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Technologies in line with societal values: from theory to practice

Authors (in alphabetical order)	Margot Bezzi[1] (CSL) Lucas Pereira Carwile[2] (CSL) Katrina Petersen[3] (PSCE)
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[1] Innovation Policy Analyst at CyberSocial Lab (CSL).
[2] Sociologist Consultant at CyberSocial Lab (CSL).
[3] Senior Research Consultant at Public Safety Communication Europe (PSCE).

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6G4Society (grant agreement ID: 101139070) is an SNS JU project which aims to develop a value-based, sustainable, and ethics-driven approach to 6G technology, ensuring that future networks align with societal needs and expectations. The project aims at providing and fostering a multidisciplinary and complementary perspective to future technological development, applying methodologies from ethics, legal and social sciences and humanities, to promote inclusive technological development and integrate social values into innovation processes. Also, by engaging key stakeholders—including policymakers, industry leaders, researchers, and the public—6G4Society seeks to ensure correct and clear information about the expected impacts of 6G technology.

6G4Society Insight Reports

The present document is part of a series of thematically focused digests based on key contents, findings and analyses reported in *Deliverable 1.1, Societal Aspects in 6G Technology: Concerns, Acceptance Models and Sustainability Indicators* (DOI 10.5281/zenodo.14592217). Original contents of this deliverable have been recombined and slightly modified for a more agile and accessible reading experience. This source forms the foundation of the current document and is acknowledged here as the primary reference for uncited content.

6G4Society Insight Report #2: Technologies in line with societal values. From theory to practice

This document builds on the experience of 6G4Society within the wider community of 6G research and innovation projects. Its purpose is to introduce the main challenges that arise when innovation practice seeks to engage with values in the design process, particularly the management of plural and sometimes divergent views and priorities, as well as the identification of Key Value Indicators (KVIs). Addressing these challenges requires suitable tools and methods, and more broadly, a deeper understanding of how technology reflects social values and generates societal impact.

To this end, it is essential to first examine how values act throughout the research and innovation process. This includes clarifying what values should be considered, when and how they emerge, and in which ways they exert influence and become available for assessment.

Drawing on the commitment, efforts, and challenges undertaken by the 6G community, this document offers insights into these dynamics and reflects on processes for designing technologies, or technological environments, in alignment with values and goals that matter for society and the common good. We explore how a value-sensitive approach to technology requires work at different levels and across different phases of innovation, setting the basis to translate general considerations into concrete practices.

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INTRODUCTION

In the previous work, "The Relationship between Values and Technologies[4]", we explained why technology is never neutral and inherently carries and reflects societal values. The very act of designing technology and its implementation is driven by societal values, influencing political choices, institutional priorities, and ethical trade-offs; these same cultural, economic, and governance arrangements, alongside political structures, will later influence how technology both becomes embedded in, and transforms society's activities.

Building on this, 6G4Society has explored how SNS-JU projects approach and experimented with value-based design, from which a number of questions emerged:

- How does assessing value differ from assessing performance features?
- How should a project identify relevant values?
- How should a project prioritise values?
- How to work with conflicting values?
- Are values only to be assessed at the end of a project, or can they shape decision-making throughout a project's lifecycle?

In order to develop tools to answer these questions, and more generally to be able to assess how technology reflects social values or creates social impact, we first need to understand how values act throughout the research and innovation process. In particular, we need to clarify:

- How to know what values to consider;
- When and how values emerge and exert influence throughout the innovation process, and become available for assessment.

In this document, we will offer some insights towards these considerations and processes for **designing technologies (or technological environments) in line with values and goals that are important for society and social good**, starting from the commitment, efforts and challenges taken by the 6G community. We will explore how building a technology that takes into account social values entails working at different levels, in different phases of the innovation process, and can translate into a variety of practical approaches and considerations.

WHY LOOK AT SOCIETAL VALUE FOR 6G INNOVATION?

