The Voice of European Industry and Research for Next Generation Networks and Services

Online Workshop, 15 May 2025

# Media/Entertainment sector requirements for connectivity?

## 6G VISION

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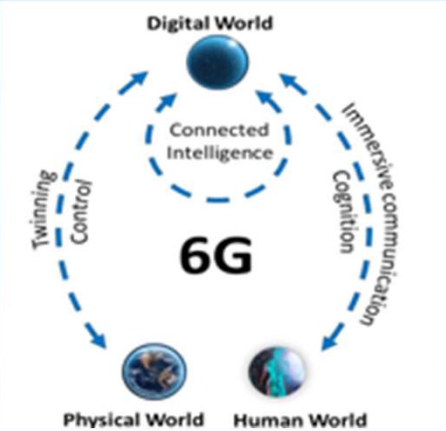
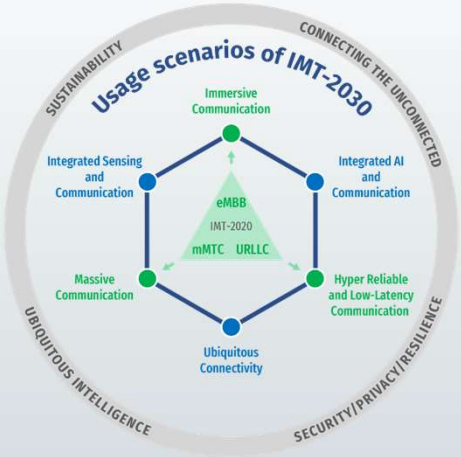
# 6G VISION From Hexa-X

# 6G Focus Use Cases from Hexa-X II Flagship



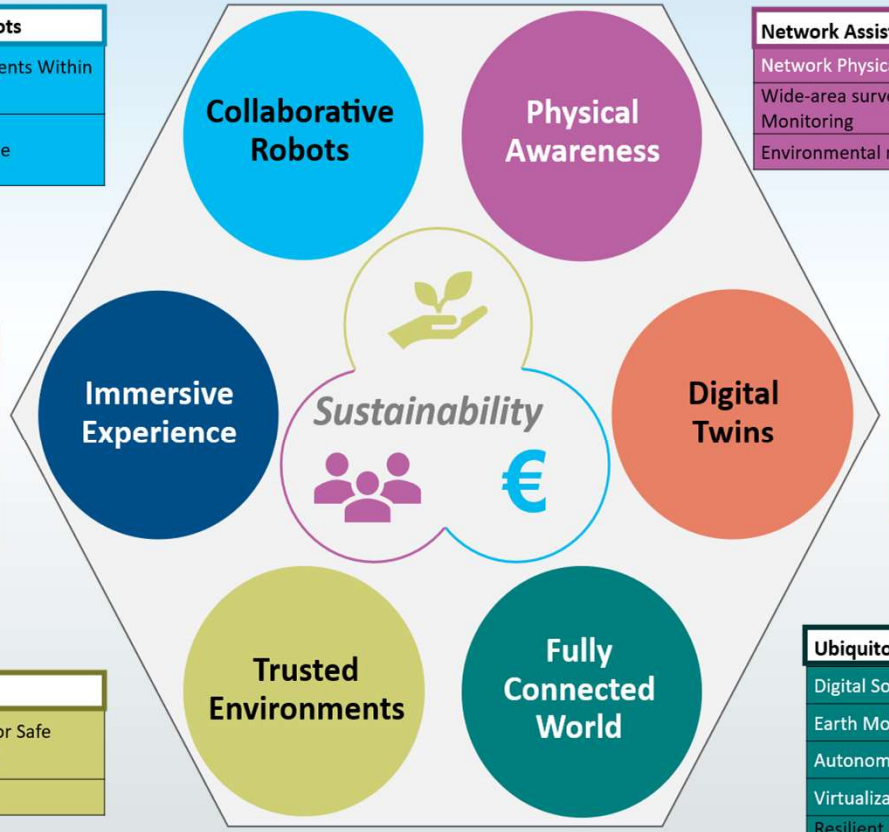

## From 6G Vision to 6G Use Cases




| Cooperating Mobile Robots |
|---|
| Autonomous Embodied Agents Within Flexible Manufacturing |
| Mesh Embodied Intelligence |

| Seamless Immersive Reality |
|---|
| Immersive Enterprise & Industry |
| Immersive Education |
| Immersive Gaming |
| Live and Interactive Immersive Content Creation |

| Human-Centric Networks |
|---|
| Industrial Sensors Network for Safe Production & Manufacturing |
| Wireless In-Vehicle Network |

