SUSTAIN-6G

Towards accountable sustainability in the 6G ecosystem

Green Charter and Sustainability in 6G

Christoph Schmelz, Nokia

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“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”

United Nations

World Commission on Environment and Development

(Brundtland Commission)

1987

Quick facts

Horizon Europe – SNS-JU Call 3

Timeline: 01.01.2025 – 30.06.2027

Consortium: 24 partners from 10 European countries

- 7 telecommunication (operators and manufacturers)
- 4 large vertical industry
- 5 academia (universities and research institutes)
- 8 SME (vertical and telecommunication sectors)

More Information:

https://www.linkedin.com/company/sustain-6g/
https://www.youtube.com/@SUSTAIN-6GProject
https://cordis.europa.eu/project/id/101191936

https://sustain-6g.eu

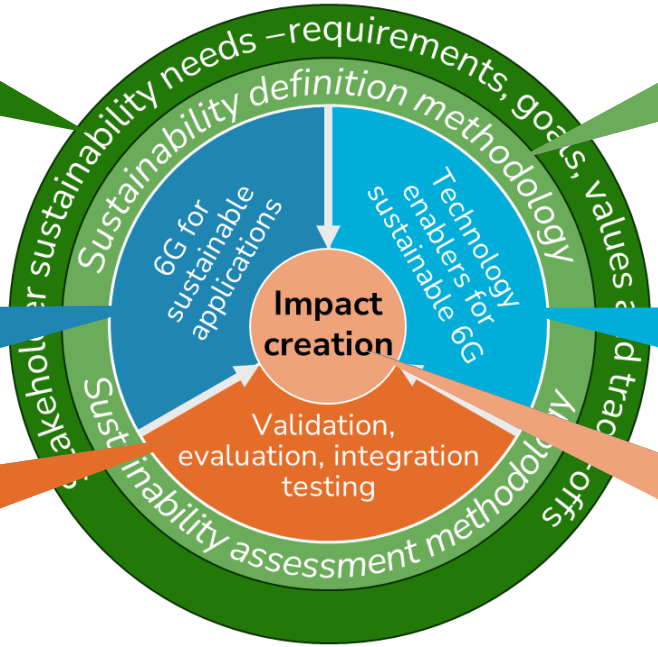
Motivation

Sustainable 6G "by design" needs to look at the whole ecosystem

Sustainability needs: address environmental, societal, economic goals and values of stakeholders

6G for Sustainability E2E ICT – Vertical interworking, sustainability mgmt., IoT devices

Guidelines + best practice recommendations for 6G design & implementation



Standardised definition and assessment of *sustainability metrics* quantification

Sustainable 6G RAN energy saving, AI/ML, OAM, Core/Cloud arch., Optical, Security

Strategic roadmap for regulation, policies, standardisation towards 6G sustainability by design