Society is not just a vessel in which a neutral piece of technology gets placed and then has meaning. Society is integral to and inseparable from technological innovation. Being conscious of this intertwined nature fosters technological development and innovation in a direction that is **socially desirable, ethically acceptable, and sustainable.** It also supports technological developments to contribute positively to societal well-being and democratic legitimacy, in line with prevailing and evolving social values.

Studies across many scientific fields and traditions have consistently demonstrated the critical importance of integrating societal considerations into technological development. When

[4] https://zenodo.org/records/15046120

society is not adequately considered, this oversight becomes a fundamental flaw, leading to a cascade of negative social consequences. These implications can manifest as **unintended harms**, such as **algorithmic bias** perpetuating discrimination, **erosion of privacy**, exacerbation of the **digital divide**, and a general **loss of public trust**. Ultimately, ignoring the societal dimension compromises not only the efficacy of the technology but also broader social well-being and stability.

Scientific fields of study dealing with the relationship between science and society include, among others: science and technology studies, responsible research and innovation, human-computer interaction, sustainability studies, innovation studies, philosophy and ethics of science and technologies, sociology of science and technology, media and communication studies, critical data studies, technology assessment, and foresight studies.

This socio-technical and value-based perspective is important for 6G in three central ways.

- **6G is expected to profoundly transform society and the economy.** Unlike earlier networks, 6G introduces game-changing features such as hyperconnectivity (seamlessly connecting everything) and native AI (AI built directly into the network). These innovations seek to trigger fundamental shifts in how people live and work. Given 6G's ***enabling power***, it is critical to consider its long-term implications, in context, out there in the world. This underscores the importance of not just understanding but critically assessing the values 6G embodies and the impacts it expects.

- **6G is foundational to how we share information and communicate**. Throughout history, information and communication tools, like writing, the telegraph, and the telephone, have always deeply changed society. By radically altering how we exchange information, they have shaped our understanding of the world. They are at the core of how civilisation has developed, reshaping how society works, what is considered normal, what people see as better lives or a good society, and even how individuals see themselves and act every day. Given how deeply information and communication technology affects every part of our lives and society, it is crucial to carefully consider 6G's transformative potential and the values it will bring.

- Since 6G is still in its early, conceptual stages, **it presents a unique opportunity to actively guide and shape how this technology develops**. This should be done now, before its choices become too deeply tied to other technologies and ingrained in society. A proactive approach increases the chances of the promised benefits to emerge and be accepted and trusted as a route to better futures for all. Moreover, if a proactive approach is not taken, any potential negative consequences might only become clear after they are too late or extremely costly to fix.

The project 6G4Society has introduced reflections[5] on how the **aspects of societal impact, values, and social acceptance relate to each other.** It is also developing tools to support this awareness, consideration, and practice of integrating social considerations and sustainability into 6G development from the outset, focusing especially on two key processes:

- **The definition of Key Value Indicators** (KVIs), with a focus on indicators relevant for sustainability. Unlike standard Key Performance Indicators (KPIs), KVIs assess how values influence and are affected by technology. They focus on different aspects of the

[5] Deliverable 1.1, Societal Aspects in 6G Technology: Concerns, Acceptance Models and Sustainability Indicators, https://zenodo.org/records/14592217

innovation process and can be applied at different points in the development process compared to KPIs.

- **The exploration of social acceptance of technology (SAT),** through a dedicated framework aimed at integrating social considerations into technology development. In particular, the study of acceptance is key to uncover stakeholders' concerns and reveal underlying tensions between stakeholders' priorities and driving values.

