A holistic perspective on *Sustainability* in the 6G Ecosystem

Christoph Schmelz

Nokia

SUSTAIN-6G Coordinator

“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

The “6 Dimensions” of 6G Sustainability

Environmental

Conserve natural resources, protect ecosystems

Economic

Foster long-term growth & enable new business models

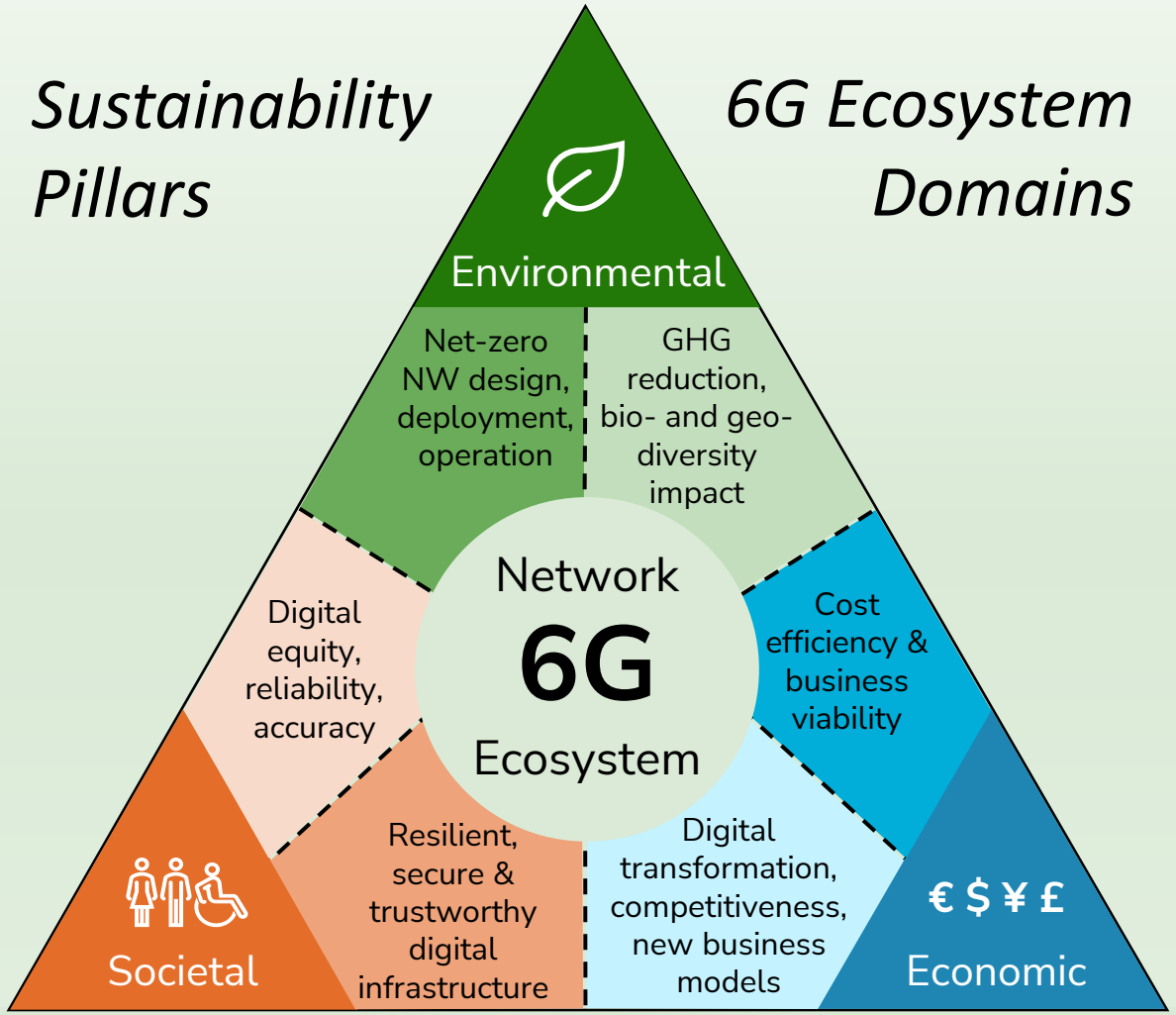
Competitive advantage

Societal

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

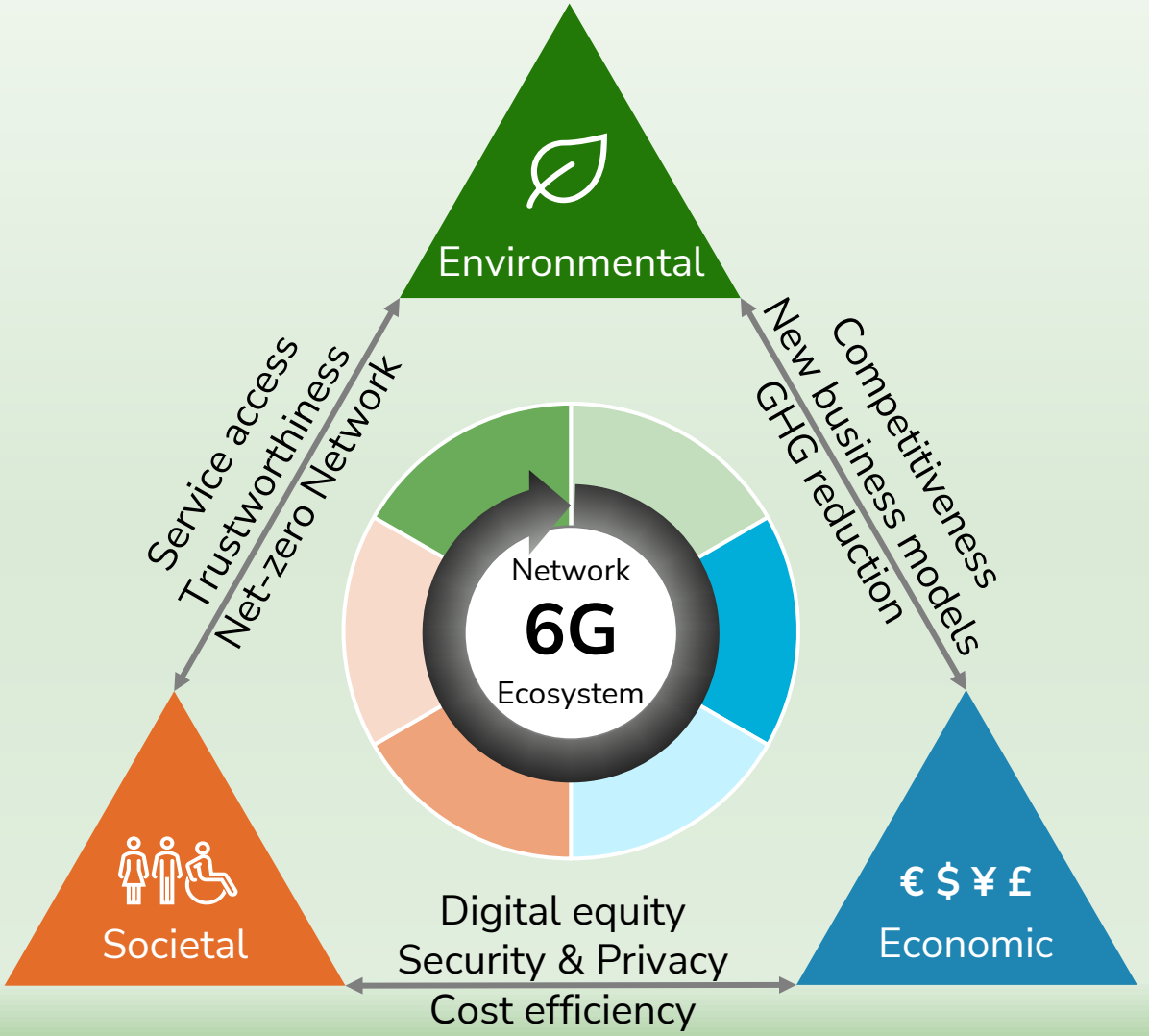
Induced by the use and application of ICT based solutions

