



Key strategies for 6G smart networks and services



This webinar is being recorded – The video and presentations will be shared after the webinar

Time	Topic	Speaker
10:00-10:10	Welcome - Opening -Scope of the Position paper – What is Technological Sovereignty	Colin Willcock
10:10-10:20	Micro-electronics	Werner Mohr
10:20-10:30	Open SNS solutions	Aitor Garcia
10:30-10:40	Cloudification and distributed computing	Toon Norp
10:40-10:50	Network Intelligence	Christine Leurquin
10:50-11:00	Security and privacy	Emmanuel Dotaro
11:00-11:05	SNS Knowledge base skill	Carles Anton HAro
11:05-11:15	Sustainability	Raffaele de Peppe
11:15-11:25	KVIs	Gustav Wikström
11:25-11:30	Closing remarks - next steps	Alex Kaloxylos



Colin Willcock
Chair of the 6G-IA Board
Chair of the SNS JU Board
Opening

What was the need?

- Create a comprehensive set of key strategic reflections and recommendations for 6G smart networks and services,

What is the goal?

- Capture the views and priorities from 6G-IA members.
- Provide input to SNS R&I WP and SRIA
- Offer a blueprint for collaboration in Europe.

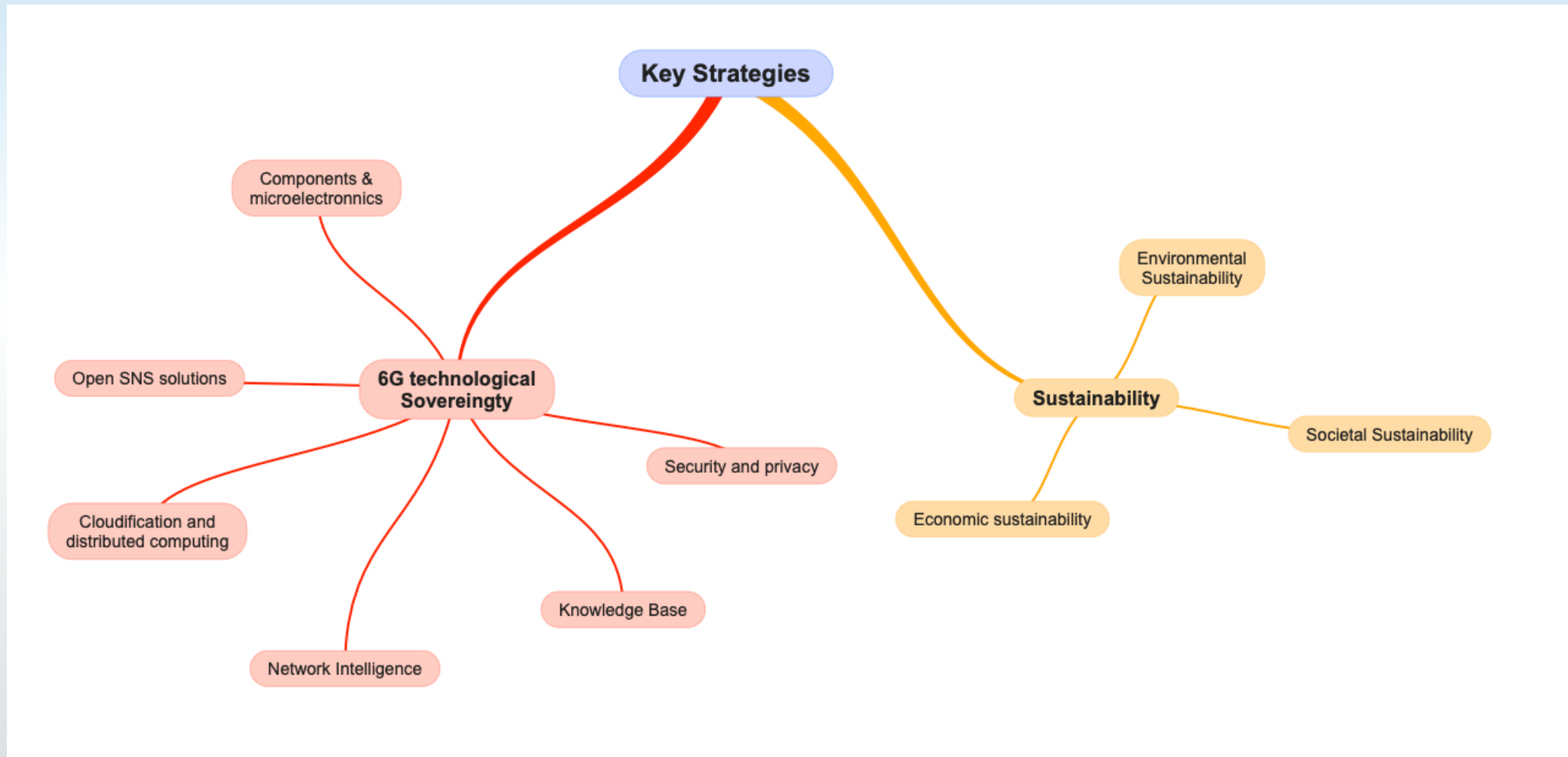
Sanity check with 6G-IA members in a consultation with wide acceptance of the recommendations

New position papers will be released at an annual basis



Available at <https://6g-ia.eu/plans-papers/>

What areas does it cover?



Technological Sovereignty

*...the ability for Europe to **develop, provide, protect, and retain critical technologies** required for the welfare of European citizens and prosperity of businesses, and the ability to **act and decide independently** in a globalised environment ...*

Source: [https://www.europarl.europa.eu/RegData/etudes/STUD/2021/697184/EPRS_STU\(2021\)697184_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/697184/EPRS_STU(2021)697184_EN.pdf)



Werner Mohr

Member of the 6G-IA policy task force

Co-editor of the position paper

Components and Microelectronics

Technology Sector		Europe 	USA 	China 	Taiwan 	Korea 	Japan
Micro-electronics ¹⁾	Design	Need to catch up in chip design	Dominance in chip design	Need to catch up in chip design	Weaker position in chip design	Strong position in chip design	Strong position in chip design
	Manufacturing	Strongly reduced capacity in manufacturing with 9 % in 2020	Strongly reduced capacity in manufacturing with 12 % in 2020	Strong growth of capacity in manufacturing with 15 % in 2020	Stable capacity in manufacturing with 22 % in 2020	Relative stable capacity in manufacturing with 21 % in 2020	Slightly reduced capacity in manufacturing with 15 %

With the

- EU Chips Act,
- IPCEI 2 on Microelectronics and Connectivity and
- recent announcements by international vendors to deploy fabs in Europe based on significant public funding Europe is making a big step forward to catch-up in the global micro-electronics market

1) Boston Consulting Group, Semiconductor Industry Association: Government Incentives and and US Competitiveness in Semiconductor Manufacturing. September 2020, <https://www.bcg.com/de-de/publications/2020/incentives-and-competitiveness-in-semiconductor-manufacturing>.
 2) Der Kinsta-Blog: Cloud Marktanteil – ein Blick auf das Cloud-Ökosystem im Jahr 2020. 29. Juli 2020, <https://kinsta.com/de/blog/cloud-marktanteil/>.
 3) EU Kommission: „Industry Policy after Siemens-Alstom“. 2019, file:///C:/Users/dems1cf8/AppData/Local/Microsoft/Windows/INetCache/IE/NLQHX0PI/ES0419287ENN.en.pdf.
 4) Dell’Oro Group: Worldwide Telecom Equipment Revenue. <https://www.delloro.com/key-takeaways-the-telecom-equipment-market-1h20/>.

- SNS vision with focus on infrastructure connectivity is considering **Horizon 2020 COREnect project** industry roadmap to improve European technological sovereignty in microelectronics domain ^{1), 2)}
- Follow-up project COREnext since January 2023

- **New IPCEI (Important Project on Common European Interest) on Microelectronics and Connectivity** in 20 participating EU Member States has main objective to invest in innovative industrial capacities such as “critical raw materials, equipment, wafers, research, pre-production and design to support Europe’s leadership in critical supply gaps and enabling innovation” ³⁾
 - Activity related to EU Chips Act to reduce dependencies and to improve resilience in areas like
 - processors for high-performance computing,
 - specialised chips for AI and
 - autonomous driving
 - Ambition to develop a pan-European chips design ecosystem to tackle new challenges on transistors in a more than Moore approach, and on circuits architectures with increased security and trustworthiness

- SNS is looking for cooperation on requirements on 5G and 6G systems towards research and design on future microelectronics components as well as to identify similar synergies with national initiatives from Member States

- “**The European Chips Act** aims to enhance Europe’s competitiveness and resilience in microelectronics technologies and applications for digital and green transition

- One of its objectives is to reach leadership in chips for digital connectivity infrastructures
- Europe has
 - leading position in global connectivity infrastructure market,
 - while has strong dependencies on chipset vendors from outside the European Union
 - EU will mobilise more than € 43 billion of public and private investments and set measures to respond to any future supply chain disruptions, together with Member States and EU international partners

- Aims to
 - i. strengthen Europe’s research and technology sovereignty towards smaller and faster chips
 - ii. put in place a framework to increase production capacity to 20% of the global market by 2030
 - iii. build and reinforce capacity to innovate in design, manufacturing and packaging of advanced chips
 - iv. develop an in-depth understanding of the global semiconductor supply chains and
 - v. address the skills shortage, attract new talent and support the emergence of skilled workforce

- Joint **activities between the KDT/European Chips Act and SNS JUs** in respective Work Programmes, with both constituencies being encouraged to participate in such calls
- SNS Joint Undertaking Work Programme for 2023-2024 includes
 - strand “SNS-2023-STREAM-B-01-05: Microelectronics-based Solutions for 6G Networks” and
 - strand “SNS-2024-STREAM-C-01-01: SNS Microelectronics Lighthouse” to develop an experimental platform where solutions from the micro-electronics domain developed either in the context of Phase 1 SNS WP, or Horizon Europe Cluster 4, or the KDT JU will be validated in terms of performance and applicability for 6G networks
 - Therefore, solutions developed in projects funded under the current KDT focus topic could find their way into the aforementioned SNS topics

- Monitoring and **strengthening links with the closely related areas of photonics**
 - Potential areas of cooperation
 - optical wireless communication
 - advanced optical transmitter and receiver technology
 - next generation Terabit/s transceivers
 - optical switching systems
 - photonic integration as combination of optical, radio frequency and digital radio systems and highly linear optical modulators or fronthaul and backhaul systems
 - SNS JU and 6G-IA can derive important component and device requirements and provide relevant test environments for prototype devices resulting from Photonics21 developments
 - Synchronisation of activities for holistic approach to reduce environmental impact of next-generation networks
- **NetworldEurope SRIA 2022** on all technical topics related to 6G networks including
 - devices
 - micro-electronics and
 - optical networkswith research challenges in short-, medium- and long-term timeline
 - Analysis of NetworldEurope SRIA and Electronic Components & Systems and Photonics21 will provide cooperation opportunities of the involved communities and funding instruments

Above-mentioned instruments could act as catalyst to bring together research and innovation European resources to contribute towards technological sovereignty on components, optical communication, and micro-electronics for 6G connectivity

Created knowledge and skills help boosting European market and reduce dependencies from other regions

Recommendations

- Synergies between related Horizon Europe partnerships and European Technology Platforms (ETPs) need to be further pursued.
- Joint collaboration roadmaps in the 6G areas of baseband, RF and signal processing, radio front-end, antenna systems, as well as optical communication components among related partnerships for the next two years need to be further investigated. Such roadmaps should take into consideration the priorities of each funding instrument, and the plans of the private sector.
- Synergies between related Horizon Europe partnerships must investigate how integrated, configurable and generic hardware platforms will efficiently support network virtualization. Research activities should target solutions that will eventually foster supply sources diversification and cluster risks and dependencies avoidance from very few dominating sources to improve resilience.