This work is guided by a foundation based on **Responsible Research and Innovation (RRI)** and the **United Nations' Sustainable Development Goals (SDGs).**

RRI calls for a shift from technocratic and market-driven models of innovation toward approaches that are anticipatory, inclusive, reflexive, and responsive to the input coming from society. Such an approach requires researchers and innovators to adopt participatory and transparent processes that reflect the ethical, cultural, and social aspirations of diverse stakeholder groups, including citizens, policymakers, researchers, and industry actors. Its end-result is intended to be a technology that is *in line with social values.*

As concerns the **UN SDGs**, they constitute a comprehensive global framework describing sustainability through its interconnected social, environmental, and economic challenges, and providing a normative reference point for framing research and innovation objectives. From the perspective of the SDGs, scientific excellence as well as industrial competitiveness are grounded in their contribution to advancing equity, environmental sustainability, human rights, and inclusive economic growth. Building on these complementary frameworks, EU research and innovation policy now emphasises mission-oriented research that tackles specific societal challenges through collaborative, cross-disciplinary approaches and meaningful stakeholder engagement. In 6G development, this means the SDGs serve as high-level goals, helping projects identify which problems to solve. Although inspiring, these goals risk remaining overly generic and high-level, which creates the challenge of translating them into context-specific and operational design criteria that can, in turn, support the later assessment of societal impact.

The sections below offer some initial practical guidance on engaging values in innovation activities. We focus on when and where values should be considered, how to identify which values matter, how KVIs can support the innovation process proactively and reactively, and what challenges remain to be addressed. Future work will offer more specifics about deriving and implementing specific KVIs.

EXPLORING SOCIETAL VALUES IN PRACTICE

6G is not a standalone technology, but an interconnected system made of interdependent infrastructures, enabling technologies, and applications. This complexity means that assessing

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6G's societal impact requires understanding how different layers and components – such as network infrastructure, AI-driven automation, cybersecurity policies, economic structures, and social expectations – interact as a whole.

> **Values** are enduring priorities that function both as individual guiding principles and as shared cultural frameworks which motivate actions, shape attitudes, and define what is deemed desirable or negative in society.
>
> In innovation contexts, values can become **operational criteria** – specific standards used to guide design decisions, evaluate trade-offs, and assess outcomes.
>
> For example, if "inclusivity" is identified as a key value, it becomes an operational criterion asking: Does this design choice make the benefits of the technology accessible to diverse users? Is my design team inclusive of diverse voices so as to support inclusive outcomes?

Traditionally, innovation decisions have been driven primarily by technical feasibility and economic competitiveness. However, 6G's transformative potential requires expanding these criteria to include societal values and stakeholders' needs throughout the innovation process. This shift requires innovation teams to answer three fundamental questions about value integration in order to have a strong grasp of when and where these value-based assessments should come into play.

1. Which Societal Values should guide our innovation process?

- ⇒ Identify values that matter to affected stakeholders, not just project teams.
- ⇒ Ask explicitly: "Whose values are we prioritising and why?
- ⇒ Balance universal principles (human rights) with context-specific priorities, identifying the most salient principles based on situational needs, risks, and constraints.

2. When and where do values shape technology decisions?

- ⇒ Why assess values? Clarify what decisions will result from value assessments.
- ⇒ When to assess: Identify all steps throughout the innovation process - from concept to deployment – where values may have an influence or of concern.
- ⇒ Where to assess: identify all system layers - infrastructure, software, applications, and usage patterns.

3. How do we address bias in our value assessments?

- ⇒ Recognise that research teams bring their own assumptions and perspectives.
- ⇒ Use diverse stakeholder input to challenge these assumptions.
- ⇒ Document whose voices are included and excluded in value identification.

These steps provide the foundation from which it then becomes possible to develop Key Value Indicators, which we explore in the next section. Let's examine some of these questions in more detail.

Which societal values should guide our innovation process?

Identification and prioritisation of driving Key Values is an important first step, especially when dealing with technologies, like 6G, with a high transformative potential for society. Societies often agree on values as high-level principles, like those found in charters and declarations of human rights. However, when values are *operationalised* in given contexts – geographical, sectoral, cultural, etc. – some challenges arise. Different social or interest groups may attribute different valences and priorities to these broad principles. Also, different interpretations and ethical considerations arise (e.g. is fairness equality or equity?) making it difficult to translate the abstract principle into real-world applications.