Interrelations within and between

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 – Societal – 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

Sustainable 6G by design - approach

Deliver technical means to enable holistic solutions

- Understand needs / values of all 6G ecosystem stakeholders
- Qualitative / quantitative metrics for 1st & 2nd order effects
- Processes & methodologies to define values & assess effects
- Solutions to enable sustainability data exchange and E2E mitigation considering lifecycle(s)

Sustainability in EU 6G research

From EU Horizon 2020 to SNS JU

Baseline requirements & concepts

2021

Hexa-X

Technology enablers
Use Cases
Methodologies
Processes

2023

2024

HEXA-X-II

6G SNS IA

6GSNS

Holistic approach towards standardisation

2025

HEXA-X-II

SUSTAIN 6G

6GSNS

KVI framework

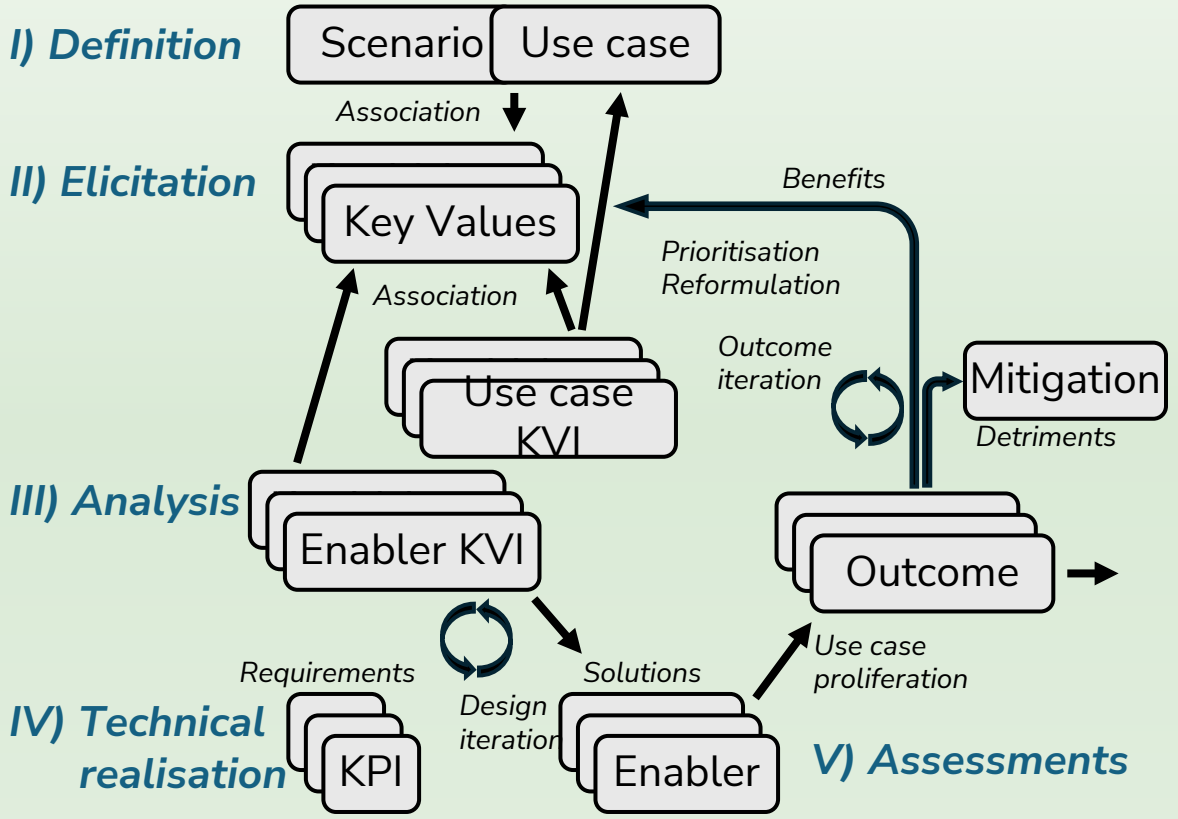
Process to define, analyse, assess sustainability in ICT