1. Final COREnect Industry Roadmap. Deliverable D3.6, June 2022, Available at: COREnect D3.6 Final COREnect Industry Roadmap.pdf (squarespace.com), [https://static1.squarespace.com/static/5f46601a7f9764175fb38f1c/t/62cfd87c20a77659f3b029a0/1657788588357/COREnect D3.6 Final COREnect Industry Roadmap.pdf](https://static1.squarespace.com/static/5f46601a7f9764175fb38f1c/t/62cfd87c20a77659f3b029a0/1657788588357/COREnect_D3.6_Final_COREnect_Industry_Roadmap.pdf).
2. Core Technologies Development Recommendations and Guidelines. Deliverable D3.7, June 2022, Available at: COREnect D3.7 Core+Technologies+Development+Recommendations+and+Guidelines.pdf (squarespace.com), [https://static1.squarespace.com/static/5f46601a7f9764175fb38f1c/t/6294ab1b5405c476fbdf31ad/1653910300850/COREnect D3.7 Core+Technologies+Development+Recommendations+and+Guidelines.pdf](https://static1.squarespace.com/static/5f46601a7f9764175fb38f1c/t/6294ab1b5405c476fbdf31ad/1653910300850/COREnect_D3.7_Core+Technologies+Development+Recommendations+and+Guidelines.pdf).
3. Blog Pots by Thierry Breton, 20 December 2021, IPCEI on microelectronics – A major step for a more resilient EU chips supply chain available at: https://ec.europa.eu/commission/commissioners/2019-2024/breton/blog/ipcei-microelectronics-major-step-more-resilient-eu-chips-supply-chain_en.



Aitor Garcia

Member of the 6G-IA policy task force
Chair of the 6G-IA Open SNS WG

Open SNS Solutions



“Open networks are networks built based on open, standard-based and programmable architectures requiring the integration of various data sources and services into unified and automated platforms”

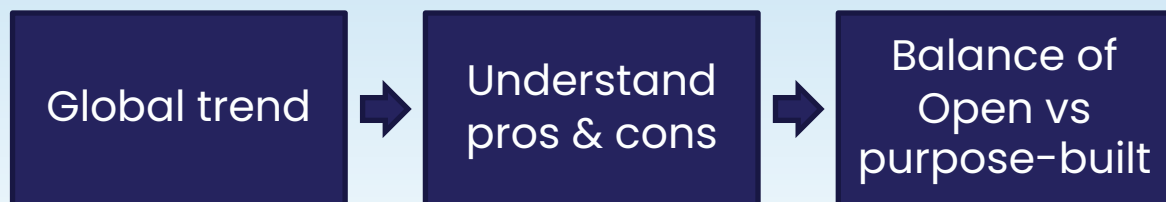
- Appears to be a promising trend
- Complex topic where important points need to be considered

Opportunities

-  More choices to mix and match multi-vendor components diversifying dependencies
-  Disaggregation/Modularization for simpler network O&M and HW/SW reusability
-  Greater automation and flexibility for operational efficiency
-  New possibilities for innovation
-  New opportunities for EU market players, for example real and non real time applications

Challenges

-  Higher integration complexity which may impact on energy and operational efficiency
-  Increased threat vector for the overall security
-  Not all is open, proprietary components and software
-  Over-standardization could put in risk innovation opportunities
-  EU technological sovereignty may be threatened if EU ecosystem not well developed



This area clearly has potential and should therefore be considered in current and future European research activities

- Already in the first R&I Work Programmes of the SNS JU related activities
- Additional research and innovation efforts
- Additional accessible experimental platforms

1. Further strengthen a collaborative European research and innovation, environment for open SNS solutions where new results will progressively reach higher Technology Readiness Level (TRL),
2. Create pan-European large-scale testing facilities to transparently verify achieved results in terms of reproducibility, repeatability and reliability of claims,
3. Promote the engagement of European actors along the full chain to generate innovative solutions and services,
4. Develop a public marketplace of research and innovation facilities and solutions available to European stakeholders for experimentation and generation of new knowledge. Towards this end, it is important to leverage existing testing facilities and ensure linking and complementarity at a European level,
5. Reinforce European leadership in standardization for open networks,
6. Ensure that the provided solutions address security and privacy conforming to European values, EU standards and citizens' needs,
7. Build-up and retain a knowledge base of experts to implement, operate and manage Open SNS infrastructures.



Toon Norp

Member of the 6G-IA policy task force

**Cloudification and distributed
computing**

6G = cloud based

6G applications implemented as distributed components on a cloud

6G networks will be cloud-based

6G edge networks will be cloud-based

6G RAN will be running on edge cloud

If everything in 6G is cloud based, it is important to understand who is providing this cloud

- US based hyperscalers are dominating the cloud market
- Operators still have private (edge) cloud networks



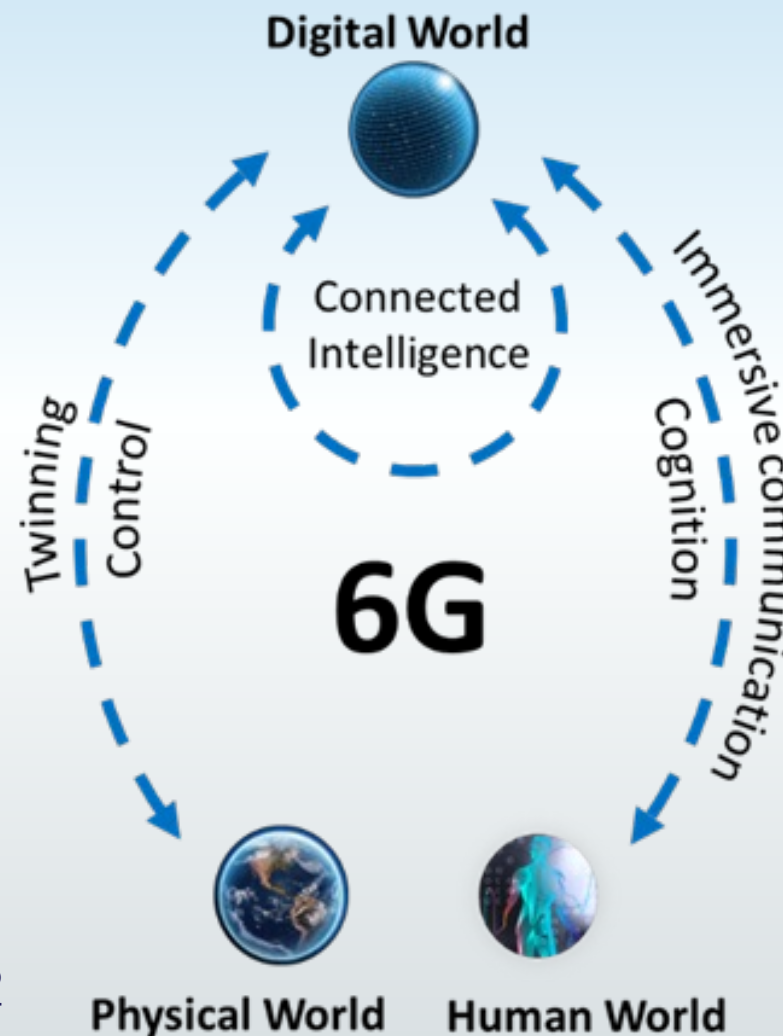
4 largest cloud providers have 78% of the market

Sovereignty concerns with cloud hyperscalers

- Dependency on non-EU players
- Winner takes all mentality
 - Limited portability
 - No interoperability
- Too large, too powerful
- Risk of chain dependency

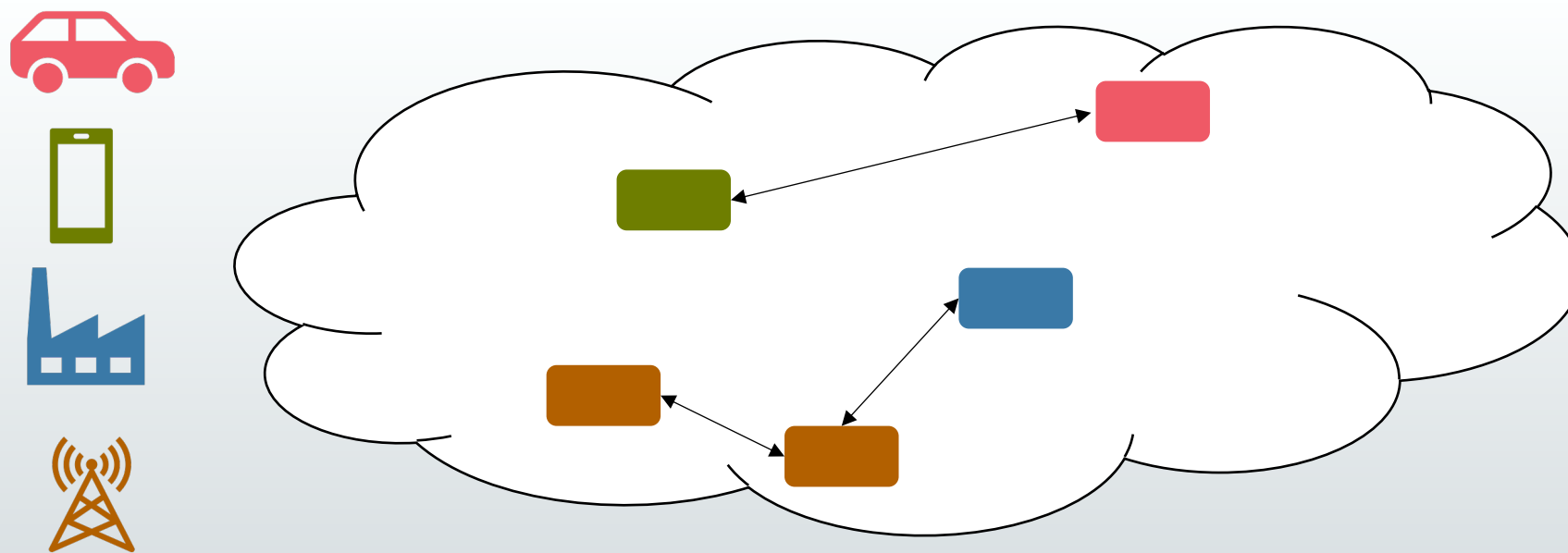
- Operator market for edge cloud, not quite there yet
 - + Sylva open source project for operator based cloud infrastructure
 - + Camara project to specify common APIs for network services, including for edge computing/storage
 - Hyperscalers are entering the edge market with increasingly distributed clouds
 - Operators outsourcing hosting of their network to hyperscalers

- Connected Intelligence
 - Digital representations (e.g. digital twins) are interconnected in the cloud