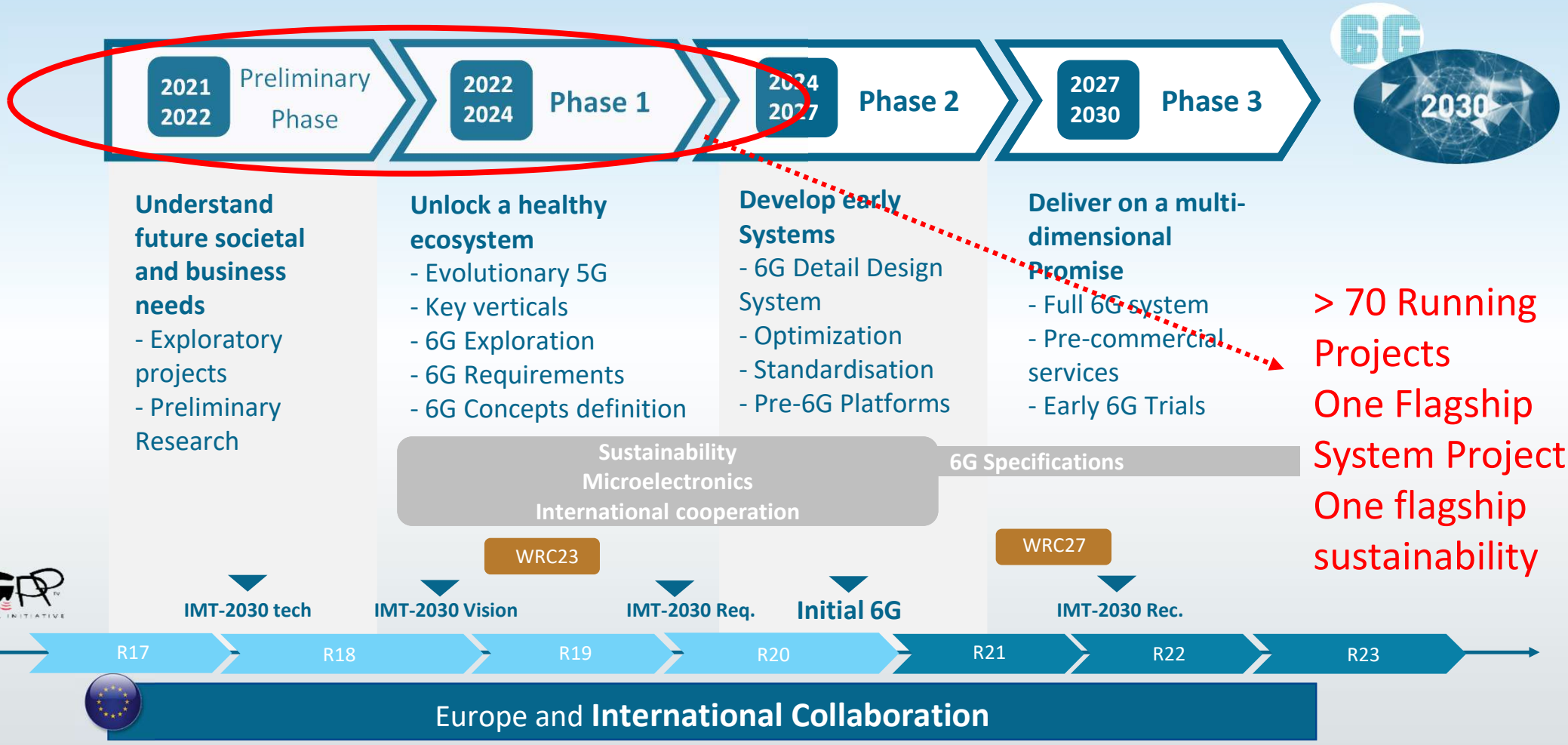



| Network Assisted 3D Mobility |
|---|
| Network Physical Data Exposure |
| Wide-area surveillance/Smart Crowd Monitoring |
| Environmental radio sensing |

| Realtime Digital Twins |
|---|
| Cloud Continuum |
| Smart Maintenance |
| Digital Twins (Building Model) |
| PPDR Digital Twin |

| Ubiquitous and Resilient Network |
|---|
| Digital Sobriety and Enhanced Awareness |
| Earth Monitor, Sustainable Food Production |
| Autonomous Supply Chain |
| Virtualization of Device Functionalities |
| Resilient Communication for Safety critical Applications |