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Therefore, to express their value and truly make sense in society, high-level principles need to be interpreted in specific contexts: What are the current challenges that context is facing, and what are their goals for maintaining or making things better? What is the technology for? Who is using it? What are the potential consequences, for whom, when? Who is making decisions around it? The identification of the societal values that are key in our specific technological context starts with an analytical exercise, comprising top-down and bottom-up analyses, combining perspectives and priorities shaped at different levels:

This balanced approach helps ensure that innovation is guided by societal impact alongside technological potential, unlocking new innovation avenues by grounding them in societal desirability. It also mitigates risks like potential harms, lack of adoption, and lack of acceptance.

Any value-based activity needs to start from these objectives:

- Uncover divergent values, where different groups prioritise different values;
- Prevent “ivory tower” solutions where products reflect solely an industry perspective, which may not resonate with the values and needs of the people they aim to serve;
- Be transparent and explicit about whose values are being prioritised and why.

The following steps can help:

Step 1: Reflect on the implicit assumptions and values orienting our innovation path and priorities.

To help avoid potential biases and unintended outcomes, innovators shall ask themselves:

- Whose needs, perspectives and priorities do the choices being made reflect? Those of specific users’ subgroups or an “ideal user”? of everyone who is affected? Or just those who are leading the development process?
- Whose values are we giving voice to?
- When should broader views be incorporated?

Examples of assumptions driving innovation in the public safety sector

Innovators often assume hyperconnectivity universally benefits society, but in public safety, it is crucial to question if these complex, data-rich systems truly serve everyone and remain effective amidst real-world challenges from disasters like infrastructure failure, cognitive overload, or can serve vulnerable communities with less starting resources.

As concern use-cases, for example, a common belief is that increasing the speed and coverage of disaster alert systems will inherently make people safer. This assumes that technical capability equals responder ability to make timely decisions, social preparedness and trust in systems.

However, real-world conditions—such as outages, infrastructure damage, information overload, and the spread of misinformation—can help complement or overturn this assumption, reminding us that the drive for greater capability must be balanced with responders’ need for clarity and simplicity, and with the priority of ensuring network resilience over merely adding more performant or augmented features.

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Step 2: Challenge assumptions early on by exploring the perspectives of stakeholders

The objective is to **question** the extent to which perspectives, priorities and driving values of the leading stakeholders (typically industry institutions) align with what society (especially target users or key social subgroups) considers important or a priority.

This includes:

- **Understanding the views of different users or social groups** on the impact of potential solutions, to discover what social, environmental, and or economic issues are more urgent to address. To explore stakeholders' views and elicit what values matter and how, many methods exist, such as: Design Thinking; Systems Mapping; Design Justice; Public Interest Design; Backcasting; Democratic Assemblies; Value Sensitive Design; Impact Assessments; Societal Readiness Assessment, etc.
- **Addressing biases**, including those of researchers themselves. The exploration of this plurality of perspectives shall take biases into account. A bias mitigation strategy should be developed to identify and minimise potential biases in data collection, stakeholder involvement, and the analysis process – particularly as consensus is built around which values to prioritise and which KVIs and data should guide the assessment. These biases may include selection bias, confirmation bias, response bias, and cultural bias. Mitigation methods should be thoughtfully applied at key stages of the value definition and indicator development process.
- **Uncovering any divergent position** in relation to the objectives of our innovation. Engaging with diverse communities makes different opinions, priorities, values, and visions emerge. This plurality of perspectives also brings to the surface divergencies or even conflicts.

  Conflicts around innovations arise whenever different social groups prioritise different values or interests. If public controversies around a certain innovation are already represented in the public debate, it is most probably because the diversity of public perspectives has not been sufficiently represented in the decisional process, and certain social groups do not feel represented by innovation visions and expectations.

> Whenever communities' values and specific needs and priorities are ignored, even "positive" technologies can face resistance from local communities, as it is the case for the "green-on-green" controversy (e.g., renewable energy projects conflicting with local environmental values).