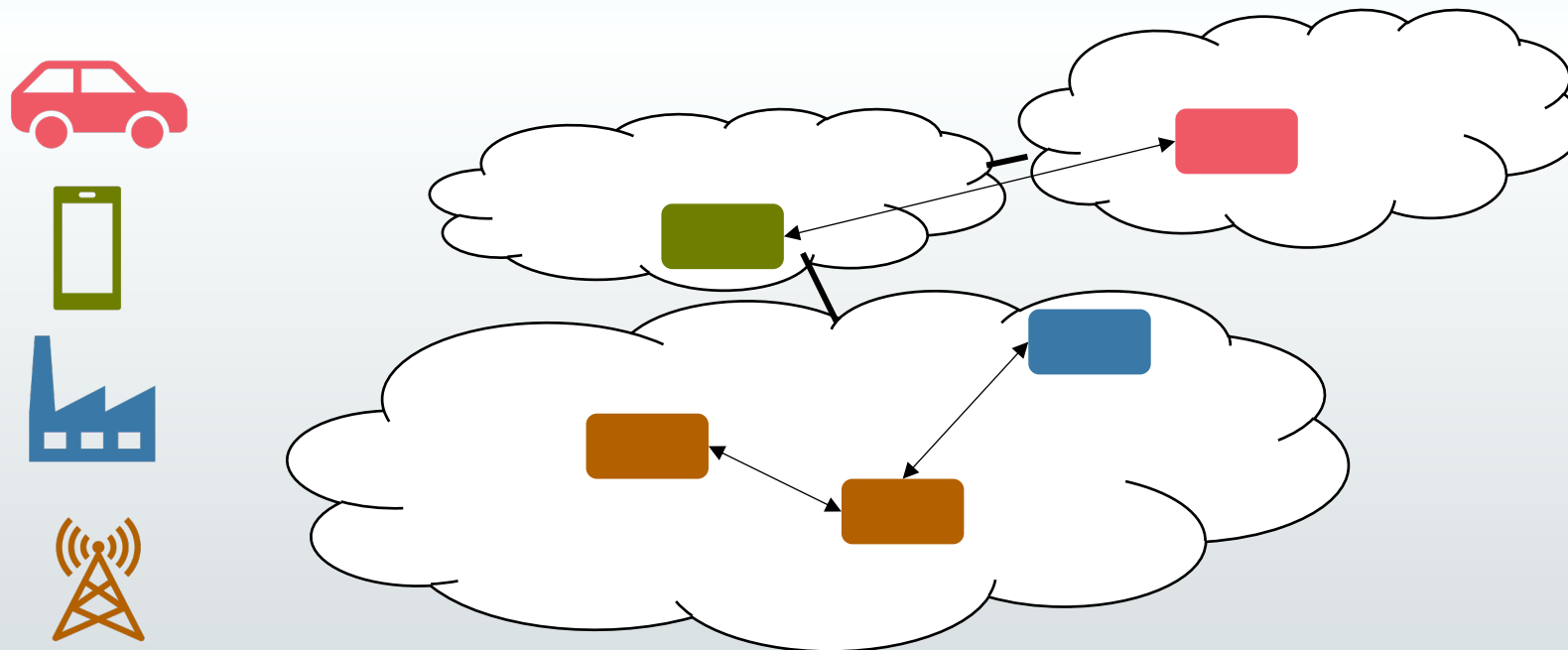


European Vision for the 6G Network Ecosystem - 5G-PPP

- 6G cloud will have to host intelligent components for network control and user applications
- Cloud can support discovery / routing / trust relations between intelligent components – on a single cloud



- Interfaces are needed between intelligent components that are running on different clouds
- We need standardized support for intelligent component discovery, mobility & routing, and authorization & authentication



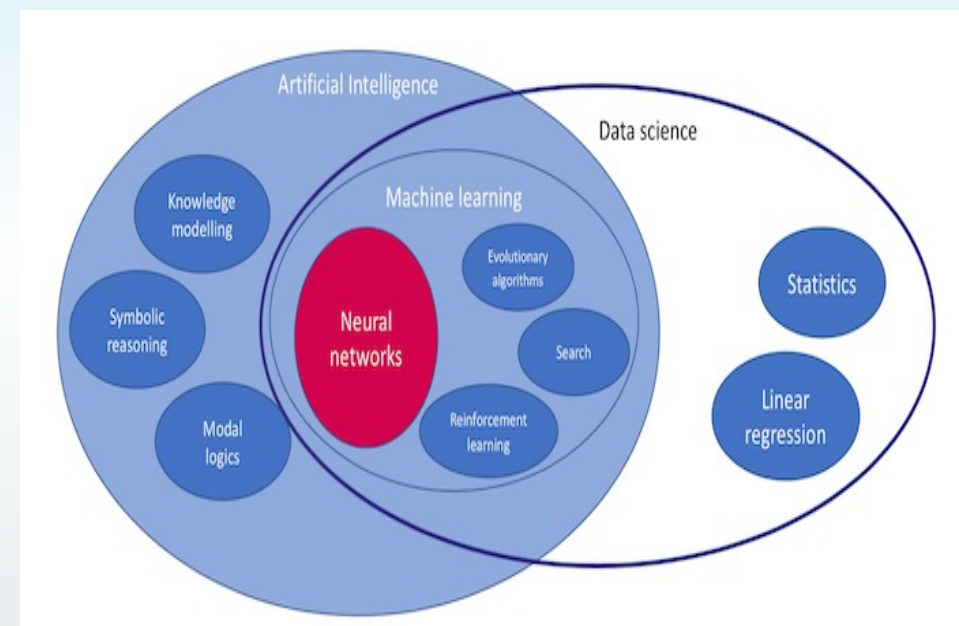
1. European solutions for network cloudification in all domains (RAN, edge core),
2. Open-source solutions to contribute to 6G technological sovereignty,
3. Open interfaces to enable cloud interoperability & cloud enabled telco services interoperability
4. Solutions conforming to European legislation for data security and privacy,
5. EU-based open, interoperable, and multi-provider cloud infrastructures for ICT networks.

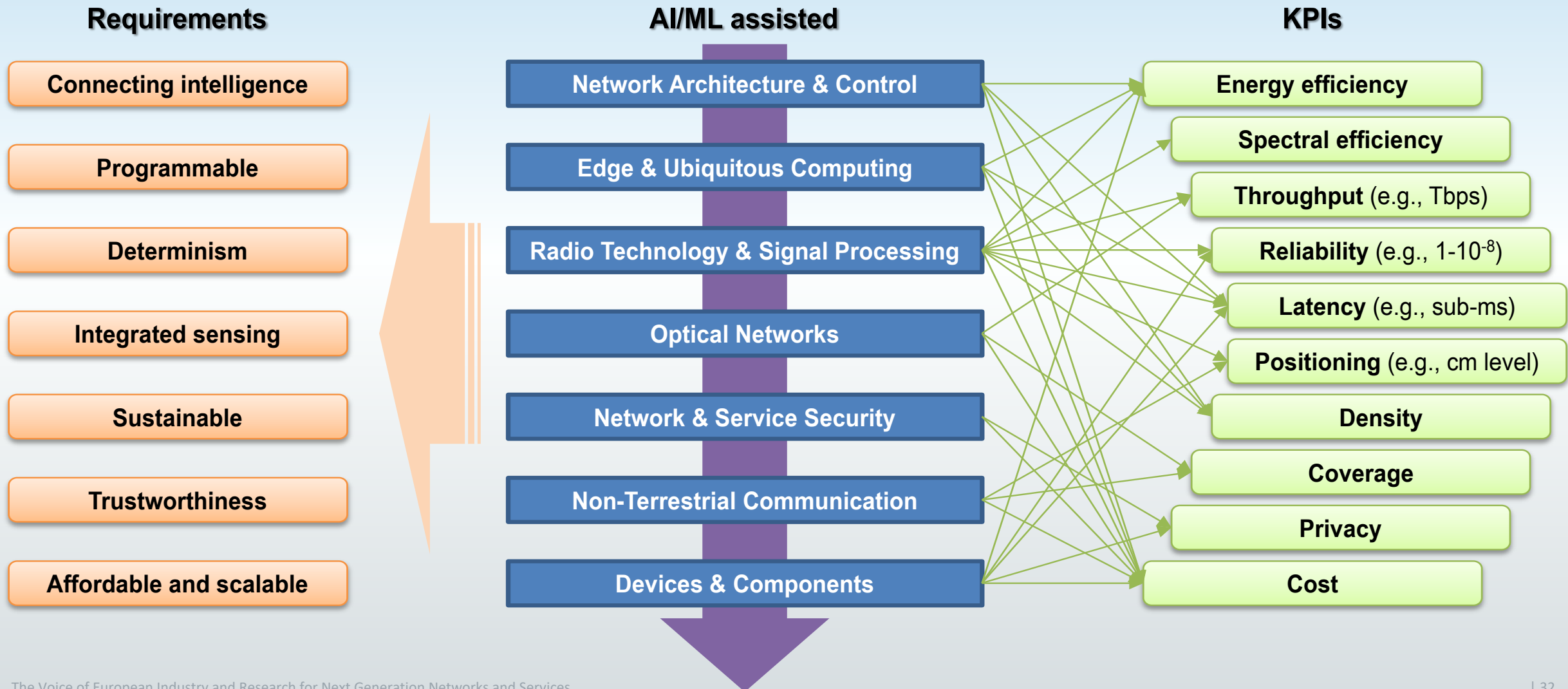


Christine Leurquin,
Member of 6GIA Policy Working Group

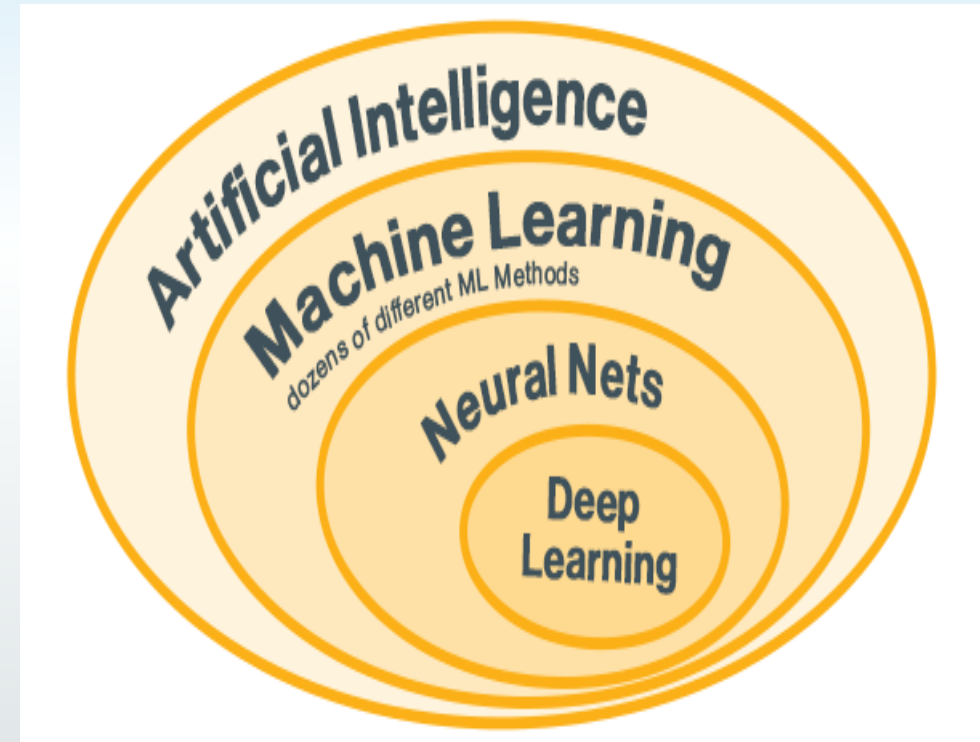
Network intelligence

- AI/ML (Machine Learning) solutions across various streams
- Future 6G system aspects : radio, security, user applications
- Reference framework for AI usage in telecom domain





- a) Define and implement standardized interfaces for training and execution of AI models
- b) Ensure that either real-world or synthetic datasets for training purposes are available for use in SNS and promotion of such datasets towards standards bodies for system benchmarking and evaluation.
- c) Run pilots with new customer segments to identify AI/ML opportunities
- d) Examine the use of AI/ML and automation for network operations, including control and management functions, in a sustainable way
- e) Stimulate adoption of new solutions for AI/ML and automation to facilitate the introduction of new use cases and services,



- f) Establish and ensure long term operation of an open repository for communications and networking datasets that can be used for training and benchmarking AI/ML algorithms,
- g) Define widely accepted data acquisition and curation procedures that with a strong impact in standardization activities,
- h) Develop synergies between SNS JU and AI, Data and Robotics cPPP.
- i) Define open solutions and standardised interfaces that enable interconnection and interoperation of intelligent components across different stakeholders.
- j) Secure AI systems throughout the entire machine learning lifecycle.