# SNS JU Phased Approach



# 6G Immersive Applications

## Key Ingredients:

Environment rendering, high definition, 2D, 3D, 4K, 8K, 16K…

Precise positionning/timing;

Environment understanding;

Environment control;

➔Network as glue for sensing, data capture, understanding, control;

➔ Impact on specific techs, e.g low latency and data capture;

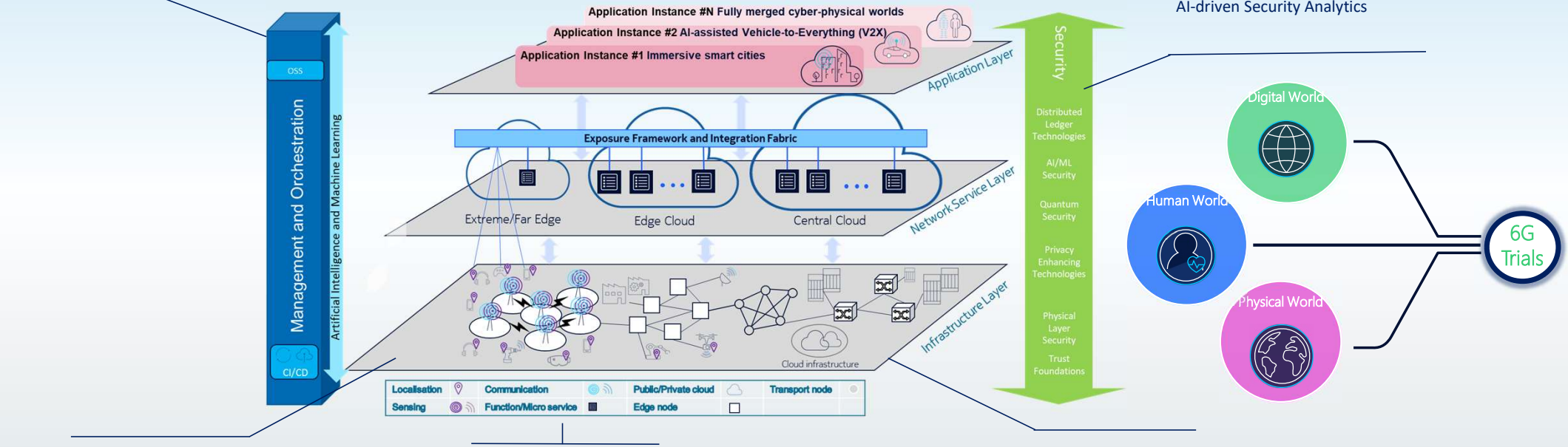
➔Huge AI impact on communicating entities! (what data, what coding)

# 6G E2E Architecture Foundation: Vision on Architecture Innovations

### AI-powered Immersive Communication
Support for Immersive XR, e.g., holographic teaching
Joint computing & networking resource allocation
AI & Analytics Engine Orchestration

### Sustainable Massive Communications
Low-density LEO for massive IoT
Decentralized implementation of UPF-CU-DU
GPU-based acceleration for DU/RU Offloading

### Secure, Reliable and Trustworthy AI & Communication
E2E Multi-domain Slicing as Mitigation Enabler
PQC
FL-based anomaly detection
AI-driven Security Analytics




### Ubiquitous Connectivity
TN-NTN Integration
Unified RAN & Radio Interface
Multi-link Connectivity
RIS

### Dependable & Resilient Communications
Time-critical Automation
Efficient & real-time network monitoring
Multi-domain & multi-technology Deterministic Communications
Predictable Packet Delay
In-X Subnetworks

### Integrated Sensing and Communications-Enabled 6G Networks
Enabling new use cases, e.g., beam tracking, VRUs sensing
Joint Sensing & RIS Operation

Reference: 6G book "Towards Sustainable and Trustworthy 6G"