> **Manage conflicts**
>
> Formal decision-making tools can support the work of exploration and management of plural and divergent positions, such as multi-criteria decision analysis, Delphi techniques, or analytical hierarchy process.
>
> They can also complement techniques for problem definition and vision building by clarifying shared goals and challenges. Once the objectives behind a Key Value are established, a set of prioritisation criteria should be developed to guide decision-making and facilitate agreement on what success looks like and thus what the indicator (KVI) should be.
>
> If controversies are already being debated in the public and media space, the exploration of such controversies can then be a way to highlight which values are perceived as neglected or violated, offering important insights into societal priorities.

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- **Embracing different possibilities**. Such exploration can disrupt our understanding of the societal challenges at hand and make us aware of different approaches to address them, which we did not expect. Both biases and conflicts shall be addressed in ways that support sound decision-making.

Step 3: Identify what values are priorities in the specific context

Once having produced a clear mapping of all the assumptions and priorities involved, it becomes possible not just to identify the corresponding underpinning social values, but also what those values mean in that specific combination of context, problem, technology and stakeholder. This shall guide the definition of innovation and technology objectives.

In practice, this could involve identifying which value principles are most salient in a given context and prioritising their implementation based on the situational needs, risks, and capacities. Though this starts with the more universal baseline, it involves engaging stakeholders locally to the problem setting, mapping context-specific risks, values, and constraints, and then revising what is most important for the impact sought. For example:

Universal principle: *Safety* as a value is the freedom from harm, abuse, or undue risk. This is a foundational right in digital and physical environments.

Specific Objectives: *Safety* includes a range of more specific priorities, such as the right to protection and rapid response during emergencies and disasters, protecting women and girls from harassment in digitally surveilled public spaces, ensuring that vulnerable groups aren't excluded or penalised by automated decision-making, or ensuring health and well-being in the workplace. Clarity is needed as to which one.

Context Priorities: What counts as safety varies depending on personal and geographic risk, community infrastructure, past experiences, and current technological goals. Take the case of the right to rapid response during emergencies:

⇒ In a city deploying 6G-enabled disaster surveillance or emergency response systems, engagement with local communities shall be sought to assess not just technical performance but social trust, historical patterns of over-policing, or experiences of exclusion. Here, rather than assuming that more sensors or faster response times equal more safety, design activities should consider accountability, privacy, and inclusivity, especially for marginalised populations.

⇒ In a rural community that is wildfire-prone, deploying 6G enabled-technology like high-tech sensor surveillance or advanced mesh-communication, should assess not just early detection capabilities, but whether it respects local self-determination over land management, fosters trust in external aid, or ensures equitable resource allocation. Here, rather than assuming sophisticated data streams inherently lead to better outcomes, design must also prioritise the fundamental values of local agency, fairness, and building genuine, reciprocal trust.

Where and when do values enter the innovation process?

Considering values is not just a single task you check off at one point; it is an ongoing, dynamic process woven throughout innovation. This is because technology and values are constantly shaping each other during the entire development cycle. It is crucial, then, to keep societal values central at every stage of technological development.

To make this happen, innovation teams should regularly map their planned process against societal values. This practice will reveal just how many different steps and elements contribute to a technology's overall societal impact. It can also help illuminate which one of these potential intervention points could have the greatest influence in each situation, outcome, or decision. For example, values can be directly engaged and assessed at these points:

Conception	Development	Deployment	Use	Diffusion / Adoption
Identifying and defining the values that the innovation should embody, promote, reinforce in society. Includes the ideation, choice and formulation of use cases. Understanding stakeholder societal needs, priorities and corresponding underpinning values.	Embedding values into the design and functionality of the innovation. Addressing potential value conflicts and trade-offs.	Considering the values and priorities of the context (cultural, geographic) in which the innovation will be implemented. Addressing potential value conflicts and trade-offs.	Evaluating how the innovation is used in practice, and its impact on relevant values. Includes observing possible unexpected and positive innovative uses.	Promoting the adoption of innovation in a way that aligns with societal values and maximizes benefits. Addressing potential ethical and social implications of widespread use.

