# Value Approach of 6G: The Role of Key Value Indicators in Design and Societal Impact

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***Abstract*—As technological innovation accelerates, measuring impact through Key Performance Indicators (KPIs) is no longer sufficient to capture the full scope of societal outcomes. Key Value Indicators (KVIs) emerge as a complementary framework designed to evaluate the broader societal value generated by projects, especially in transformative domains such as 6G development. This paper explores the strategic objective of KVIs: to embed human-centric, policy-aligned, and sustainability-oriented values into decision-making processes. It distinguishes KVIs from KPIs by examining their qualitative dimensions and their role in guiding complex trade-offs.**

***Keywords*— Key Value Indicators (KVIs*), Key Performance indicators (KPIs)***

## I. INTRODUCTION

The evolution of 6G is shifting beyond technical innovation towards delivering tangible societal value. With increasing citizen expectations and policy frameworks evolving towards next-generation technology, the developers are increasingly expected to demonstrate how their technology contribute to addressing complex sustainability and ethical challenges. This requires developing processes to identify, prioritize, assess, and measure impact. Key Value Indicators (KVIs) have been introduced within the Smart Networks and Services Joint Undertaking (SNS JU) community to provide a structured methodology [1] for evaluating broader impacts, bridging the gap between societal values, high-performance technology, and business needs.

The diverse and complex landscape continues to evolve with the "practical implementation of Key Value Indicators (KVIs), with varying interpretations emerging across different contexts. The learning and trends are captured with human centric sustainability approaches which is especially evident in laboratory-based or low-maturity projects with stakeholder engagement or when projects are working in value areas that are less well understood, such as social sustainability.

## II. MOTIVATION AND CONTEXT

Demonstrating how KVIs work in practice. The focus is on the current landscape of KVIs, demystify their importance, clarify how they differ from—and relate to—Key Performance Indicators (KPIs). Present and outline methodologies for prioritizing values across verticals and use cases and address how KVIs can be integrated into technology research projects and programs, even those at low Technology Readiness Levels. The aim is to:

- Share case studies of successful KVI applications from different verticals and maturity levels;
- Discuss implementation challenges and strategic solutions to integrating societal values into 6G design and use;
- Further elaborate the conceptual framework behind KVIs and map inter-dependencies, between key ideas;
- Identify gaps and pathways for future work.

## III. BRINGING KVIS FOR SOCIETAL IMPACT, SHAPING THEM, AND FUTURE WORK TO COME

Within the Hexa-X-II project sustainability is two-fold, 6G for Sustainability emphasizes the potential of 6G to enable or help various sectors enhance their sustainability efforts. Sustainable 6G refers to ensuring that the sixth generation of mobile communications is sustainable [2]. The project also splits sustainability into an environmental, social and economic part. Hexa-X-II started with formulating the high-level Human and Planetary Goals (HPGs). HPGs are fitted to the ICT context and connected to the United Nations Sustainable Development Goals (UN SDGs). As the HPGs represent goals, a 6G use case should then contribute to those goals. The impact of a given use case and technology it uses (6G in our case) on the goals (i.e. the HPGs) is represented by Key Values (KVs). A first important work is to establish the KVs. The process of establishing KVs means identifying all potential positive aspects which are to be maximized (i.e. the sustainability handprints) and all potential negative aspects, which are to be minimized (i.e. the sustainability footprints). Hexa-X-II recommends involving a representative set of stakeholders (of a given use case) to brainstorm on all sustainability handprints and footprints. This process remains a subjective process. However, by involving a representative set of stakeholders, it should be possible to obtain a broad view and to identify most of the KVs perceived as relevant. This exercise is to be done in all of the three sustainability

domains (i.e. environmental, social and economic). As the obtained list of KVs may be huge, an assessment should be done to enable a focus on the most important KVs, which can be used to start the work. As the overall aim is to improve the sustainability situation and to reach the defined HPGs, an indicator is needed to assess a potential positive or a potential negative impact of these KVs: the Key Value Indicators (KVI). A KVI is a qualitative or quantitative indicator. The indicators can be grouped into use case KVIs (quantitative or qualitative indicators used to assess an impact of a use case or its application) and enabler KVIs (a quantitative or qualitative indicator to assess the impact of the technical enabler, i.e. the technology applied to a Use Case, 6G in our case).