# Major differences with respect to 5G

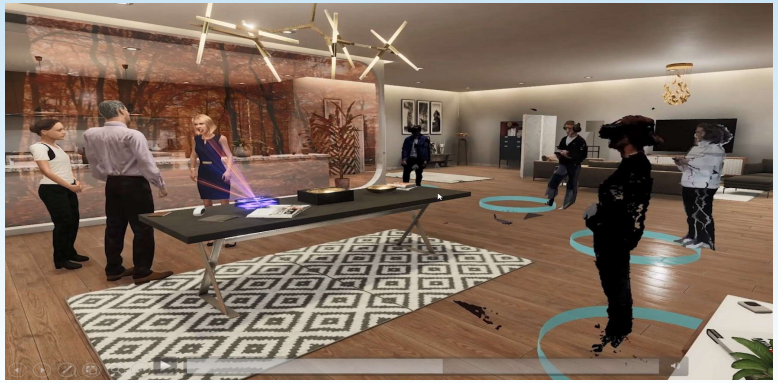

| Capabilities | IMT-2030 (6G) | IMT-2020 (5G) |
|---|---|---|
| Peak data rate | 50-100-200 Gb/s | 20 Gb/s |
| User exp. data rate | 300-500 Mb/s | 100 Mb/s |
| Spectrum efficiency | 1.5-3 x IMT-2020 | |
| Area traffic capacity | 30-50 Mb/s/m$^2$ | 10 Mb/s/m$^2$ |
| Connection Density | $10^6$ –$10^8$ dev/km$^2$ | $10^6$ dev./km$^2$ |
| Mobility | 500 – 1 000 km/h | 500 km/h |
| Latency | 0.1 – 1 ms. | 1 ms. |
| Reliability | $10^{-5}$- $10^{-7}$ | $10^{-5}$ |


- IMT-2030 KPIs significantly more demanding than those for IMT-2020
- 6G to support selected United Nations' SDGs: sustainability, inclusion, trustworthiness,…
- Requires integration of new technology components: key innovations in radio access and core networks

# Example Requirements of Metaverse/XR Applications on connectivity/computing

| | |
|---|---|
| **High Resolution Digital Twin of 1 $m^2$ with 16K resolution** | **> 1Tb/s data rate** |
| **Quasi instantaneous Real Time response** | **< 1ms latency** |
| **Continuous Real Time response** | **Deterministic communications, E2E slicing** |
| **Very high resolution twin positioning capabilities** | **<< 20cm positioning** |
| **Very high resolution twin positioning** | **Spectrum use > 100GHz** |
| **High capacity twin processing** | **Edge computing, storage and flexible service deployment (AI based)** |
| **High resolution real time environment mapping** | **From asymmetric to symmetric image/content coding** |