Currently, assessment practices often limit themselves to development only or hypothetical use (via trials). But values can be considered in these other moments as well, sometimes with greater impact or ease of assessment. Drawing on the experience of rural wildfires, we provide some examples of how values exert their influence, and can be considered, at each stage of innovation,

Conception: Who defines the wildfire problem and who is on the design team are crucial questions at conception. Engaging local cultural and ecological knowledge holders and disaster responders from the outset through participatory assessments makes visible the values that drive community action, ensuring these principles inform the problem and solution frames from the start.

Development: At this stage, it is good to revisit the solution frame. For example, exploring whether the technology provides actionable insights that local land managers and residents can use and interpret directly reveals the degree to which local agency and self-determination are supported rather than just assumed. Potentially piloting different prototypes and exploring various governance policies around the technology can provide early indicators of community trust and fairness.

Deployment: Choices about where and how technology is first integrated into real-world operations are critical. For high-tech drone surveillance or fire prediction, engaging local skills for installation and providing localised training makes visible the community's true preparedness and resource equity, assessing if the solution genuinely empowers or creates new dependencies.

Use: Ongoing operation in controlled environments involves continuous feedback loops with community members and local responders. This sustained engagement makes visible how the system genuinely fosters (or erodes) trust in its outputs and external support, for example, though a deeper understanding of user confidence in its reliability, their willingness to truly rely on it, and the perceived openness and accountability of communication from developers, serving as a direct indicator of value alignment during practical application.

Diffusion/Adoption**:** The very process of building business models and exploitation plans can be intervened with to explicitly integrate values. This means, for example, designing revenue models (e.g., subscription vs. open source) that work for the wildfire-prone communities, support structures (e.g., local training vs. remote help-desks), and data governance strategies (e.g., community-owned data vs. commercial aggregation) that are values-driven.

Indeed, such an approach implies exiting one's comfort zone, as it may result in challenging a system of values that is taken for granted. With this background work in place, it is now possible to start identifying indicators to assess alignment with societal values.

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Assumptions in use-case selection. Often, the definition and selection of use-cases are based on assumptions about what is technologically feasible, rather than on an exploration of which impacts are actually desirable. The pressure to demonstrate what a technology can do tends to shape – and may limit - the range of options that are proposed and pursued. As a result, even if social needs and preferences are later explored, this typically happens only at a later stage, within a predefined and constrained set of possibilities, where key assumptions and directions have already been established. Value driven work requires a shift in priorities.

EXPLORING VALUES THROUGH KEY VALUE INDICATORS

The concept of Key Value Indicators (KVIs) emerged within the European 6G research community. Indicators of similar kinds also exist in research areas other than 6G – such as finance, governance, health – although sometimes referred to under different names and used for procurement and responsible business practices. In general, KVIs or similar indicators have progressively gained traction in research and innovation policy and in industry discussions, with regulators and global organisations considering their role in sustainable digital infrastructure.

Key Value Indicators are a tool to ensure that persons, planet and prosperity remain at the centre of technology development, and that intangible yet essential elements of life are reflected in the creation of business value and market opportunities. In this way, KVIs support approaches that are societally accountable and in line with responsible innovation principles.

Key Value Indicator (KVI): a qualitative assessment or quantitative metric used to evaluate the extent to which 6G technology research and development aligns with and furthers fundamental societal values (as principles) and achieves positive societal, environmental, and economic outcomes (as impact).