The “6 Dimensions” of Sustainability

Environmental

Conserve natural resources, protect ecosystems

Economic

Foster long-term growth & enable
new business models

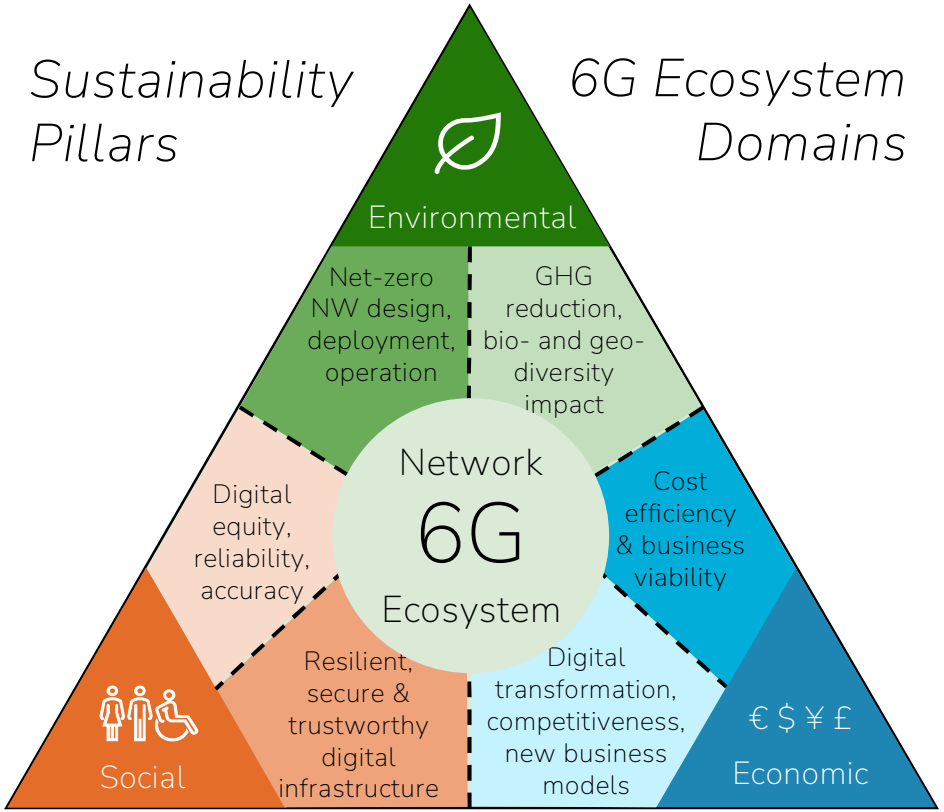
Competitive advantage

Social

Enable inclusive, empowered, resilient, fair societies

Sustainability Pillars

6G Ecosystem Domains



Sustainable 6G Technology Enablers

“1st order” effect

Associated with the existence of an ICT based solution

6G for Sustainable Applications

“2nd order” effect

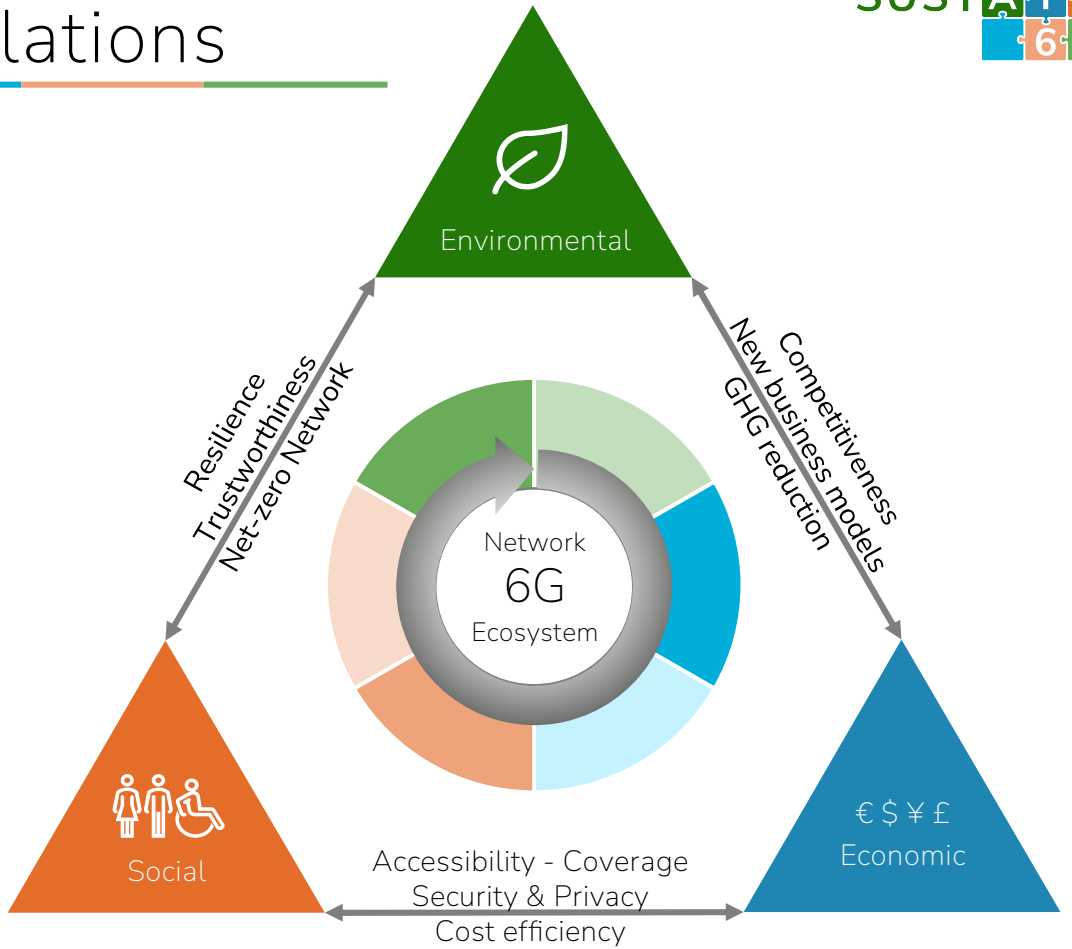
Induced by the use and application of ICT based solutions