# Example 6G SNS Metaverse/XR related projects



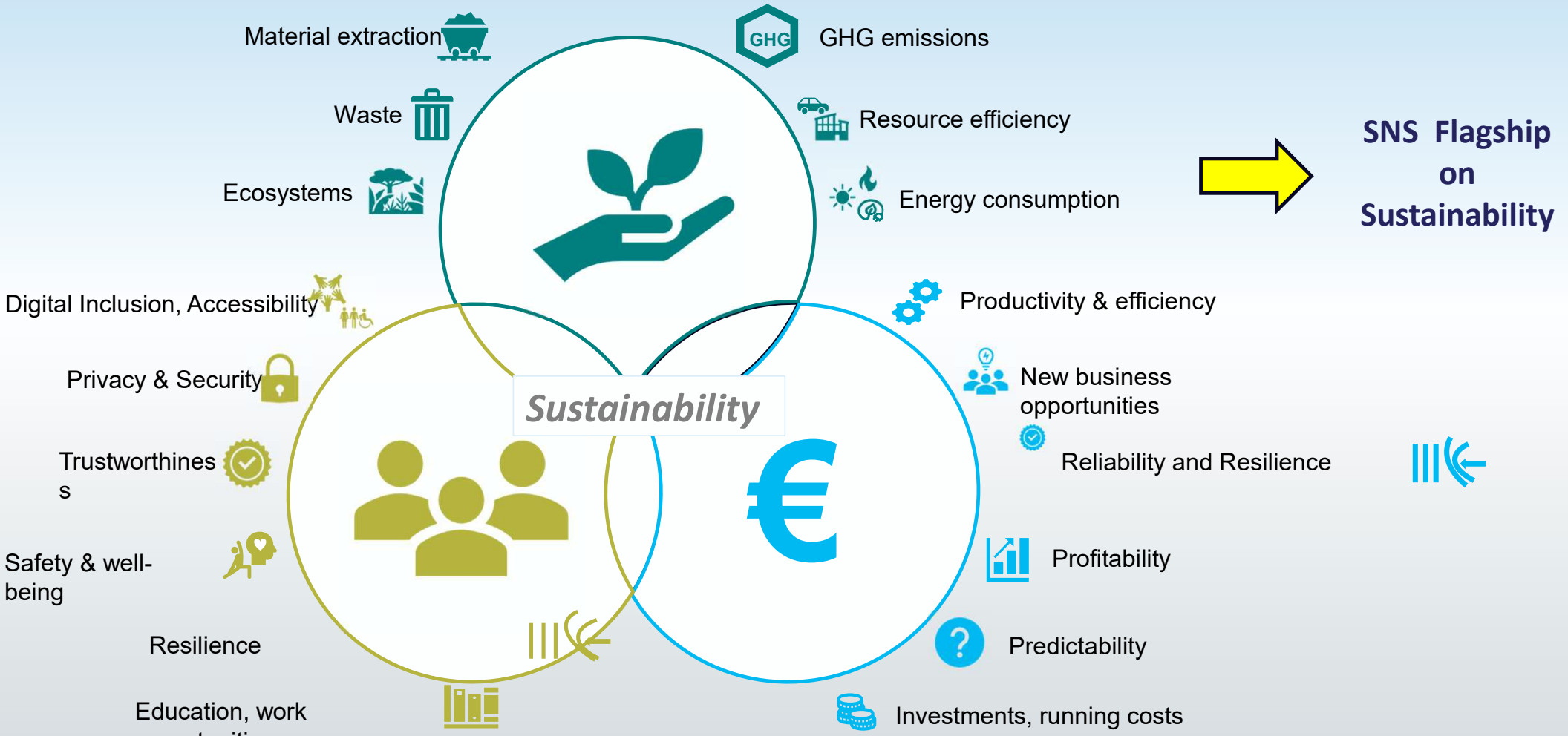
**6G BRICKS** in XR/VR technologies to support social interactions in virtual spaces. Pushing the limit of 5G network capabilities, requiring extremely high downlink capacity (>100Mbps per device), and low latency (<5ms), allowing users to interact in 360 XR environments, while freely navigating in a Virtual Environment (VE).
**Proof of Concept**: Holographic conferencing; industrial applications

**TRIALSNET Digital** Reconstruction of a feudal touristic environment in Borgo with sensors and XR interaction capabilities with Digital model in the cloud with various situations for immersed objects and people

**6GSANDBOX:** Experimental platform with 4 sites (Malaga ,Athens, Berlin, Oulu with computing, storage and connectivity capabilities enabling hosting XR digital twin experiments

**6G-XR:** Real Time holographic communications in XR virtual environments. Evolvable experimental infrastructure over SNS lifetime

# Beyond KPI's, Sustainability Drivers



# Underpinning the Vision: Key Areas of Technological R&I

*Examples*
*Non-exhaustive*

**Smart Network Infrastructure** (6G capabilities)

**Convergence** with other adjacent technologies

## 6G will require significant technological breakthroughs to enable its ambitious goals

### AI-Driven Architecture

- Programmability and Control
- AI governance
- Deterministic networking

### Radio & Signal Processing

- 6G RAN modulation
- Disaggregated RAN
- Beamforming, RIS
- THz bands, VLC
- Harmonized Comms and Sensing

### Optical Networks

- Intrinsically **secure, green and flexible** transport networks.
- Sustainability

### Ubiquitous Computing

- Edge-Cloud Integration
- Responsiveness, reduced data flows
- Distributed microservices

### Security

- Network and Services
- Larger attack surface
- Micro-segmentation
- Security as-a-Service

### Non-terrestrial Networks

- Integration with TN
- (LEO) networks
- UAM services
- Edge flying nodes
- Unification?