Emmanuel Dotaro
6G-IA Board member
Member of 6GIA Policy Working Group
Security and Privacy

Security is a pre-requisite

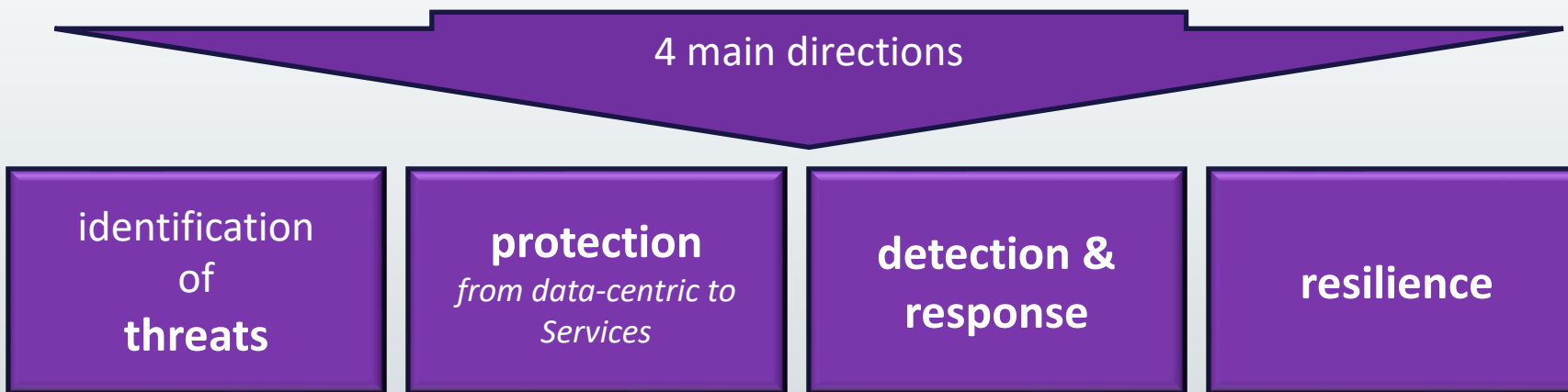
- A Fundamental Human Right
- Both Economical and societal growing dependencies upon digital infrastructure

→ opportunity to foster Strategic autonomy and Human-Centric EU vision

&

6G (following 5G) is NOT business as usual

- Crossroad of technologies (cloud-native, AI-native)
- Complex E2E/3D architectures
- Beyond « by design » needs → whole life cycle:
 - Supply chain
 - Deployment
 - Operations
 - Services
- Regulation set/Acts (CRA, AI-act, NIS2,...) as instruments
- Overall resilience objectives



identification
of
threats

- Facing attacks sophistication
- Capitalizing on 5G history (ENISA threat Landscape, Toolbox,...)

protection

*from data-centric to
Services*

Opportunity for a public/private approach

detection &
response

6G-dedicated cooperative European Cyber Threat Intelligence (CTI)

liaised with cloud infrastructure, microelectronics and other 6G integrated technologies

resilience

Strongly related to

Evaluation and monitoring of security conditions

identification
of
threats

protection
*from data-centric to
Services*

detection &
response

resilience

- Data centric
- HW & SW components
- Operations
- XaaS

➔ multi-layer of policies applications

➔ Multi-level of security targets

identification
of
threats

protection
*from data-centric to
Services*

detection &
response

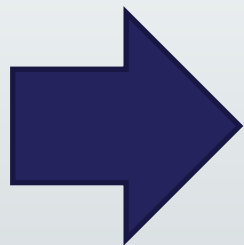
resilience

- Attack detection means and distribution

→ leading to cooperative response across Public and NPN

sharing/coordination of information and countermeasures

→ including contamination limitation



Closing the loop with CTI

1. Create a collaborative environment for key public and private forces that are actively dealing with security and privacy to work together and cover the complete range of needs from research activities, opportunities for new products and services as well as policies
2. Identify areas where critical hardware and software solutions are indispensable and ensure European implementations of such solutions,
3. Develop and adopt certification processes for hardware and software solutions so that their conformance evaluation against European policies and legislation is feasible without impacting access to critical ICT technology for Europe.
4. Develop synergies and joint actions between 6G-IA and ECSO including on standardization, certification and labelling.



Carles Anton Haro

6G-IA Board member & Chair of 6G-IA Trials WG

Member of 6GIA Policy Working Group

SNS Knowledge base and skills



Skilled **digital experts** are **key** to effectively deploy and adopt 6G networks – **shortage** in EU.

Critical mass of **EU stakeholders** working in **innovative 6G solutions** mobilized by 6G-IA/SNS-JU.

Opportunity to create a **6G SNS knowledge basis**.

Women in Telecommunications and Research (WiTaR): EU initiative for gender equality promotion in the 6G R&I community.

Time-frame after 2024:

1. Ensure that the **generated knowledge** becomes an **integral part of the curricula** in Europe, starting with the SNS calls from 2025.
2. **Collect the generated knowledge on 6G** smart networks and services and make it **widely available** for European experts in **life-long learning** activities
3. Stimulate and **motivate 6G-IA members** to support the skills development through **open lectures** on key topics.





Raffaele de Pepe

Vice-Chair of the 6G-IA Bord

Chair of the 6G-IA VTF

Member of the 6G-IA policy task force

Sustainability

Sustainability

...meeting the needs of the present without compromising the ability of future generations to meet their own needs...

Source: <http://www.un-documents.net/our-common-future.pdf>

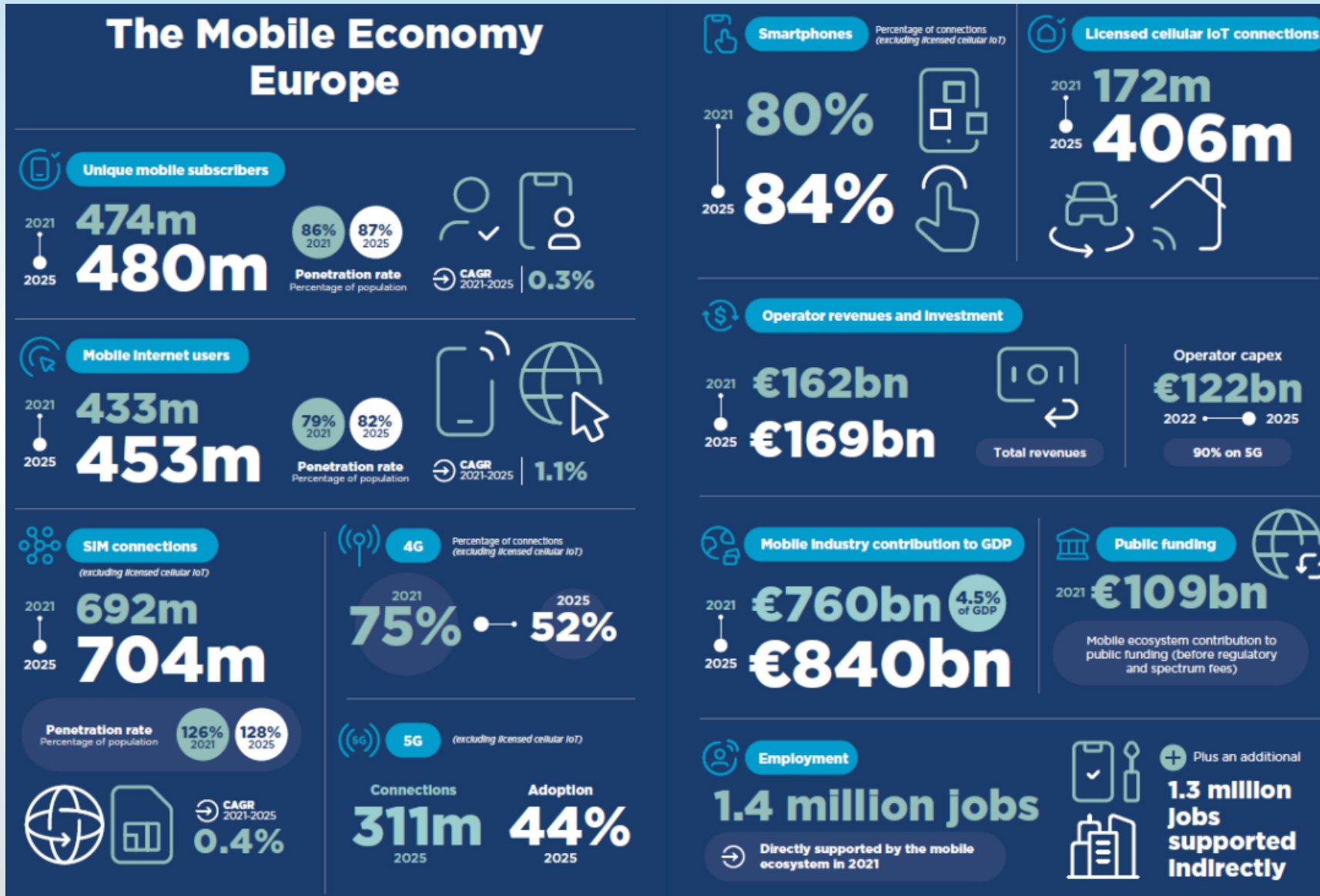
Three facets:

1. Environmental
2. Societal
3. Economical

Two main notions:

