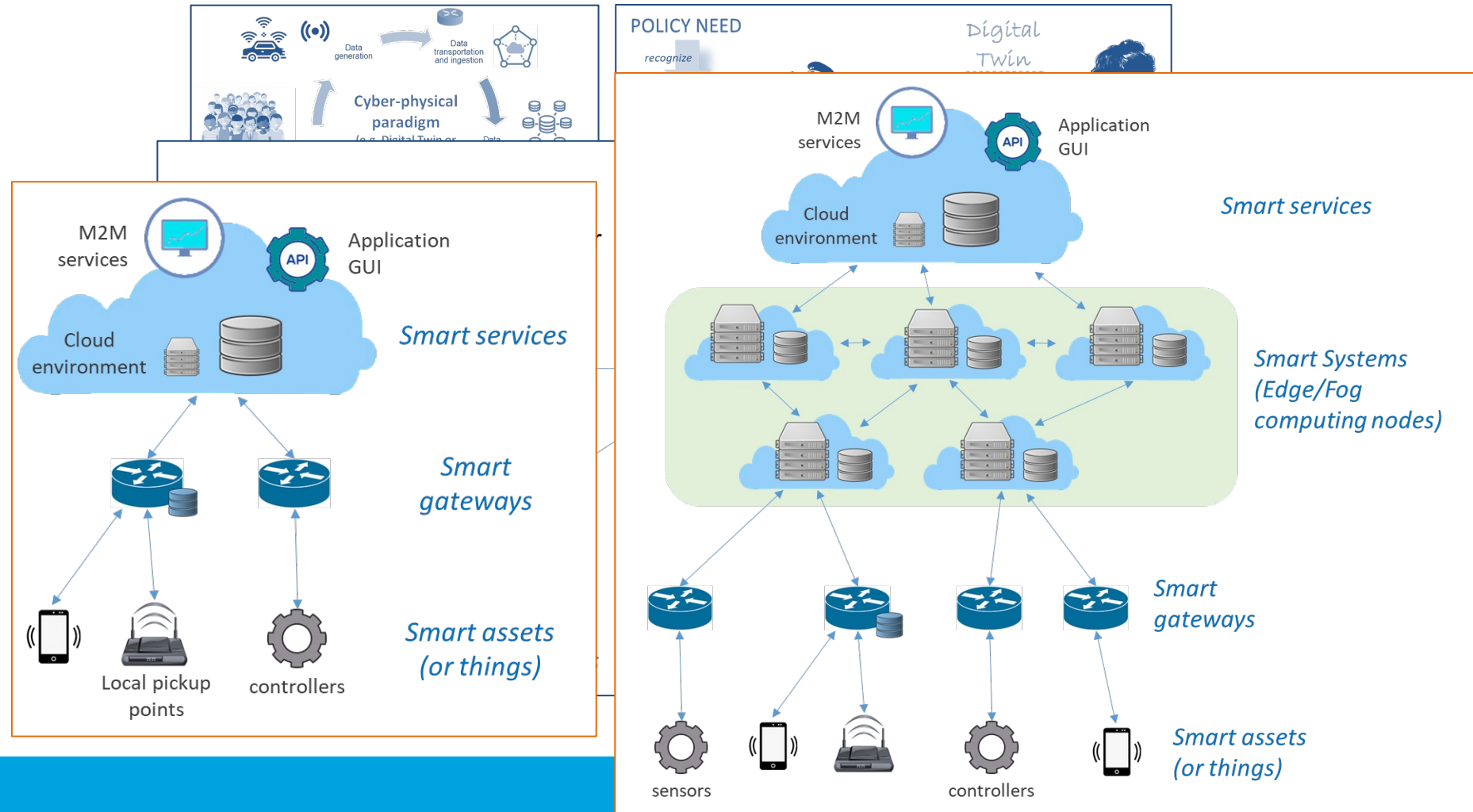(D.WG2-02; Ed. Nativi, Bertoldi, Serrenho)

Best Practice Catalogue on Environmentally Efficient AI & Blockchain Application
(D.WG3-05; Ed. Santoro, Boldrini, Nativi)

Cyber-physical paradigm, reference framework, and deployments

Set of good practices for energy efficiency of **cyber-physical applications** – making use of **IoT**, **AI**, and **Digital Twins**