### Devices & Components

- **Advanced micro-electronics**
- Efficient Tx/Rx modules
- Optical & hybrid transceivers
- Neural processing units

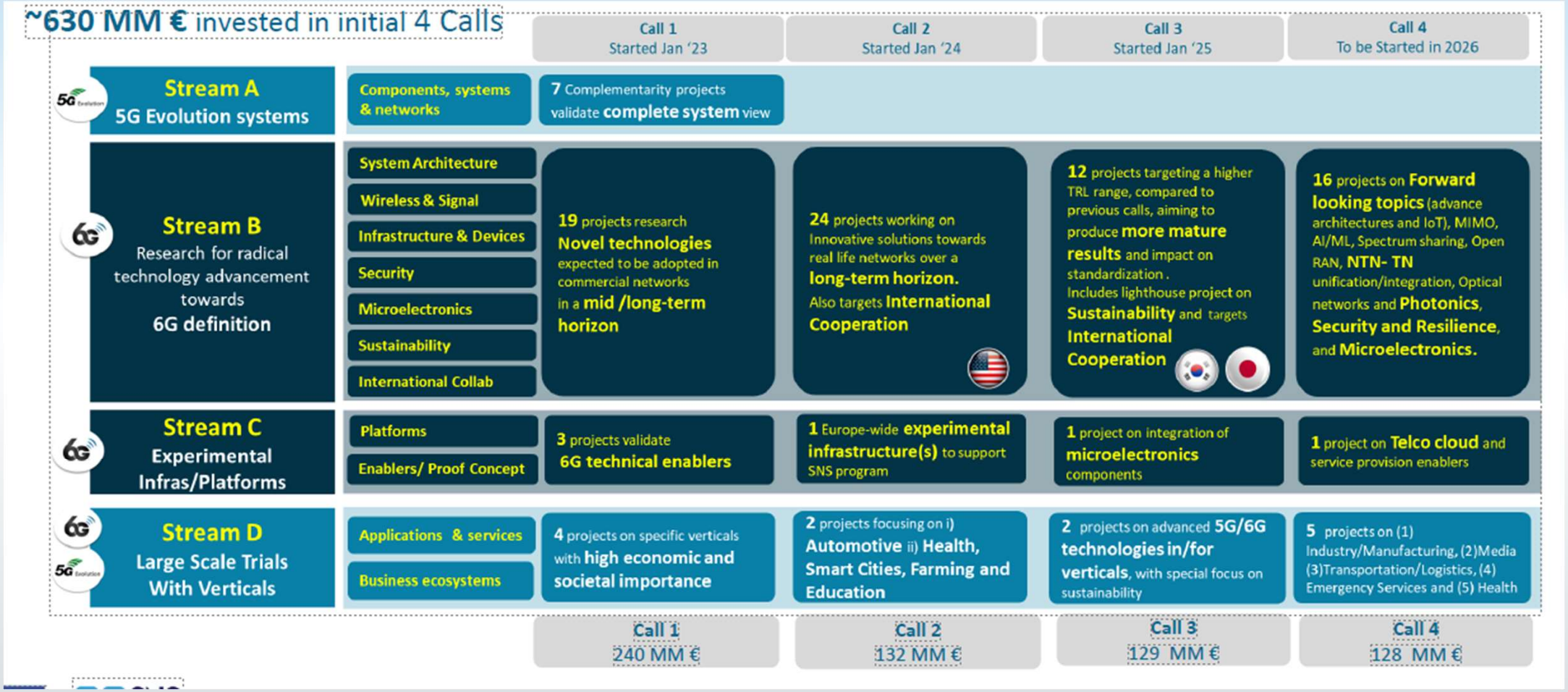
### Special purpose (sub)-networks

- **Vertical sub-networks** such as in-body, in-robot, in-car networks, etc

### Future Emerging Technologies

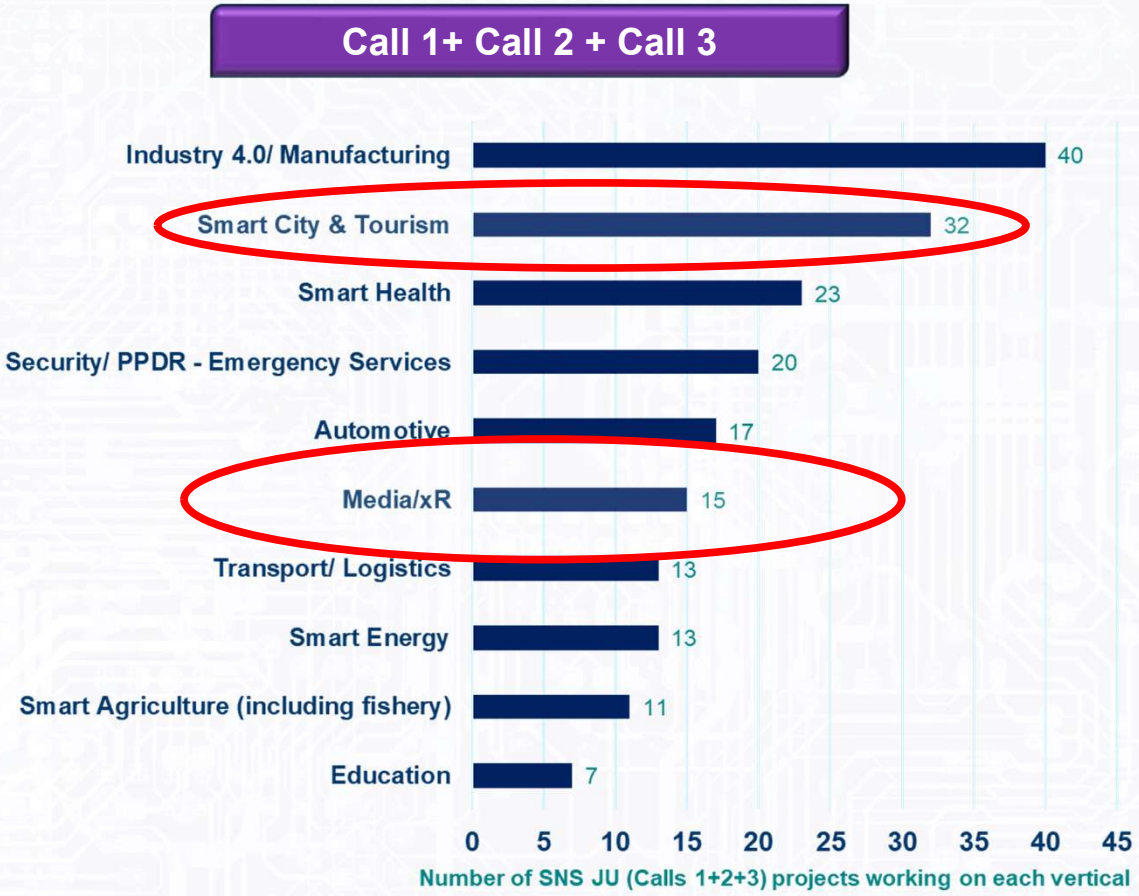
- May have deep impact in the future
- Do not have a clear industrial path yet

Source: Networld Europe SRIA - https://www.networldeurope.eu/sria-and-whitepapers/


~630 MM € invested in initial 4 Calls
Call 1
Started Jan '23
Call 2
Started Jan '24
Call 3
Started Jan '25
Call 4
To be Started in 2026
Stream A
5G Evolution systems
Components, systems & networks
7 Complementarity projects validate complete system view
Stream B
Research for radical technology advancement towards 6G definition
System Architecture
Wireless & Signal
Infrastructure & Devices
Security
Microelectronics
Sustainability
International Collab
19 projects research Novel technologies expected to be adopted in commercial networks in a mid /long-term horizon
24 projects working on Innovative solutions towards real life networks over a long-term horizon. Also targets International Cooperation
12 projects targeting a higher TRL range, compared to previous calls, aiming to produce more mature results and impact on standardization . Includes lighthouse project on Sustainability and targets International Cooperation
16 projects on Forward looking topics (advance architectures and IoT), MIMO, AI/ML, Spectrum sharing, Open RAN, NTN- TN unification/integration, Optical networks and Photonics, Security and Resilience, and Microelectronics.
Stream C
Experimental Infras/Platforms
Platforms
Enablers/ Proof Concept
3 projects validate 6G technical enablers
1 Europe-wide experimental infrastructure(s) to support SNS program
1 project on integration of microelectronics components
1 project on Telco cloud and service provision enablers
Stream D
Large Scale Trials With Verticals
Applications & services
Business ecosystems
4 projects on specific verticals with high economic and societal importance
2 projects focusing on i) Automotive ii) Health, Smart Cities, Farming and Education
2 projects on advanced 5G/6G technologies in/for verticals, with special focus on sustainability
5 projects on (1) Industry/Manufacturing, (2)Media (3)Transportation/Logistics, (4) Emergency Services and (5) Health
Call 1
240 MM €
Call 2
132 MM €
Call 3
129 MM €
Call 4
128 MM €