Key Values (KV):

- Principles or qualities that individuals or groups deem important, desirable, …

Key Value Indicators (KVIs):

- Qualitative / quantitative indicators for KVs
- To align outcome and impact against objectives

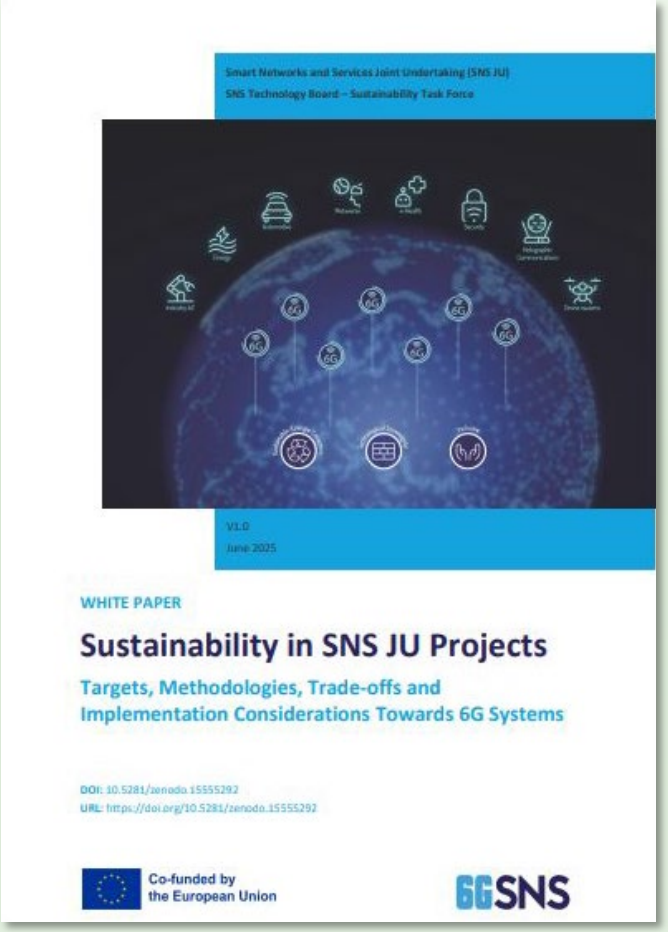


Sustainability Task Force
Sustainability in SNS JU projects

Analysis of 29 SNS JU Call 1&2 projects:

- Energy efficiency dominates the agenda
- Low TRLs limit systemic impact evaluation
- Sustainability-by-Design is gaining traction
- KVI framework useful but under-structured
- Sustainability requires interdisciplinary expertise