Sustainability interrelations

Sustainability Pillars

6G Ecosystem Domains

Lifecycle Phases

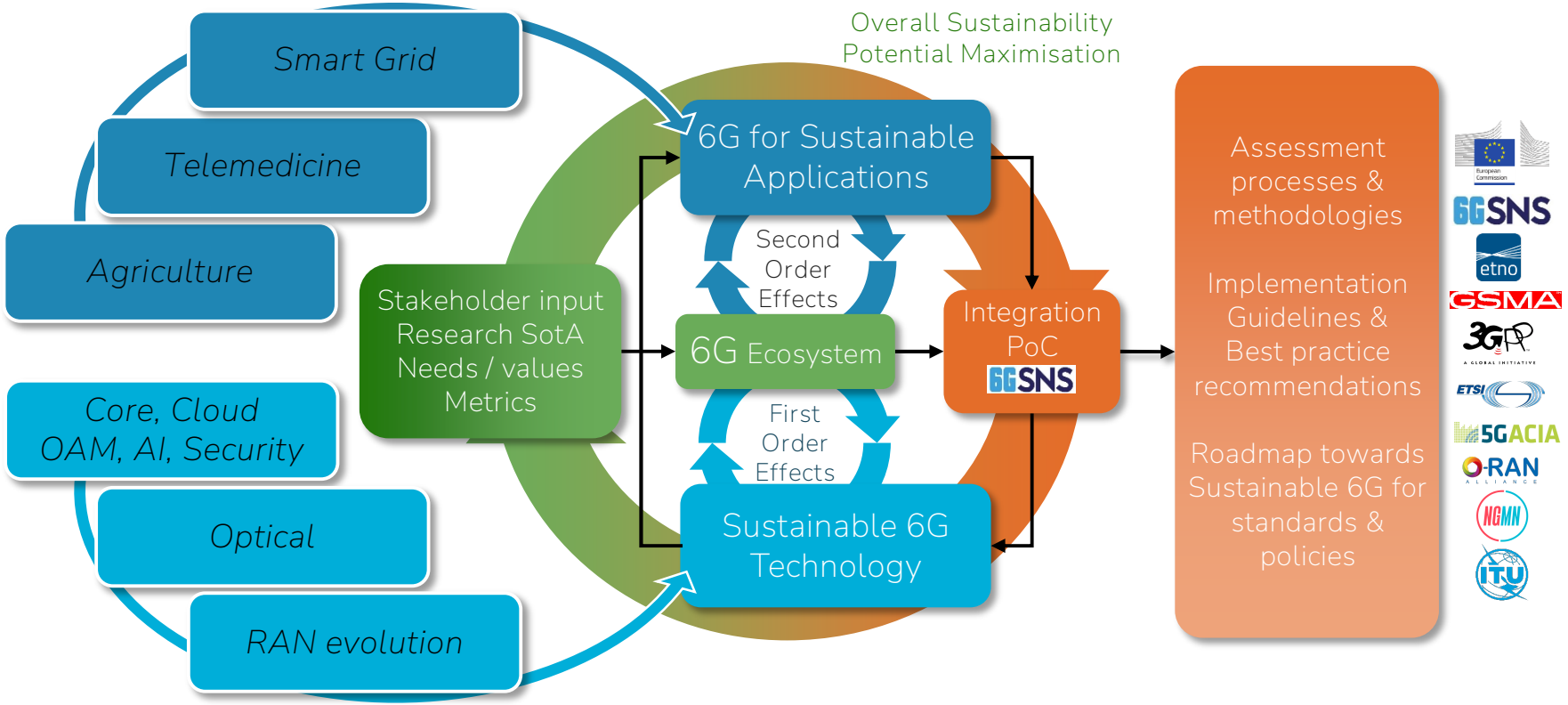


Sustainable 6G by design - challenges

Maximise sustainability potential across the complete 6G ecosystem

- Reflecting goals & values of all sustainability pillars & domains
  - Environmental – Social – Economic
  - ICT and verticals
- Taking an end-to-end perspective
  - Device – Network & Service Infrastructure – (vertical) Application
- Considering full lifecycle of assets
  - Planning – Manufacturing – Deployment – Operation – Phase-Out

Methodology



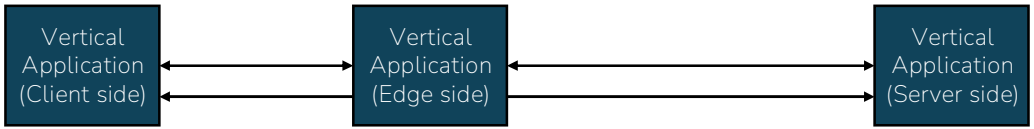
Sustainable technology enablers

Sustainable 6G / ICT

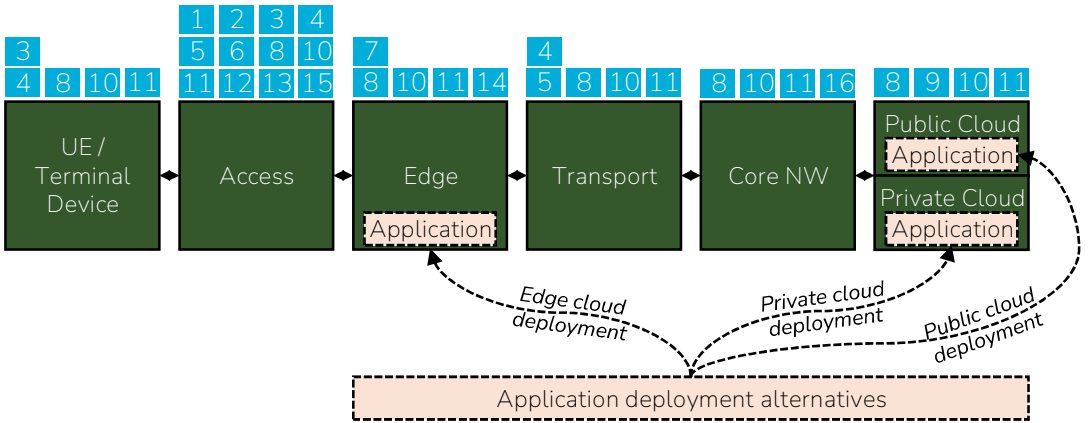
Environ-mental | Economic | Social

1	RAN energy consumption: components, modelling, evolutions
2	Energy-aware RAN operation
3	Optimised low-density parity check (LDPR)
4	Wired / wireless optical solutions for a photonic continuity (AON)
5	Fixed-mobile convergence with Fronthaul / Crosshaul / Midhaul
6	Network management under mixed constraints
7	Joint communication and computation optimisation
8	Network E2E enablers for optimal energy efficiency
9	Cloud infrastructure for energy efficient cloud-native NW functions
10	Energy efficient and sustainable AI-native 6G networks
11	Responsible AI
12	Distributed MIMO
13	Connectivity solutions for low-power IoT
14	Sustainable decision engine for robotic applications
15	Energy and QoE aware computing in the RAN
16	Idle & dynamic energy consumption of containerised NW functions