Energy Efficiency criteria

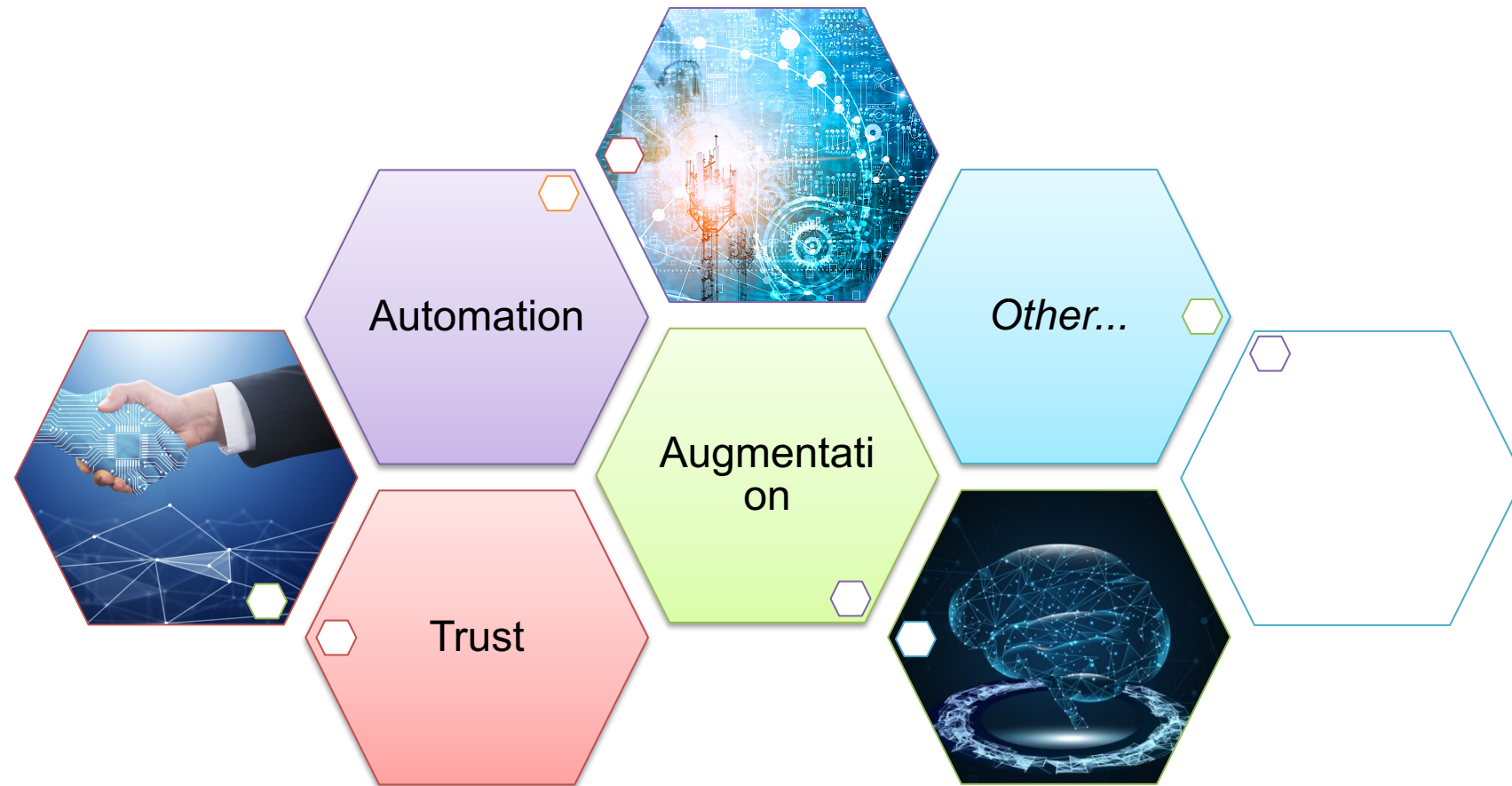Circular value-chain process:

1. Data Storage;
2. Data Transfer/Move; and
3. Data Processing/Analytics

———

Best practices and recommendations for each step and for each paradigm and related deployment

EU Codes of Conduct for ICT

The European Commission's science and knowledge service

Joint Research Centre

Added Value of AI and Blockchain Combination

Main benefits obtained by **combining the use of AI and Blockchain technologies**

Automation

Other...