Taking into account the various points of intervention for values, **KVIs can be used both *proactively* and *reactively*.** Proactively, they act as a guidance tool to highlight driving principles and motivations, pointing to the rationale and motivations (the *why*) for actions and decisions. Reactively, KVIs can be an assessment tool to demonstrate the impact on values, pointing to the '*so what*' of what was made. More in detail:

Using KVIs Proactively

Proactively, KVIs can be used to orient and guide the innovation process, embedding values considered important (e.g. privacy, security, inclusivity, trust, well-being) from the start, reflecting the values in the core objectives and functionalities of network design. In this case, they are used to:

- **Clarify technology purpose and context**: Transparently define which values and principles are truly driving the goals of the innovation and what the intention is behind the introduction of the technology into society (e.g. what is at stake for whom).
- **Integrate guiding principles into design**: Inform the conception and design phases to embed these core principles directly into technology requirements. This proactively shapes technology at the design level, transferring back and reinforcing societal values that are considered important. Considerations in design can include everything from who is on the design team, to how design enables different users to achieve their goals.

- **Frame strategic decision-making:** Set the stage for strategic decisions around the project, influencing how priorities and success metrics are defined, as well as how trade-offs are navigated throughout its lifecycle.

Priorities and principles important for society will be embraced or reinforced by:

- Keeping technology focused on real human needs and ethical considerations.
- Acknowledging the perspectives and values of different stakeholders, and broadening therefore the diversity of perspectives, needs and priorities included in design.
- Prioritising real-world problem-solving
- Ensuring technology *acceptability* in terms of regulatory or ethics compliance
- Making value an integral component of value creation, which may facilitate stakeholders' acceptance of outputs and outcomes.

Using KVIs Reactively

Key Value Indicators can also act as a technology assessment tool. In this use, **they provide a pre-defined framework for benefit assessment**, designed to capture societal values by measuring expected positive and negative impacts of innovation as they enter the world. Values, in this use, are often defined as societal goals, such as advancements in education, health, and inclusion.

This intent is well captured in this definition: *"quantitative or qualitative indicators for gauging effects on values as outcomes. The purpose of KVIs is to gauge the impact from the execution of a use case in terms of economic, social and/or ecological benefits (gain) or detriments (loss)."*[6]

In practice, KVIs should support the identification, monitoring and validation of how effectively technology is reinforcing and aligning with these identified and prioritised values. By establishing appropriate baselines or orientations, this use of KVIs can help us understand where technology is genuinely contributing positively or where future adjustments might be needed. For example, they should help to identify causality or relationships that support actualising and reinforcing in society the values that are considered important. Ultimately, reactive KVIs help measure real outcomes, tangible benefits, or changes in society.

Key Value Indicators *versus* Key Performance Indicators

KVIs, while intended to complement KPIs, are distinct from them. KPIs often ask, "Are we hitting our targets?", KVIs, on the other hand, help frame what the targets should be and ask, "Are we doing the right things for society?" The table below highlights the differences between the KPI and KVI approaches, around seven criteria. The list provides an at-a-glance idea of the perspective change that KVIs require and entail.

Feature	Key Performance Indicator (KPI)	Key Value Indicator (KVI)
Focus	Assessing past/present performance (even if working to reach a specific value in the future); internal looking.	Forward-looking, future impact that results from innovation entering the world; external looking.

[6] Gustav Wikström, Nona Bledow, Marja Matinmikko-Blue, Henning Breuer, Cristina Costa, George Darzanos, Anastasius Gavras, Tobias Hossfeld, Ioanna Mesogiti, Katrina Petersen, Pawani Porambage, Razvan-Andrei Stoica, Stefan Wunderer, *Key value indicators: A framework for values-driven next-generation ICT solutions*, Telecommunications Policy, Volume 48, Issue 6, 2024,https://doi.org/10.1016/j.telpol.2024.102778 .