The use case and sustainability analysis proposed by Hexa-X-II encompasses a technical evaluation, a business evaluation and a sustainability evaluation. The first two are commonly known and linked to technical key performances indicators (KPI) and business performances. The last one adds then sustainability considerations in the three sustainability domains. The involvement of various stakeholders, particularly civil society (e.g., through surveys), enables the consideration of specific perspectives and needs, leading to the identification of key values in the realm of social sustainability. The sustainability analysis is an iterative process with the stakeholders and the business model analysis. It allows for the refinement of identified key values (KVs). While this process never results an exhaustive list of KVs, it captures the most expected values.

The distinction between use case KVIs and enabler KVIs facilitates the identification of key value components related to both the use case and the 6G system. This differentiation clarifies which KVs are beyond the influence of 6G design, and which can be shaped by its technical design. Since enabler KVIs are associated with the 6G system, they may be mapped to existing technical Key Performance Indicators (KPIs), lead to the creation of new KPIs, or remain classified as enabler KVIs. An example within the social sustainability domain is digital inclusion, which can be represented (among others) by an enabler KVI linked to the technical KPI of “coverage”.

## IV. TMV WG - KVI ESTIMATION SG - APPROACH TO KVIS CONSOLIDATION AND VALIDATION ACROSS SNS JU PROJECTS

Within the Test, Measurements and Validation SNS-JU Working Group (TMV WG), the KVI Estimation Sub-Group undertook the task of collecting and consolidating the SNS projects approaches to KVIs monitoring, estimation and validation. A White Paper titled “6G KVIs – SNS Projects Initial Survey Results 2025” [3] has been produced to that effect, that surveys the current status per Key Value category and addresses the challenges and suggestions for the way forward sharing the results from their current white paper, the presenters will set the scene and provide an overview for all project. This collaborated effort aims to support global alignment and avoid fragmented standards.

## V. EXPLORING DIFFERENT CATEGORIES OF KVIS AND HOW THEY RELATE TO SOCIAL SUSTAINABILITY

Based on data from TRIALSNET use cases [4], we analyze how KVIs for societal sustainability influence technology adoption patterns, adapt across different verticals, create distinct proximal and distal impact pathways, and integrate with established KPIs. Challenges in KVs assessment and possible solutions to integrating societal values into 6G design and use will be discussed.

## VI. REFLECTIONS ON HOW TO WORK WITH KVIS ON LOW-TRL PROJECTS

Collaborated efforts from low-TRL projects will share solutions to the KVI challenges that they are currently exploring, such as using proxy-KPIs and conceptual scenarios to link to uncertain long-term benefits and to improve their understanding of what kinds of impacts might emerge.

The 6G-BRICKS is a stream C project focusing on technological enablers. 6G-BRICKS uses new Key Value Indicators (KVIs) to make sure that improvements in network technology benefit society and the economy. It focuses on important human values like sustainability, safety, trust, and inclusion. An innovative template Framework for the formation of the KVIs has been developed and distributed among the Proof of Concepts (PoCs) for completion. On that, a combination of Objective and Subjective methods of measurement is employed towards the aim of a clear evaluation of its target KVIs. As a result, 6G-BRICKS delivers a list of clearly identified evaluation methods for 10 discrete KV Indicators, under the clusters of Innovation, Democracy and Ecosystem.

## VII. SUSTAIN-6G PROJECT AND FUTURE WORK

SUSTAIN-6G, as a Lighthouse Project within the European Smart Networks and Services Joint Undertaking (SNS JU), is focused on promoting holistic sustainability in 6G systems by addressing six key objectives. The approach of the SUSTAIN-6G project towards a holistic sustainability framework [5] in the context of 6G, focusing on sustainability definitions, assessment methodology, guidelines, and best practices will drive KVIs to provide the foundation for industry-wide alignment and standardisation. The project aims to understand the 6G technology landscape, create an inventory of state-of-the-art approaches and technologies, and identify sustainability needs and indicators.

It seeks to define and assess sustainability goals, enhance the integration of 6G with vertical use cases (UCs) to reduce environmental impact and develop a Sustainability Management Plan (SMP) for sustainable network operations. Additionally, the project will validate and demonstrate the sustainability of 6G technologies and deliver guidelines and a strategic roadmap for 6G development.

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## CONCLUSION

We conclude by reflecting on concrete steps toward a harmonised approach to KVIs that aligns 6G innovation with a focus on societal impacts. We aim to bring diverse experience from applying and framing KVIs (e.g. from different project streams, vertical applications, access to stakeholders, disciplines) to discuss how KVIs can be effectively integrated into decision-making processes, balance competing priorities, and adapt to evolving stakeholder needs, all while ensuring alignment with societal value and sustainability objectives.

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