Question

## *Technical, T3:*
## Which of the following Vertical sectors will your project support??



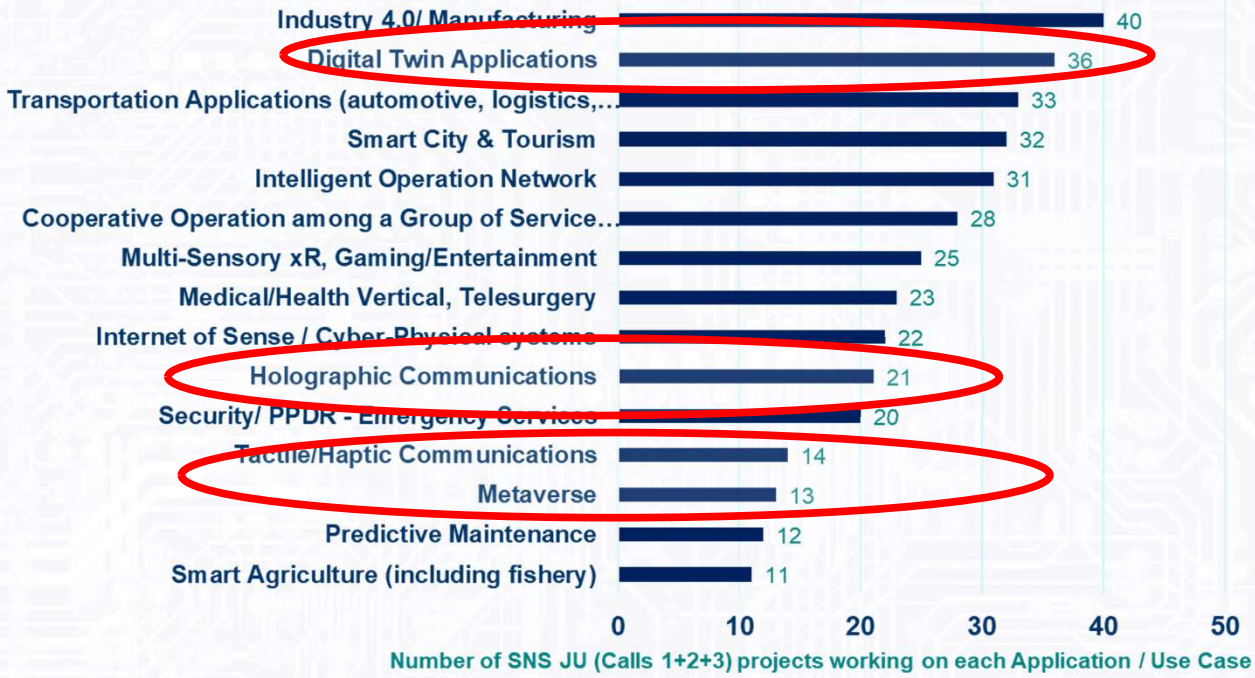

### Key Insights

- Trends remain similar to previous years with I4.0 & Smart City sectors at the top of preferences
- Broad coverage of vertical sectors with good overlap, ensuring cross-validation opportunities

Question

## *Technical, T3b:* Which of the following Applications / Use cases will your project support?

**Call 1+ Call 2 + Call 3**




### Key Insights

- Significant number of applications / use cases developed across all SNS Ju projects
- I4.0, DT, Transportation and Smart City applications are the most popular
- Broad coverage of applications / use cases with good overlap, ensuring cross-validation opportunities

# Key 6G Drivers from International Initiatives


Note: Non-exhaustive list, showing the topics appearing in at least two presentations

Source: 3GPP SA1 Workshop, May 2024

# Thanks for your attention, stay Tuned!

https://smart-networks.europa.eu/

https://www.linkedin.com/company/sns-ju/?originalSubdomain=be

https://6g-ia.eu/

https://www.linkedin.com/company/6g-smart-networks-and-services-industry-association/?originalSubdomain=be