Augmentation

Trust
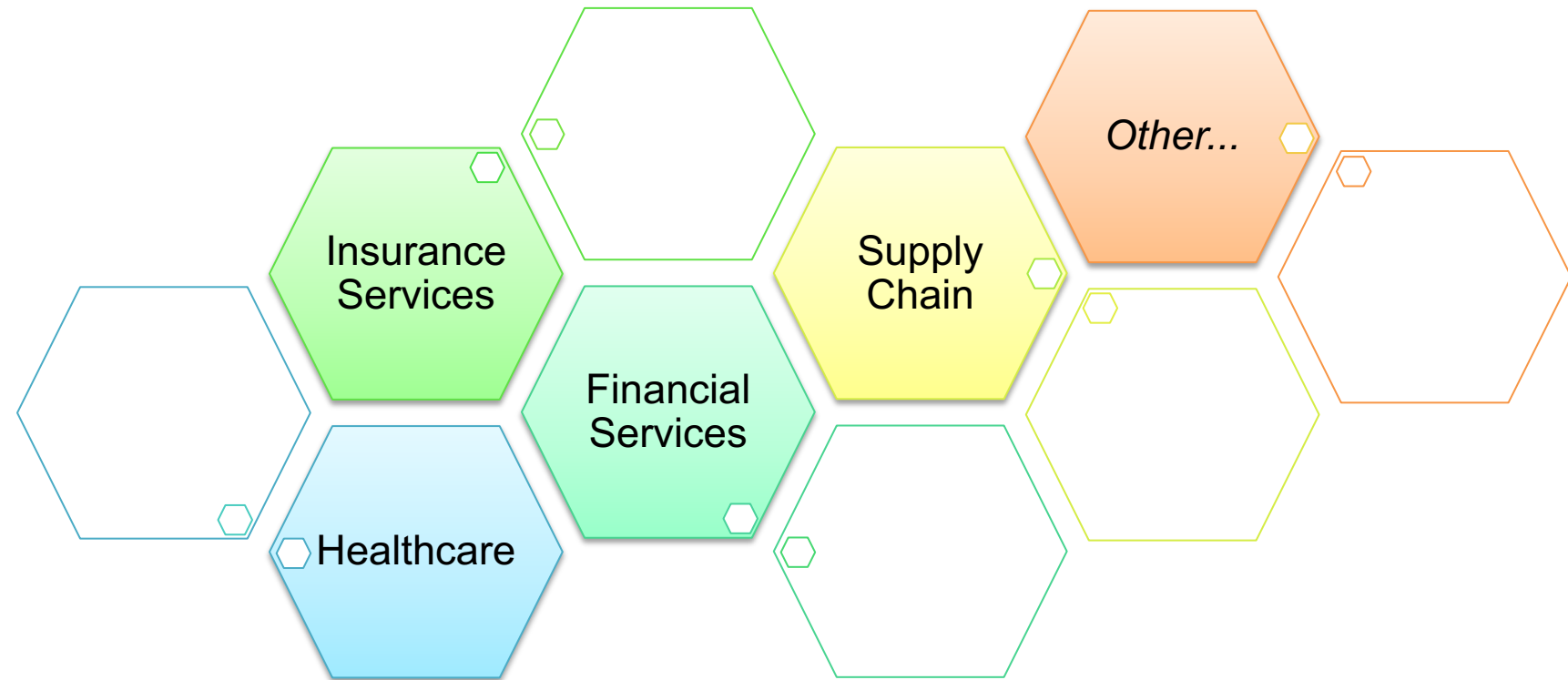
Final Considerations (on EE assessment of IT system lifecycle)

- There is the need to **adopt a holistic view based on a stepwise model**
  - E.g. EE must consider power vs utilization time –e.g. edge computing role
  - New chips architectures and SW optimization –e.g in-memory computing
- To adopt a **Satisfying philosophy rather than an Optimization one** –on a case by case approach, notably for AI and blockchain
- Where EE is already a reality (e.g. Data Centers and broadband communication system), **AI and Block-chain would help to advance the level achieved** so far and address the new challenges (e.g. 5G)

- **Voluntary best practice can play an important role to anticipate standardization** –e.g. the European Codes of Conduct on ICT
- **Include the society (human role) in a more and more cyber-physical interactive world** – e.g. smart cities

Thank You