E2E Application Level

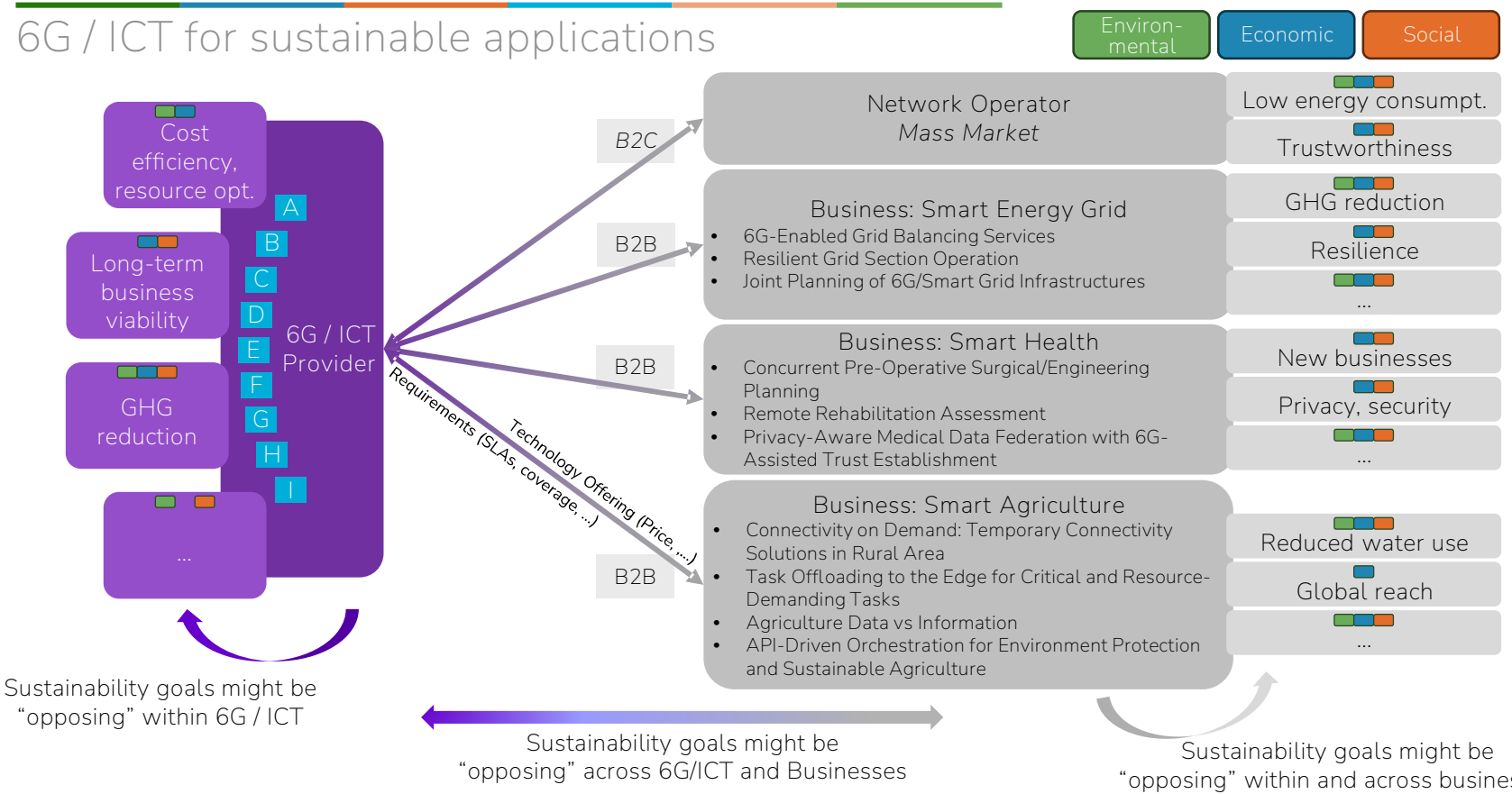


Functional Network Segments

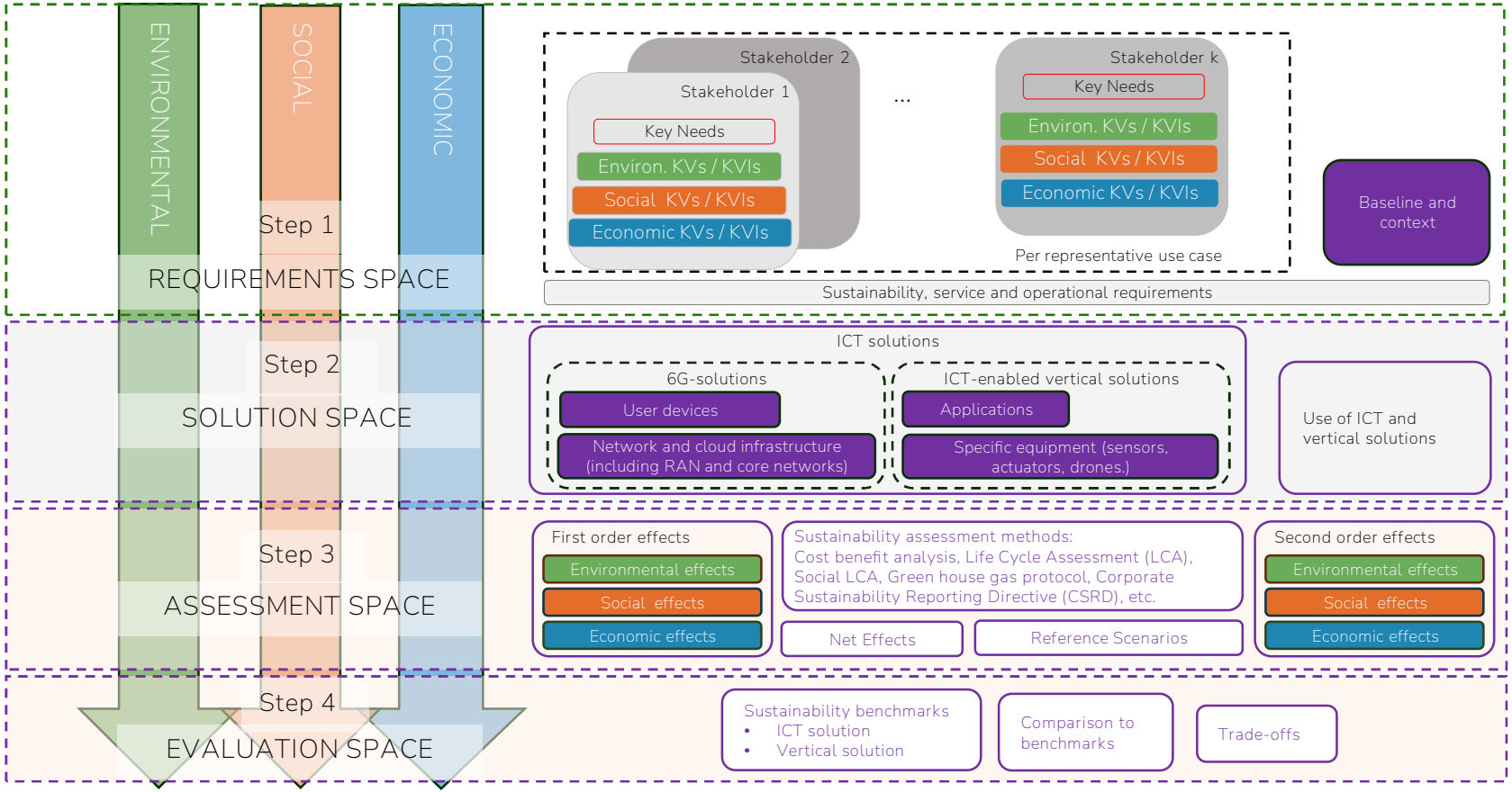


Vertical ecosystems

6G / ICT for sustainable applications



High-level assessment & evaluation framework



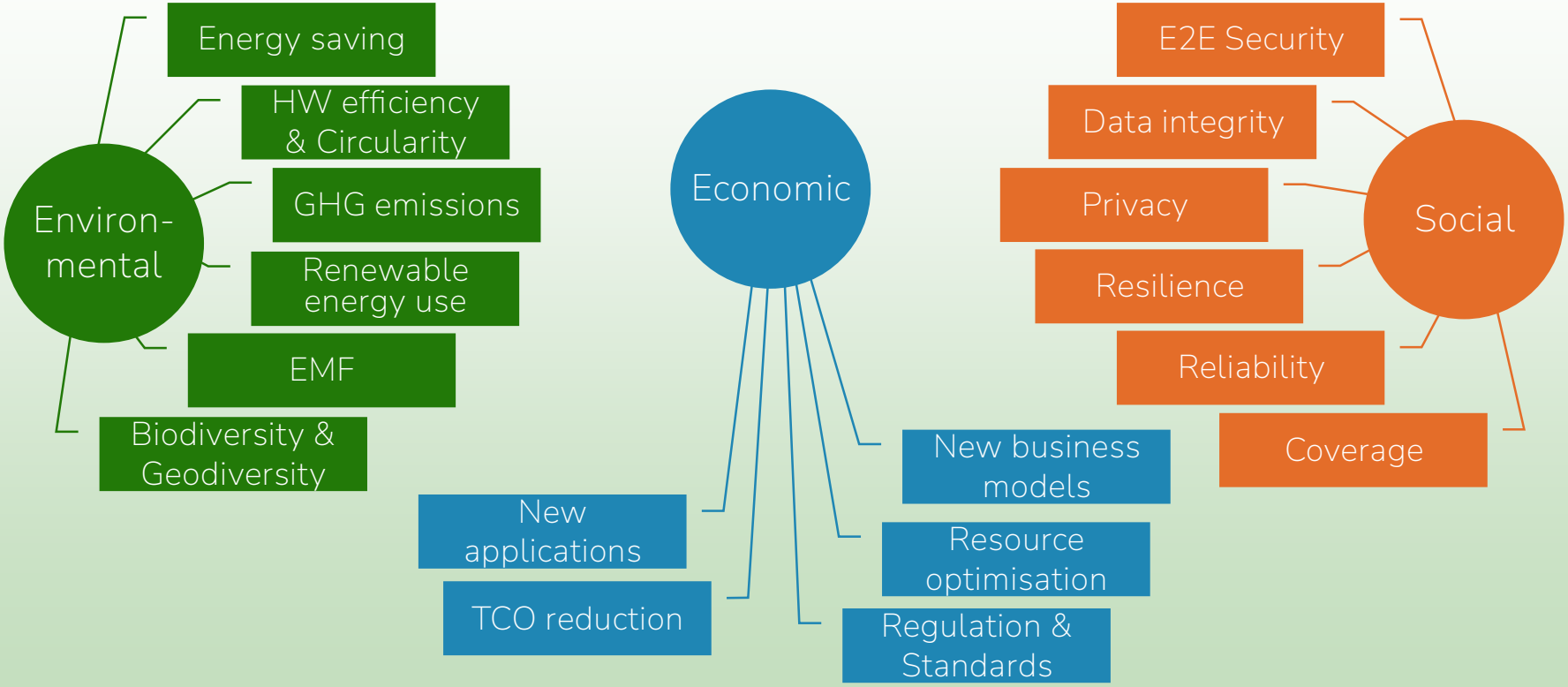
Metrics for evaluation

Initial steps implemented for PoC integration

Metric Category	Metric	Vertical scenarios where used	R&I Topics
Energy & Power	Energy efficiency	Agriculture, e-Health	2 4 5 7 9
Energy & Power	Power consumption	Agriculture, e-Health	2 3 7 9
Energy & Power	Carbon/CO_2 metrics	Agriculture, Smart Grid, e-Health	4 7
Throughput	User/Peak throughput	Agriculture, e-Health	2 3 4 5
Latency & Jitter	Latency (all types)	Agriculture, Smart Grid, e-Health	2 3 5 7 9
Latency & Jitter	Jitter (E2E/OWD)	Smart Grid, e-Health	5 9
Reliability & Availability	Reliability	Agriculture, Smart Grid, e-Health	2
Reliability & Availability	Availability	Agriculture, e-Health	4
AI & Compute	Inference accuracy/throughput	Agriculture, e-Health	7 10
AI & Compute	Compute (CPU/GPU/RAM)	E-Health	7 10
Coverage & EMF	Coverage	Agriculture, Smart Grid	
Coverage & EMF	EMF metrics	Agriculture, e-Health	4 7
Grid sustainability	Grid metrics (subset)	Smart Grid	