1. Sustainability for 6G
2. 6G for sustainability

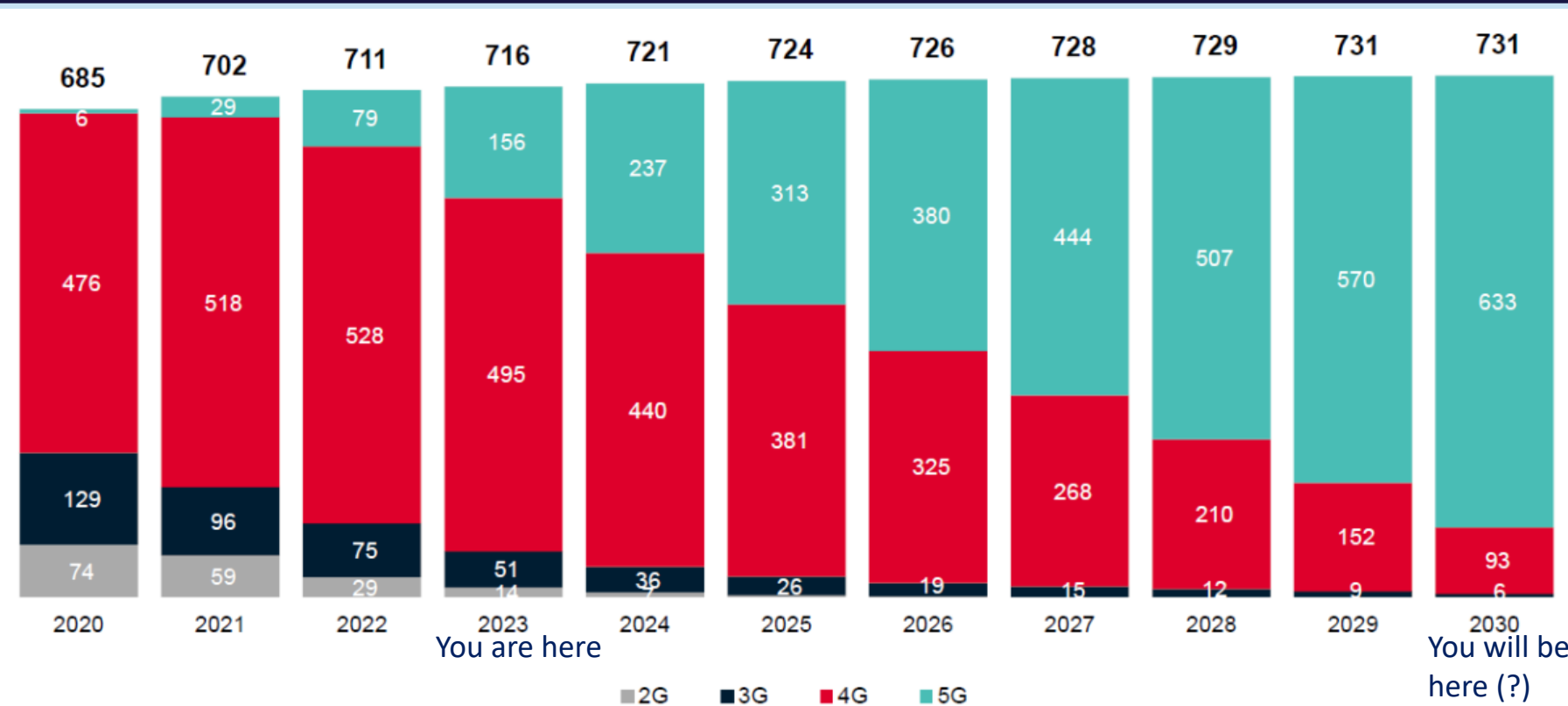
Currently qualitative frameworks



- **Mobile Sector** is key to the **European Economy**
 - Represents **4,5%** of EU GDP
 - **760B€** of economic value added
 - **109B€** contribution to Public Funding
 - **1,4 Mil** jobs supported

Source: Mobile Economy Europe 2022 (GSMA)

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



- **2023**
 - **4G** mainstream
 - **5G** growing fast
 - **2G, 3G** phasing out
- **2030**
 - **5G** mainstream
 - **4G** phasing out
 - **2G, 3G** "sunset"
 - **6G** ?

Source: GSMA

- Flat growth for mobile lines from now to 2030
- By 2030 **5G** and its evolution will be the mainstream technology to serve the consumer and the industrial market
- **6G** will coexist with 5G, a very efficient technology having a very large footprint in EU and worldwide
 - economically efficient technology to replace 5G or a new mobile technology with new monetizable services ?

FIG 14.1 : *Stoxx Europe 600 index, Stoxx Europe 600 index for telecoms and Stoxx Global 1800 index for telecoms, where the value in 1Q 2016 is set to 100, 4Q 2015–3Q 2022*

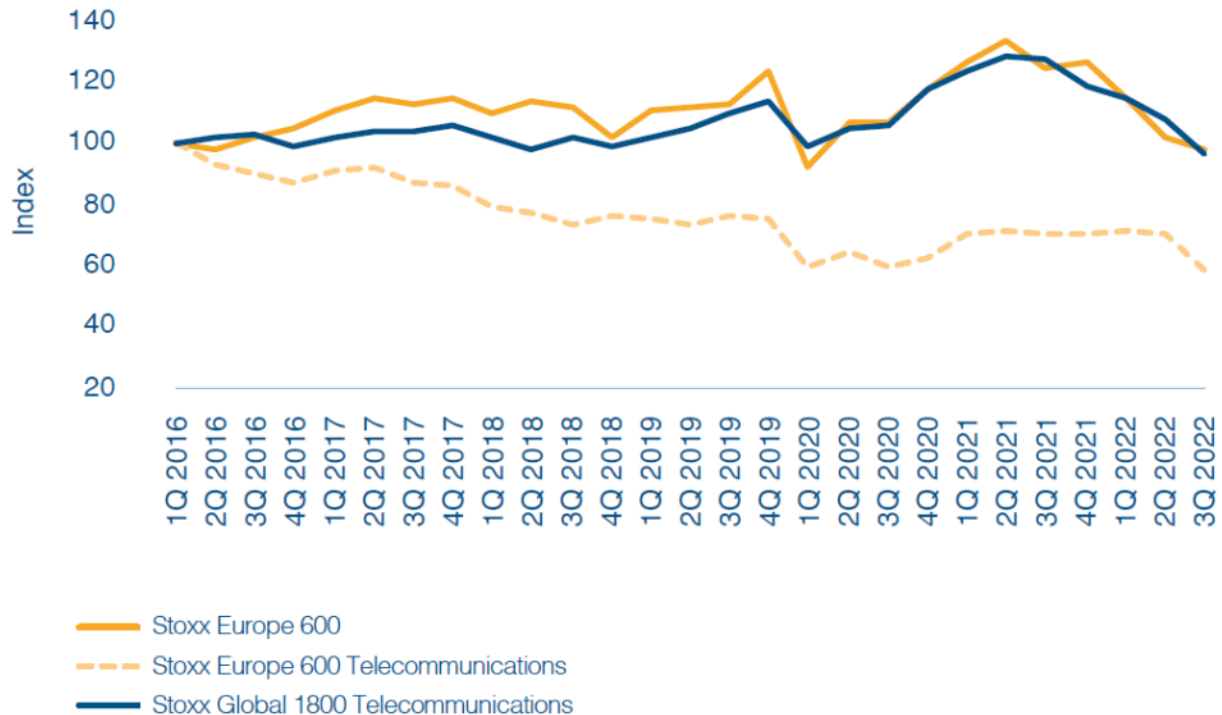
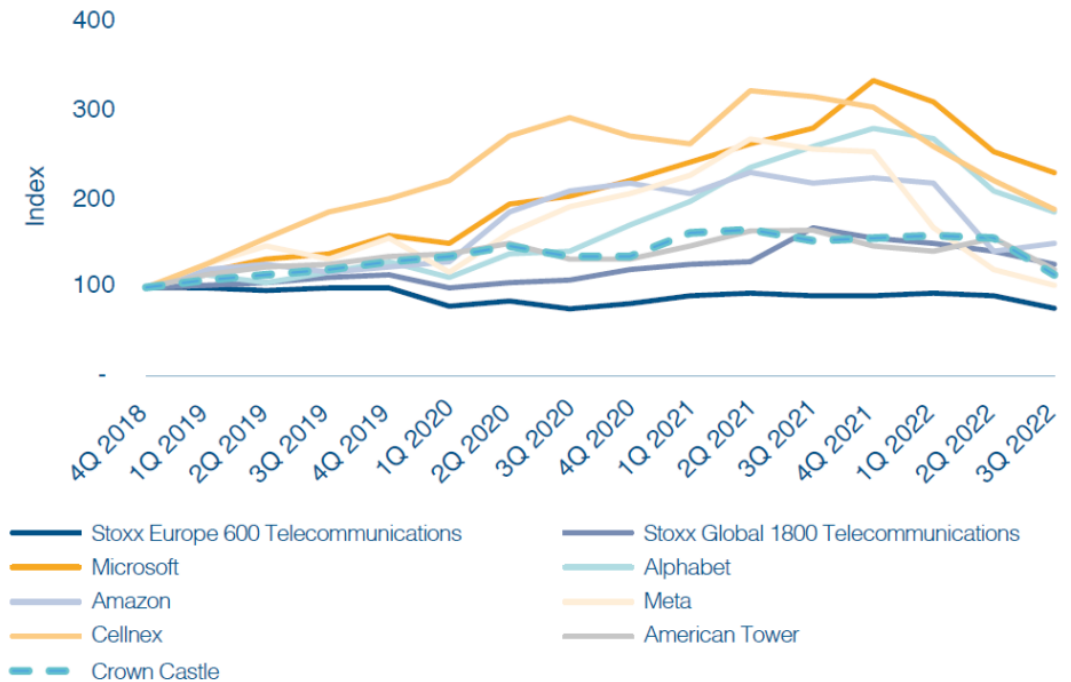


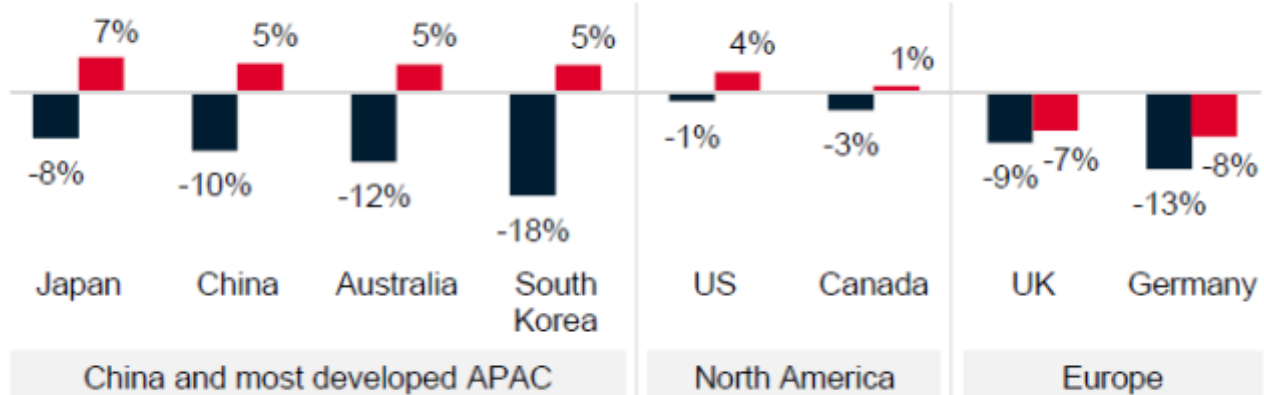
FIG 14.2 : *Stoxx Europe 600 index for telecoms, Stoxx Global 1800 index for telecoms and stock values for hyperscalers and towercos, where the value in 4Q 2018 is set to 100, 4Q 2018–3Q 2022*



Source: EtNO (2023)