https://doi.org/10.5281/zenodo.15555292



SUSTAIN-6G

Sustainability Advanced and Innovative Networking with 6G

The European Sustainability Lighthouse Project

Quick facts

Coordinator: Nokia Germany

Timeline: 01.01.25 – 30.06.27

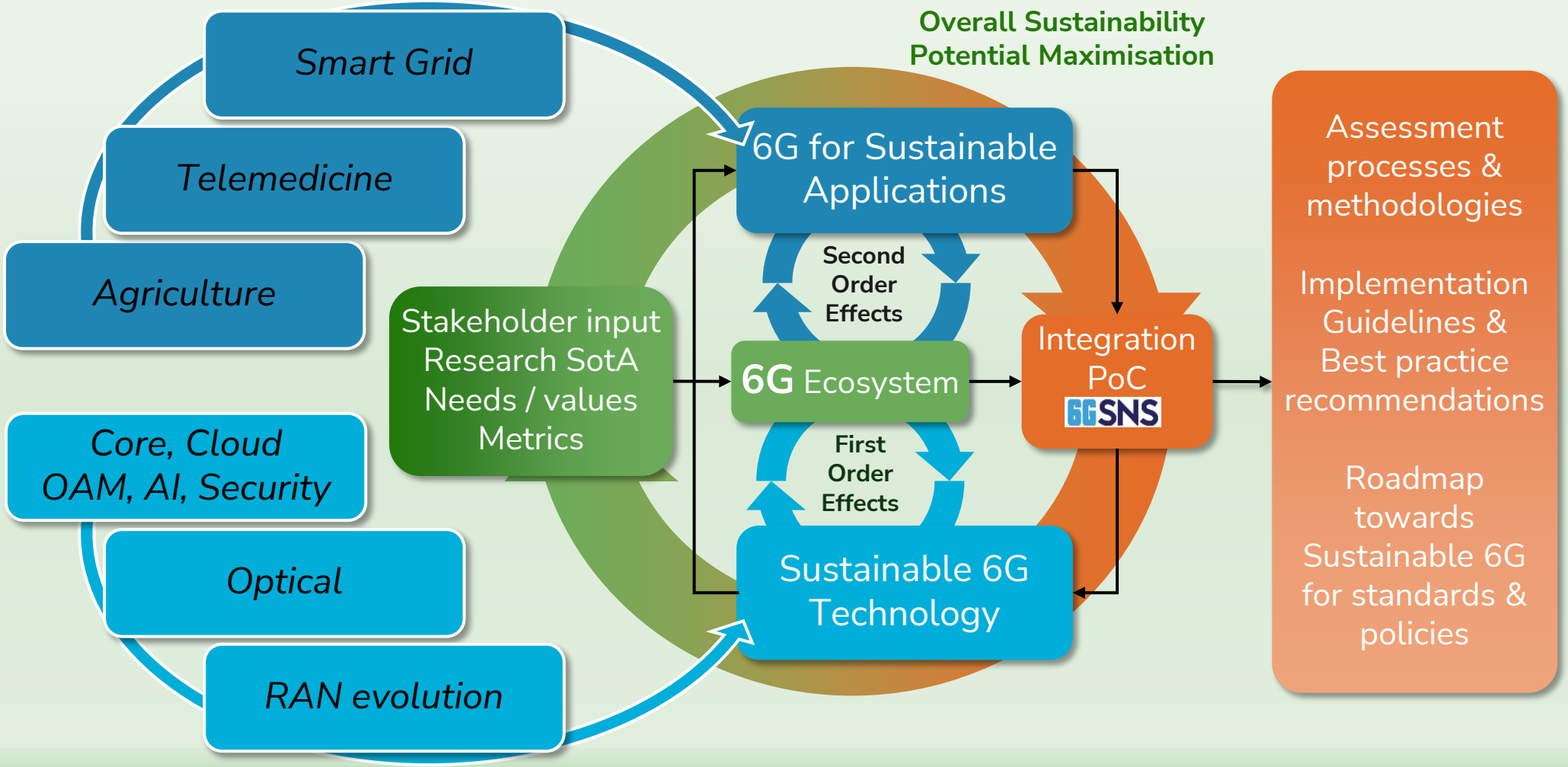
SNS-JU Call 3 project

(Horizon Europe)