Sustainability in R&D

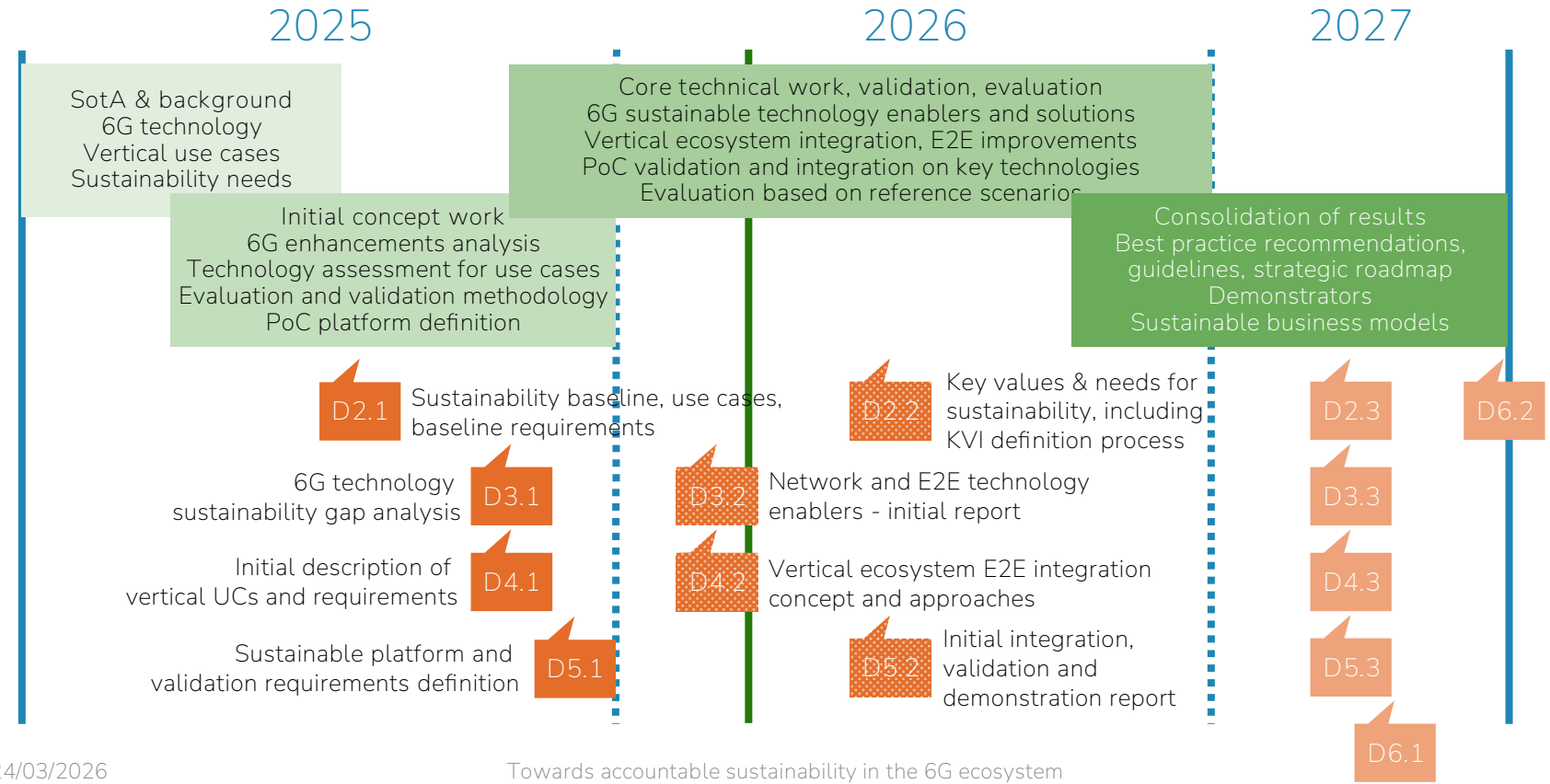
Examples: what you can instantly influence



Timeline

https://sustain-6g.eu/public-deliverables/

Project phases & key deliverables



Key takeaways

Sustainability is much more than energy efficiency

But includes topics from 6 dimensions that ICT can address

Sustainability requires interdisciplinary expertise

From ICT, vertical sectors, social & economic sciences, …

Sustainability goes beyond standards

But requires high implementation efforts & policy support

Register to the SUSTAIN-6G Newsletter!

https://sustain-6g.eu/contact/

Was alle angeht, können nur alle lösen.

What everyone concerns
only all together can solve.

Friedrich Dürrenmatt

Die Physiker (1961)

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