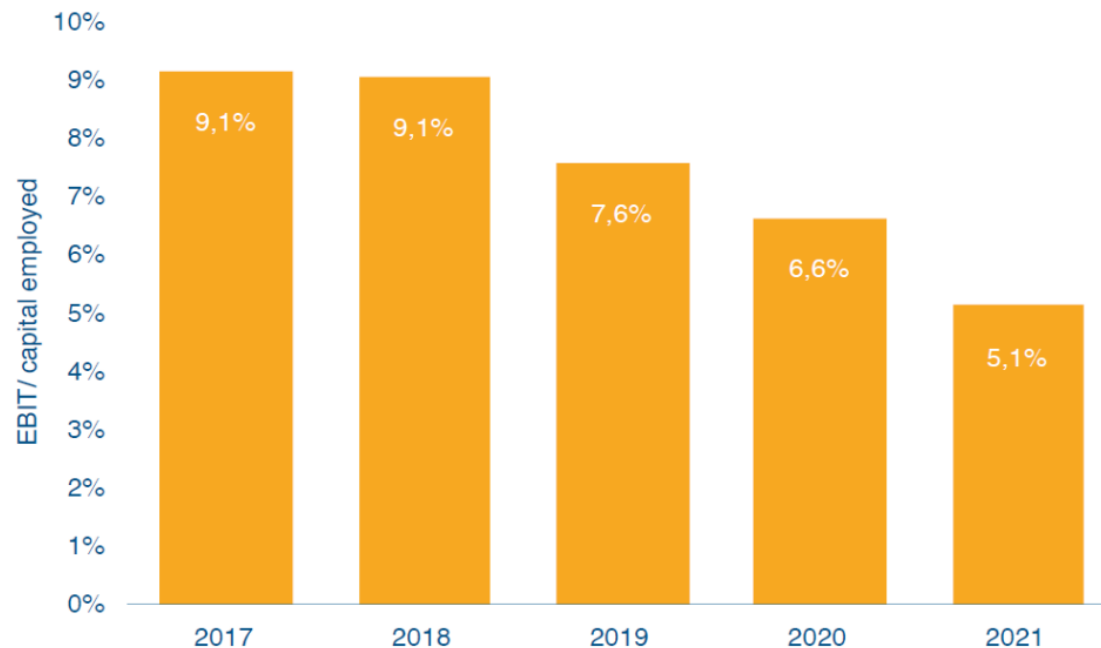
- Industry outlook is not brilliant at it was in the “golden age”
 - 2G had services (voice and SMS) inside the network -> CAPEX and revenues coherent
 - From 3G services provided mainly outside the network (es. Whatsapp), decoupling of CAPEX from revenues

Mobile ARPU trend by region



■ ARPU change 12 quarters before 5G launch ■ ARPU change 12 quarters after 5G launch

Source: GSMA



Source: ROCE for EU incumbents - ETNO (2023) from Analysys Mason Data

- Operators have to cope with falling ARPUs, 5G did not reverse the decline in EU as in other parts of the world
- Return on Capital Expenditure (ROCE) continues to fall, now close to the WACC
 - investments in new infrastructure (e.g. 6G) will be critical if returns are not generated
 - 2030 Digital Decades objectives can be at risk



Gustav Wikström

Member of 6GIA Policy Working Group

Key Values Indicators

- 6G should be designed not only for performance but to have a positive impact on societal values, and most critically for sustainability
- Impact to be assessed with Key Value Indicators (KVI) in relation to the usage of 6G networks
- To complement performance-related capabilities, assessed with Key Performance Indicators (KPIs)
- KVIs is a tool to demonstrate the value impact of technology and how societal challenges are addressed

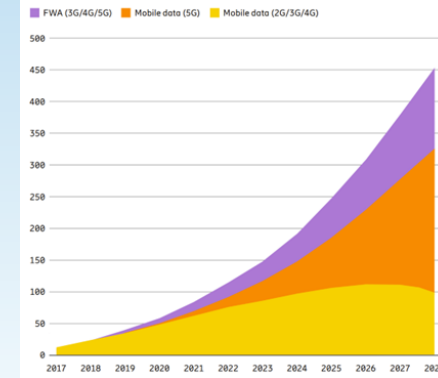
Why do we need KVIs?



Normative values

How to impact?

Performance



Technical requirements/KPIs



Society

Research projects



How to steer?

How to discuss?



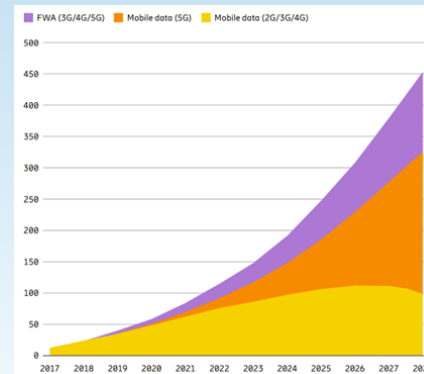
Why do we need KVIs?



Normative values

How to impact?

Performance



Technical requirements

KVIs

KPIs

How?



We got this!

KVIs

KVIs

Society

Research projects

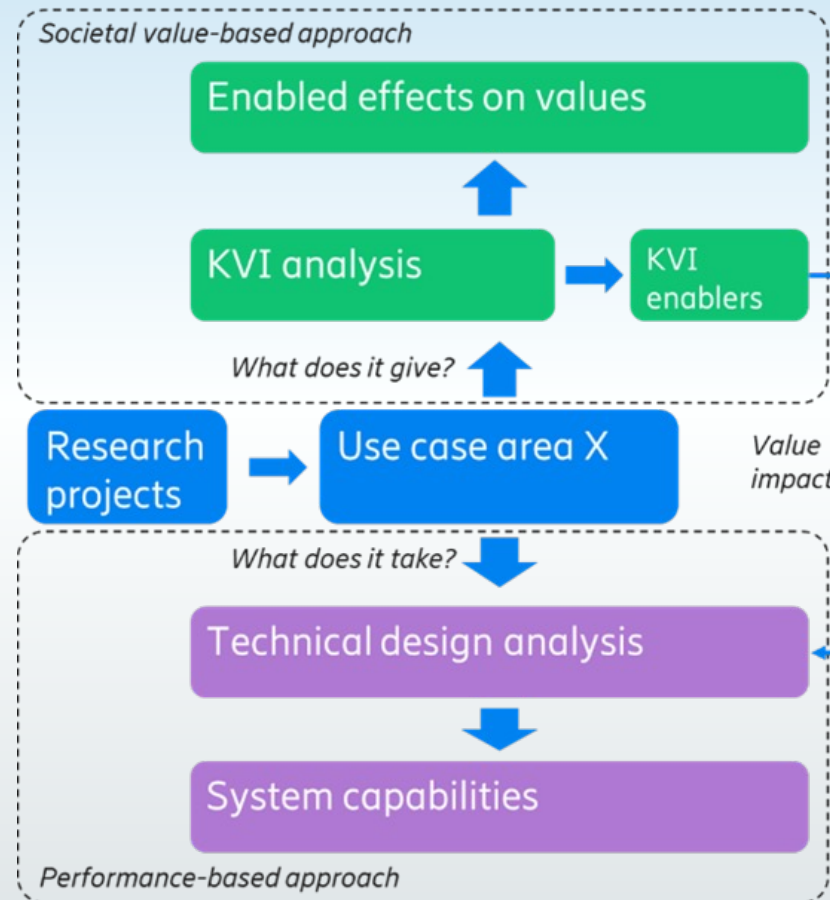


How to steer?

How to discuss?



KVI analysis



KVI analysis -example

Use case area	KV examples	KVI examples
Emergency response & warning systems	Societal sustainability	Reduced emergency response times; Increased operational efficiency of interventions in remote areas
	Environmental sustainability	Increased area of protected and surveyed natural habitats and climate preserves
	Trust	Reported confidence in advanced digital devices, systems, and services in critical missions
Smart city with urban mobility	Environmental sustainability	Environmental footprint of urban transport of persons and goods
	Personal health and protection from harm	Injuries in urban traffic
Personal health monitoring & actuation everywhere	Privacy and confidentiality	Reported user control of medical data for storage/transmission/processing
	Societal sustainability	Average cost saving in health care system per patient
	Trust	Reported trust level for autonomous e-health components; Accuracy rate in e-health AI-related events' identification and/or decision making
Living and working everywhere	Societal sustainability	Travelling / commuting time reduction; Access to job market; Life opportunities in rural areas
	Economical sustainability and innovation	Cost-efficiency of living and working in rural areas; Number of activities that can be performed anywhere
	Digital inclusion	Access to internet in communities and areas
Sustainable food production	Environmental sustainability	Environmental footprint of agriculture activities; Energy use in agricultural activities
	Societal sustainability	Increase in agriculture productivity; Reliability of food production

1. Further develop the KVIs methodology as a framework to quantify and evaluate sustainability related breakthroughs (all solutions must target sustainability, so all solutions must be ready to be evaluated against the key European values)
2. Promote the KVI methodology, initiated by Hexa-X and to be further developed under the 6G-IA Vision WG to standardization bodies
3. The double perspective of performance goals vs environmental, societal and business value impact should be taken into consideration when developing new technologies



Alexandros Kaloxylos

6G-IA Executive director & chair of the
Policy Task Force

Closing remarks

Surname	Name	Editor/Contributor	Company / Institute / University
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Norp	Toon	Contributor	TNO
Osseiran	Affif	Contributor	Ericsson
Quintuna Rodriguez	Veronica	Contributor	Orange
Schubert	Martin	Contributor	Huawei Munich Research Center (MRC)
Schulz	Egon	Contributor	Huawei Munich Research Center (MRC)
Trichias	Konstantinos	Contributor	6G-IA
Wikström	Gustav	Contributor	Ericsson
Willcock	Colin	Contributor	NOKIA