Question	Is this technology performing well?	Is this solution reinforcing / actualising important values?
Purpose	Track progress, measure efficiency and effectiveness	Anticipate societal impact, maximise future value, and orient innovation towards goals
Goal	Assess if internal targets are being hit	Stewarding resources responsibly; connect innovation to external outcomes
For Who	Narrow stakeholders (e.g. project partners, users)	Broader stakeholders (e.g. social groups and environment affected by a technology)
Decision Making	Reactive, informs adjustments based on past/present results	Proactive, informs future-oriented decisions; Reactive, capturing the value created
Format	Quantitative	Quantitative and Qualitative

OPEN CHALLENGES IN ASSESSING VALUE

Early phases of technological development represent both an opportunity and a challenge: the opportunity lies in the possibility to shape technology – including related standards – with more flexibility; challenges relate to the difficulty to fully capture the long-term and broader societal implications of artefacts that are still only at the conceptualisation phase. KVIs provide a useful tool to navigate across the complex relationship between technology and society, and across all the steps where design choices generate societal impact. However, a number of challenges remain open, for example:

Simplifying values to make them actionable and measurable. Just as values (the principles and aspirations) require context to be meaningfully understood, and are often too abstract for consistent application, Key Value Indicators also need to achieve this simplification. They are contextual, and critically require active translation of these abstract values into observable and concrete actionable terms. For example, a KVI for trust in public safety technology will look different from trust in a healthcare app or an augmented reality system. Developing KVIs requires harmonising the definitions, objectives, and the processes by which they are derived. While this paper offers starting steps, the work requires new skills and expertise on projects that, for example, support active work with stakeholders, social science research skills, or new forms of data access.

How many KVIs are needed to signal meaningful impact? This remains an open question both within SNS-JU projects and within the broader social value and sustainability indicator literature. As a whole, the answer lies in the quality, relevance, and actionability of the set of KVIs and their interrelationships. It is in part tied to the significance and scope of impact each indicator represents. It is also tied to what is feasibly gathered during the lifespan of a project. Two to three indicators per priority theme and a variety of data and measurement types help to triangulate outcomes.

Measuring longer-term societal outcomes. KVIs, to serve their purpose, must go beyond KPIs and outputs. Their primary aim is to assess the creation of a positive outcome in the future, beyond the project lifetime and the trial phase where they are conceived. This creates a contradiction in terms of timescale, and practical limitations concerning the capacity to access data and perform meaningful assessments.

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Measuring outcomes at a broader societal scale. While outputs are often easier to define and monitor, they do not necessarily indicate progress towards a larger goal. For example, a survey of a user's trust or opinion about a tool does not always correlate with societal solidarity or increased digital inclusivity. Moving beyond this requires engaging an ecosystem of applications directly. This means looking beyond project outputs, pointing at wider societal elements like reduced injuries in the workplace, improved community safety, increased operational efficiency, job opportunities, or improved health outcomes. It means working with stakeholders and experts from other disciplines to articulate what is at stake for who; digging into demographics and data relevant to a region or domain; holding focus groups or assemblies, looking at who is on the design team; understanding the implications of infrastructure on a service in the world, not just a testbed. Much of this involves finding ways to make new forms of data available to innovation activities to help guide and inform these activities. KVIs and value in general cannot be looked at from within a lab.

To truly understand value, we need support in **shifting our focus from outputs to tangible and intangible outcomes** across all project phases, scales, and scopes. This shift requires validating the links between our inputs, indicators, and the potential outcomes achieved. We can accomplish this by **shaping new processes and formats for project assessment that draw on a wider variety of expertise**, and by fostering new practices and partnerships that facilitate access to non-technical evidence and long-term observations.

Next steps

Currently, a wide variety of approaches have been taken by 6G projects to define their KVIs. Over the course of 6G4Society's activities, we aim to elaborate, enrich, and refine this basis into key guidance, working examples, and practical steps projects should take.

The next Insight Reports in this series will further develop these ideas. One report will focus on what makes **a good Key Value Indicator**, offering criteria and practical examples to guide projects in designing meaningful KVIs. Another will explore the concept of social acceptance of technology, addressing the **role of controversies**, and introducing the **Social Acceptance of Technology** (SAT) framework, as a tool for understanding and navigating societal concerns in 6G development.

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