# SUSTAIN-6G

## Sustainability terminology and needs

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# Sustainability pillars

| Economic sustainability | Social sustainability | Environmental sustainability |
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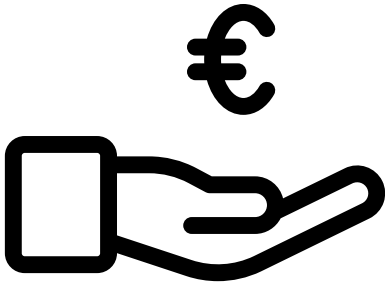
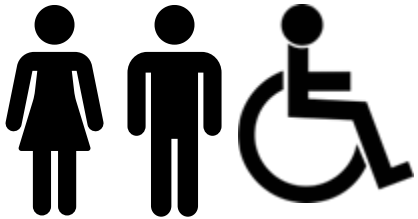
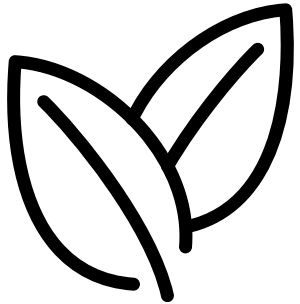
|  |  |  |

# Sustainability aspects

**Sustainable 6G**

**6G for sustainability**

# Resulting six sustainability dimensions

# New SUSTAIN-6G terminology

## First order effects

**Direct economic, societal or environmental effect associated with the existence of an ICT based solution, and generic processes supporting the deployment and operation of the ICT based solution.**

- *These could be positive and/or negative for a stakeholder.*
- *Examples include, the raw materials acquisition, production, use and end-of-life treatment stages.*

## Second order effects

**Effect induced by the use and application of ICT based solution which includes economic, societal or environmental changes. These could be positive and/or negative for a stakeholder.**

- *Target the intended purpose of use of ICT technology in the vertical sector and consider broader effects that the technology might trigger in society that we do not have full control over.*
- *Examples include reduced GHG emissions from reduced travel due to the use of ICTs, more efficient agriculture thanks to ICT solutions.*

# Key value related discussion

**Key value refers to principles or qualities that individuals or groups deem important, desirable, or intrinsically good that may be addressed or impacted by ICT.**

- No distinction is made to:
  - **Values as criteria***: Human values providing motivating goals for technological development and criteria for evaluating intermediary results.
  - **Values as outcomes*:** the enabled benefits or detriments. As an outcome of "value creation" economic, social and/or ecological benefits stem from a technology, service or business model, but also detriments or risks can result. Outcomes can be connected to the technical enablers, meaning directly stemming from the technology itself, or connected to use cases, meaning emerging from the usage of the technology.



*G. Wikström, et al. Key value indicators: A framework for values-driven next-generation ICT solutions, Telecommunications Policy, Volume 48, Issue 6, 2024.

# State of the art collection and analysis

## Collection of state of the art material

- Stakeholders: Companies, standards bodies, regulatory bodies, verticals, forums, etc.

## Document analysis

- Almost 100 documents
- Key concerns, 1st and 2nd order economic, societal and environmental effects and indicators, evaluation frameworks, etc.

# Identified sustainability themes as basis for sustainability needs

| Environmental sustainability | | Social sustainability | | Economic sustainability | |
|---|---|---|---|---|---|
| First order effects | Second order effects | First order effects | Second order effects | First order effects | Second order effects |
| GHG emissions/carbon footprint in different phases from material extraction, manufacturing, use, to the end of life | Changes in GHG emissions through user behavioral changes, optimized processes and improved operational efficiencies (reduced congestion and emissions from traffic, travel substitution) | Security and privacy concerns where data breaches and cyberattacks can lead to financial losses, legal liabilities, and damage to reputation, in addition to the direct harm to people | Better, more accessible/democratized and efficient healthcare, education and other life enhancing services through connectivity | Costs associated with implementing new technologies (e.g., AI, edge computing, mMIMO, and THz communication, infrastructure upgrades, training, system integration and radio spectrum | Efficiency and productivity gains and cost savings in businesses from energy and resource efficient technologies and digitalization |
| Energy consumption at device, network and component levels and consumption reductions | Changes in energy consumption and/or energy efficiency due to adopting connectivity-enabled services into business operations or user activities | Increased leisure time and improved conditions for the workforce from increased automation in product development, deployment and operation of networks and infrastructures | Usability of the system and viability of the service proposition from the user perspective through perceived latency and other quality measures in vertical use cases | Increased operational costs due to stricter environmental regulations and more complex technologies, and long-term cost saving due to eco-friendly innovations | High initial investment costs from upfront costs for installing infrastructure and costs of devices to be used in verticals |
| Resource consumption, scarcity of resources including metals, minerals, water, land, etc. | | | Societal acceptance tied to ethical and regulatory clarifications, backlash against perceived environmental harm | | Market expansion from new digital services and revenues from verticals and increased market value through sustainable practices and compliance |

# Key values and key value indicators

**SUSTAIN-6G terminology:**

- **Key Value** refers to principles or qualities that individuals or groups deem important, desirable, or intrinsically good that may be addressed or impacted by ICT.

**Stakeholder perspective**

- **Key Value Indicator (KVI)** is a qualitative assessment or quantitative metric used to observe the extent to which first order effects and second order effects align with the identified key values.

**KVIs are not always quantitative or calculated.**

# Next steps

- Development of sustainability requirements definition methodology is on-going. Flow has been established and applications to use cases are on-going.
- The relationships between key sustainability concepts
  - Sustainability needs and requirements
  - Key values and KVIs

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