Closing remarks

Ideas for the next edition

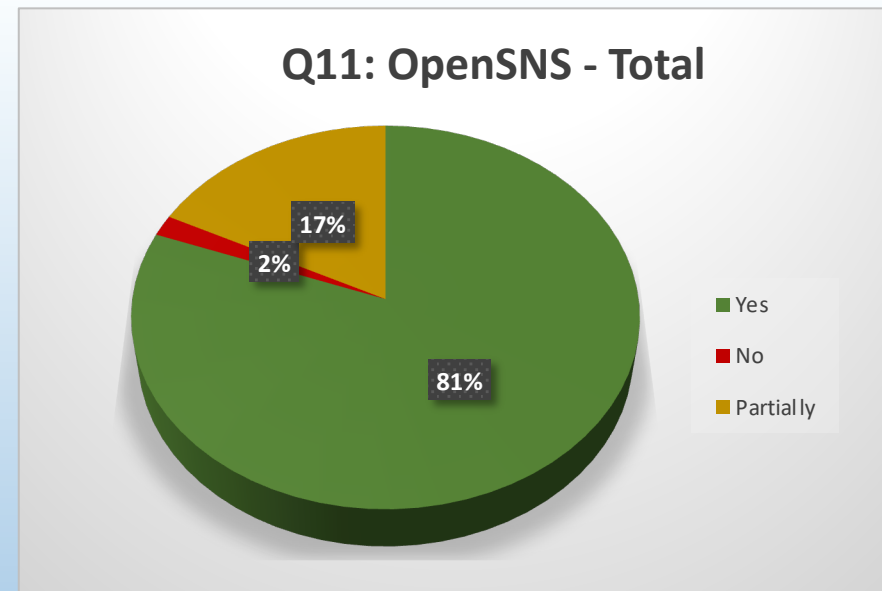
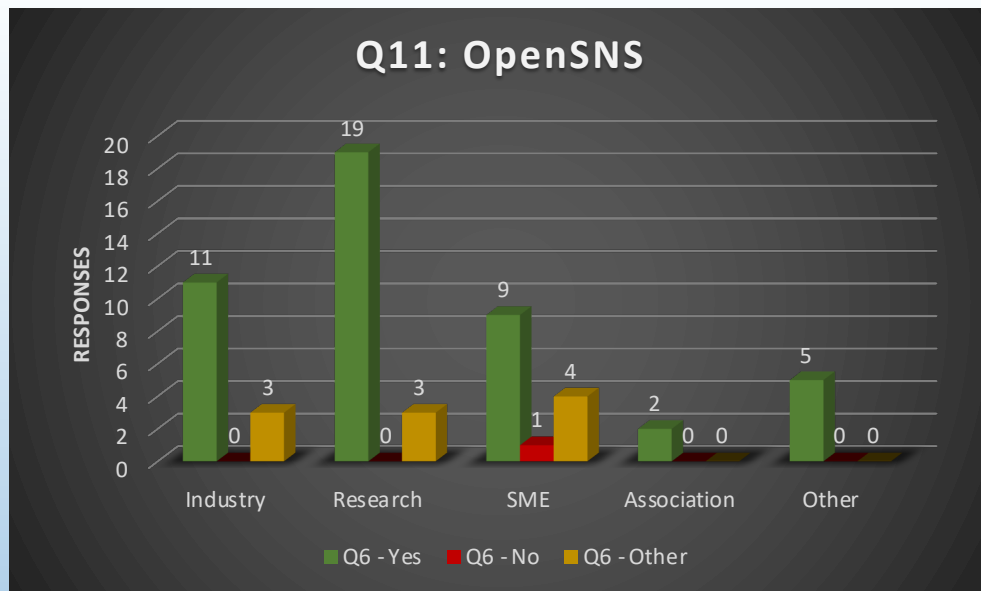
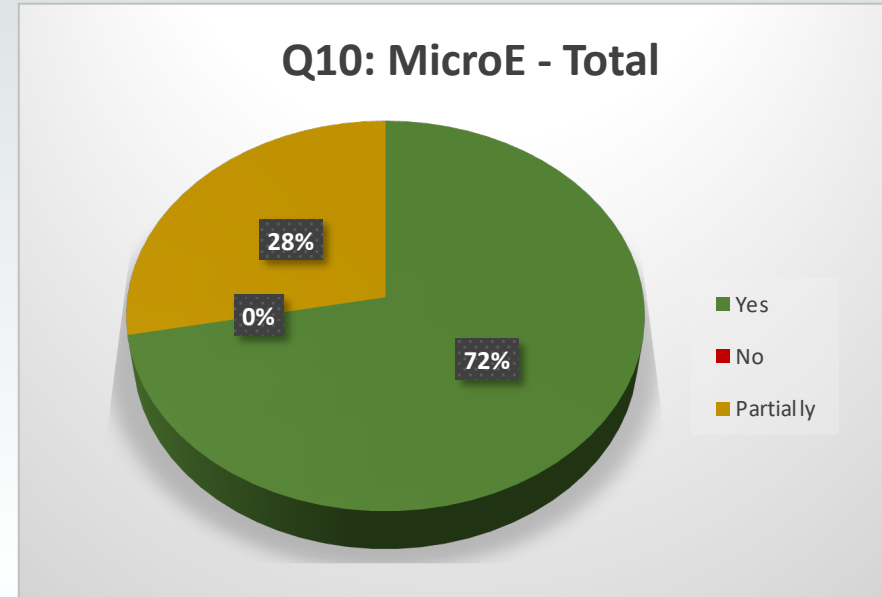
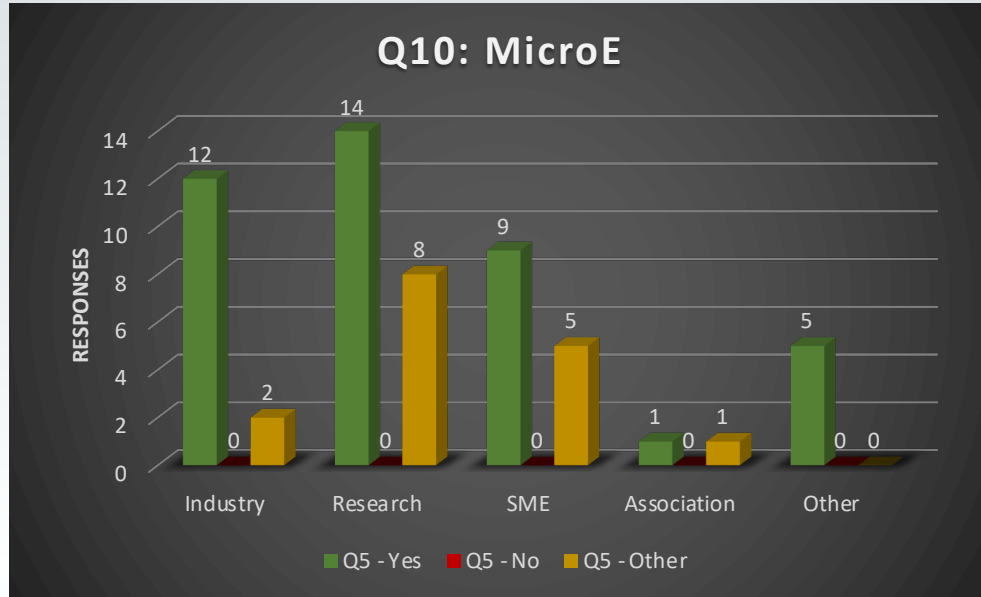
- Elaborate on Sustainability (environmental but even more on societal and economical issues)
- Verticals' readiness
- Advanced 6G services (e.g., Metaverse, Holographic communications...)
- How to boost 6G IPR development
- Spectrum
- Citizen awareness
-



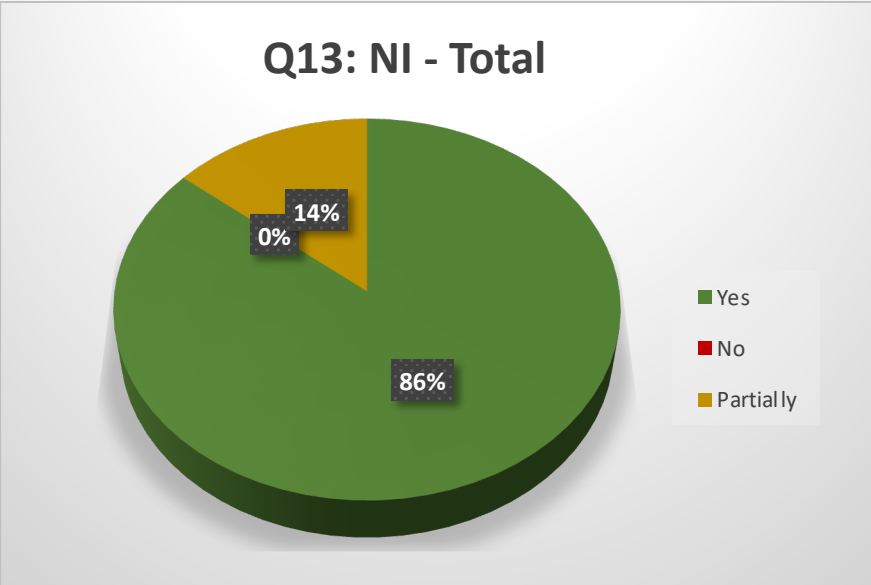
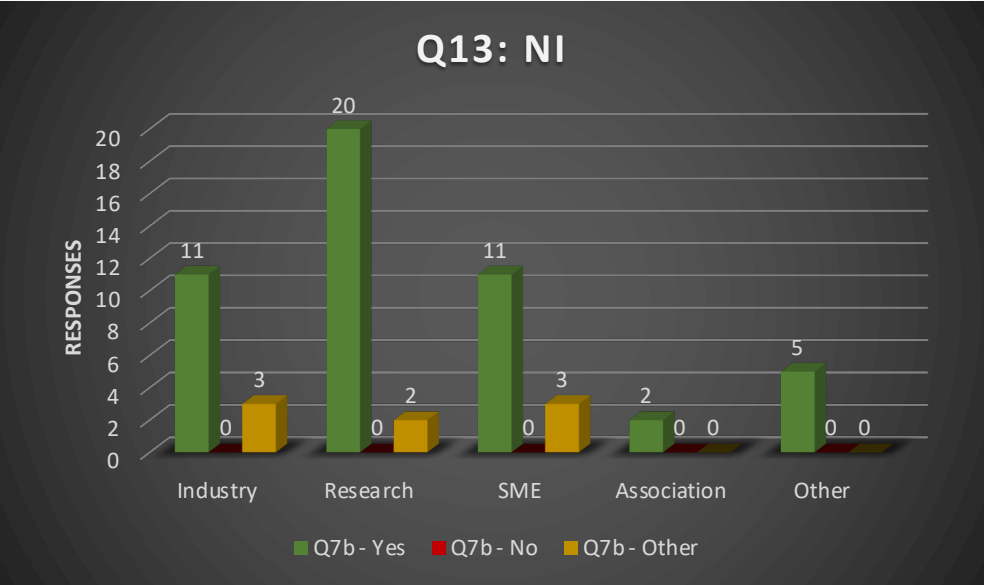
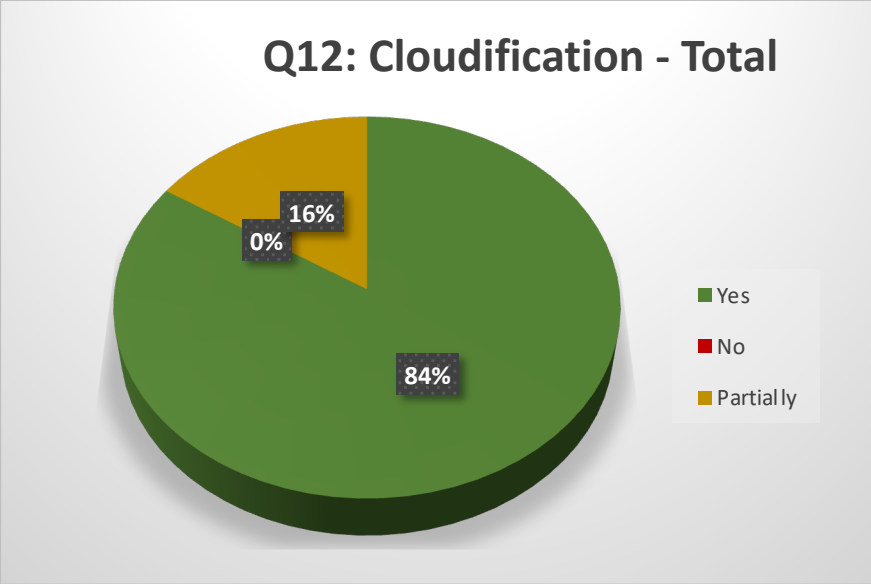
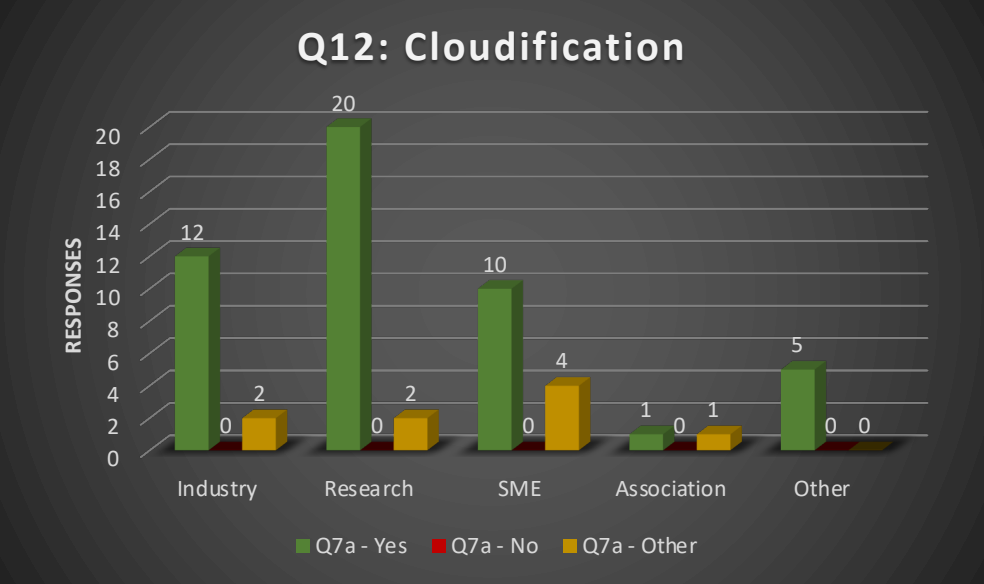
Backup slides