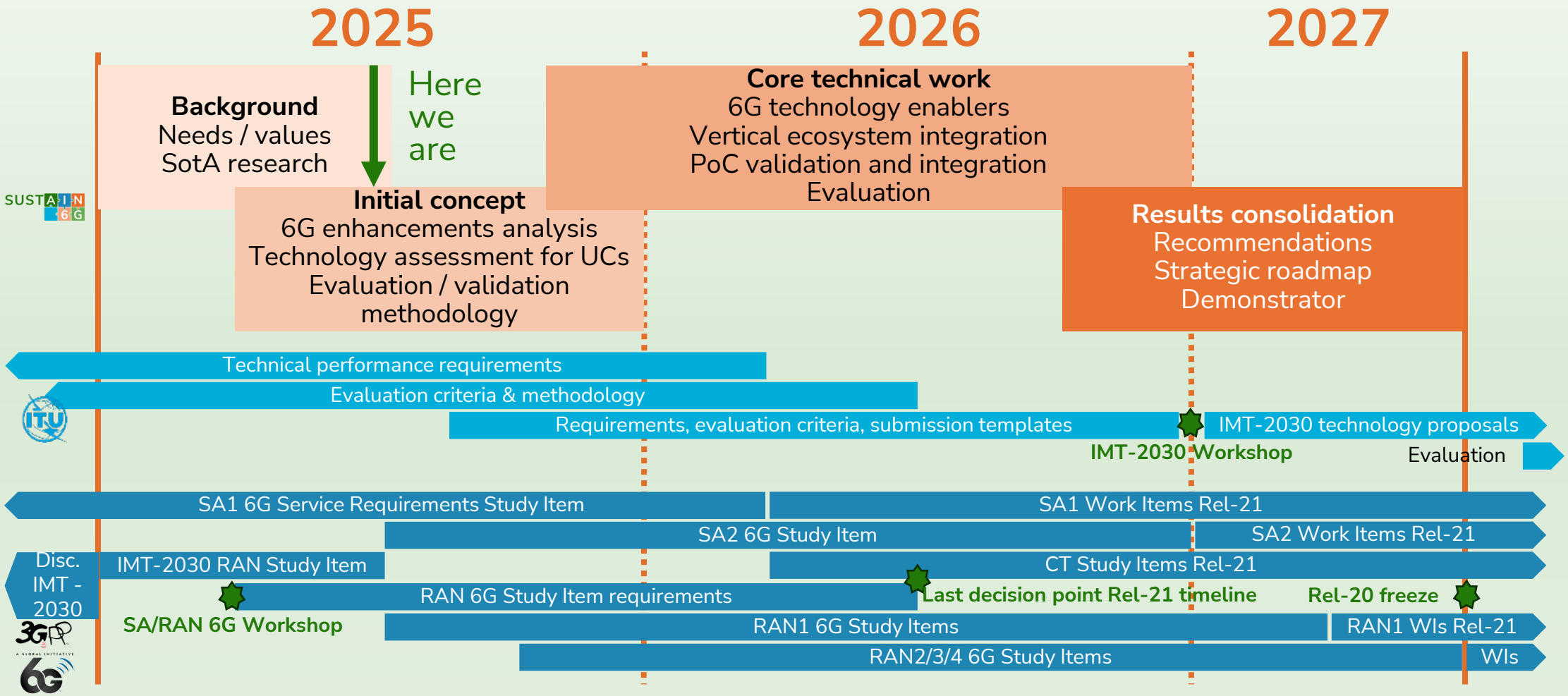
https://sustain-6g.eu

SUSTAIN 6G

Project approach



Timeline


2025
2026
2027
Background
Needs / values
SotA research
Here we are
Initial concept
6G enhancements analysis
Technology assessment for UCs
Evaluation / validation methodology
Core technical work
6G technology enablers
Vertical ecosystem integration
PoC validation and integration
Evaluation
Results consolidation
Recommendations
Strategic roadmap
Demonstrator
Technical performance requirements
Evaluation criteria & methodology
Requirements, evaluation criteria, submission templates
IMT-2030 technology proposals
IMT-2030 Workshop
Evaluation
SA1 6G Service Requirements Study Item
SA1 Work Items Rel-21
SA2 6G Study Item
SA2 Work Items Rel-21
Disc. IMT - 2030
IMT-2030 RAN Study Item
CT Study Items Rel-21
RAN 6G Study Item requirements
Last decision point Rel-21 timeline
Rel-20 freeze
SA/RAN 6G Workshop
RAN1 6G Study Items
RAN1 WIs Rel-21
RAN2/3/4 6G Study Items
WIs

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

Was alle angeht, können nur alle lösen.

As far as everyone is concerned, only everyone can solve.

Friedrich Dürrenmatt

Die Physiker (1961)

Thank you for your attention!

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