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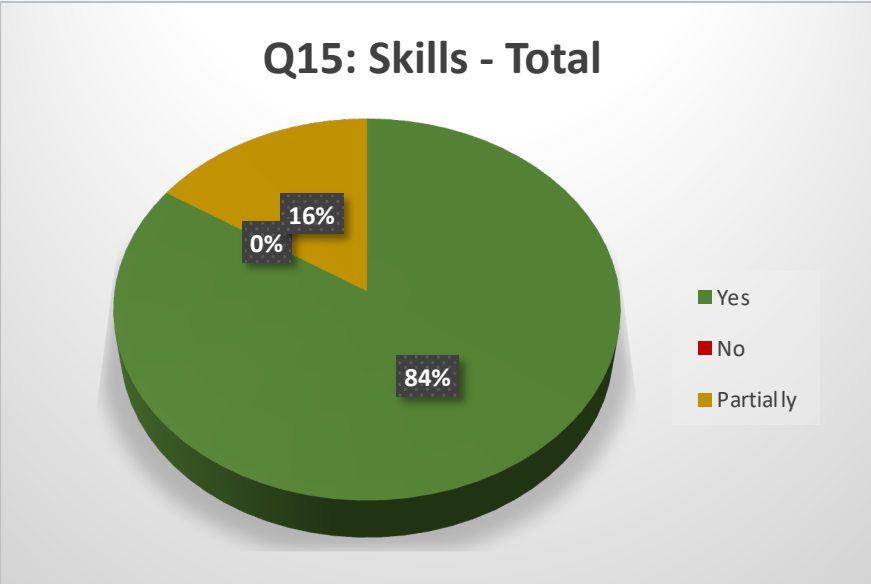
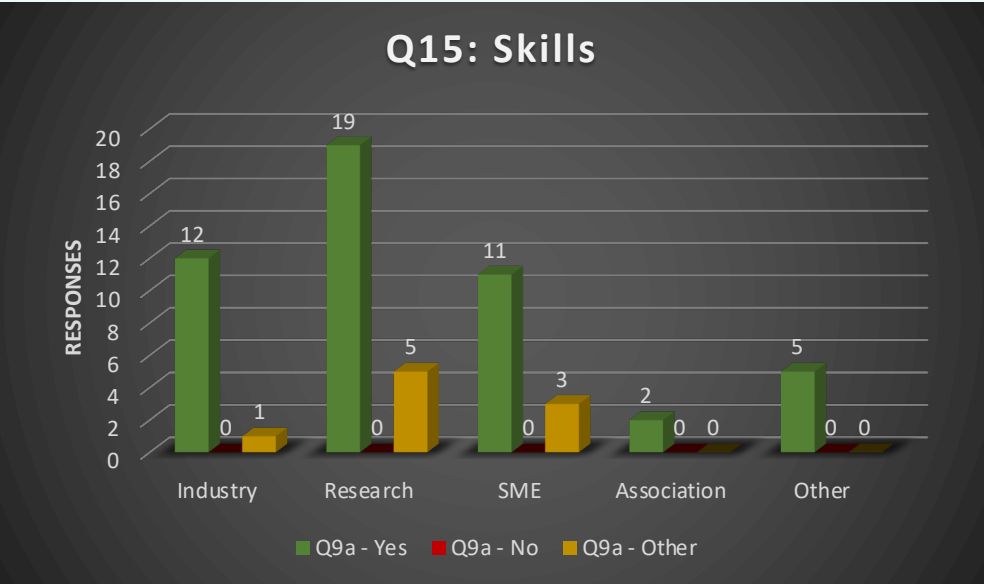
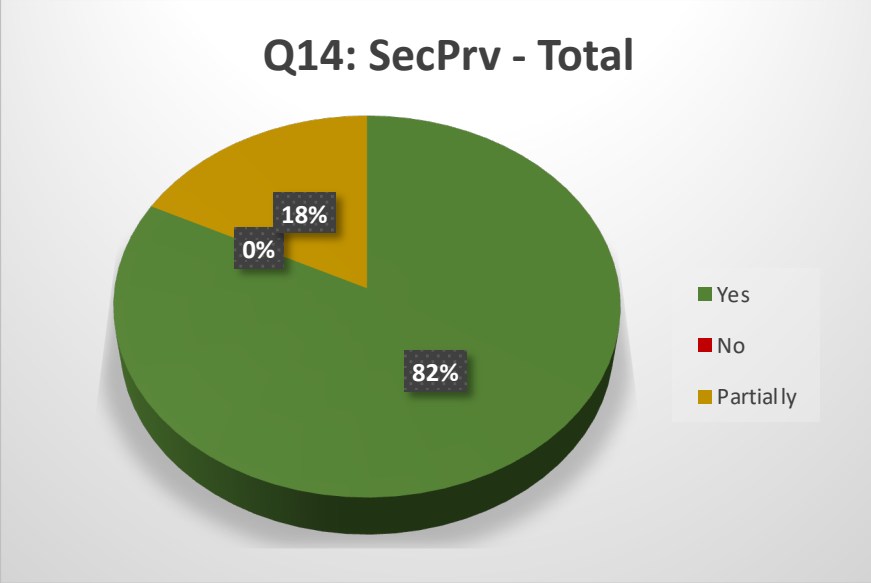
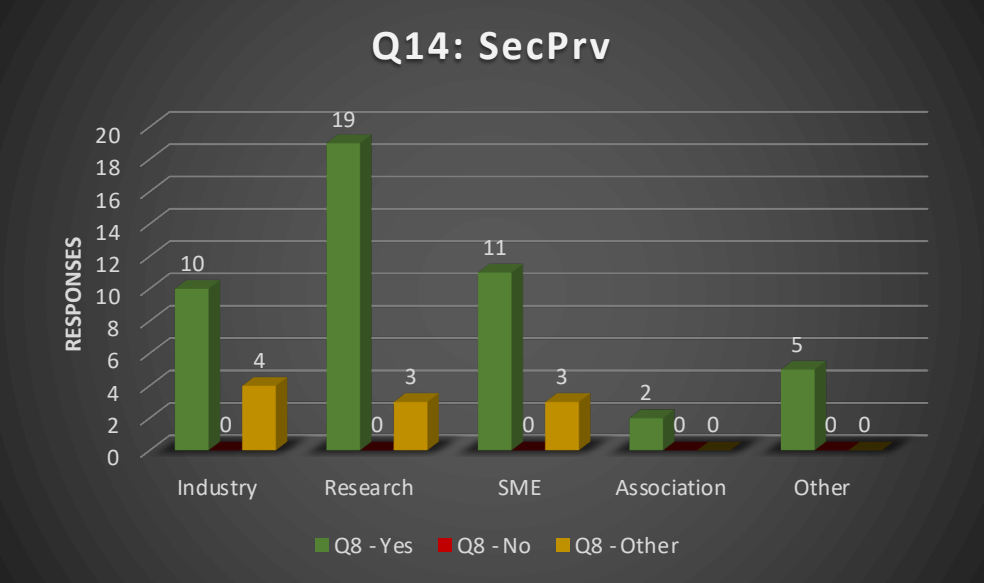
Consultation results (1/4)



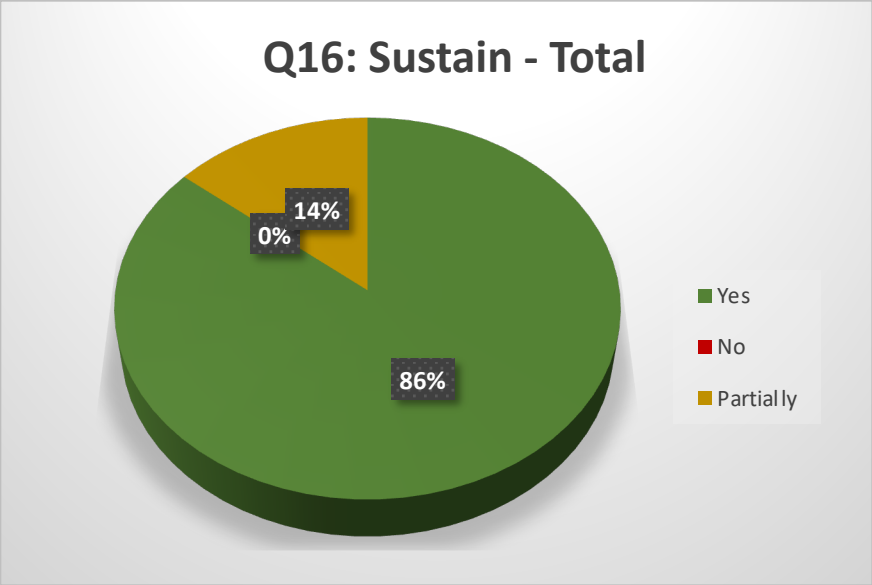
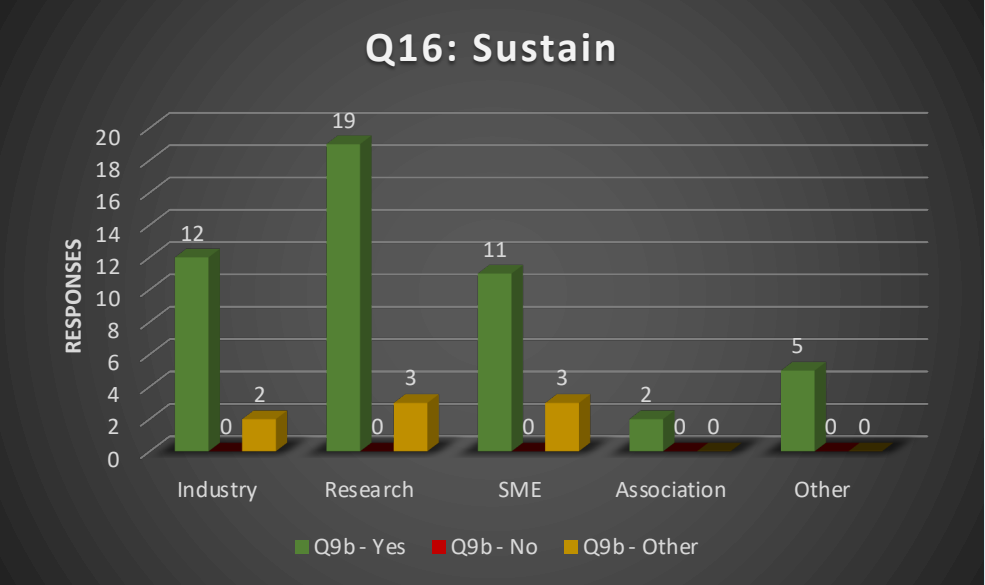
Consultation results (2/4)



Consultation results (3/4)



Consultation results (4/4)





Thank You!

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