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SmartCommUnity

DELIVERABLE 2.3.1 |

User-oriented community tool

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Abstract

This deliverable has detailed the rationale, conceptualization, and implementation of a user-oriented community tool designed to enhance the Smart transition process within the SmartCommUnity project. By building upon existing methodologies and digital infrastructure, and introducing a novel component focused on data-driven impact showcase, the work addresses key project objectives and responds directly to previously identified gaps in D2.1.1 Community based data approach.

The primary outcome presented is the conceptualization and proof-of-concept development of the Data Community component, designed as an integrated part of the broader user-oriented community support system hosted on the Smart-Alps.eu Innovation Portal. This approach leverages the strengths of existing assets: the co-creative SEROI+ methodology provides the overarching structured framework, while established Innovation Portal tools (like the Interactive Guide, Co-creative Toolbox, Smartness Assessment, etc.) support the initial phases of goal definition, stakeholder engagement, and co-creation.

The key innovation delivered through Task 2.3 is the Data Community component, which specifically operationalizes the crucial fourth step of SEROI+ – Impacts and Indicators. This web component provides a practical mechanism for pilot areas and communities to upload their local datasets (in a standardized JSON format), visualize this data through interactive charts, and critically, connect these datasets to predefined socio-economic and environmental impact indicators. It transforms abstract impact goals discussed during co-creation into tangible, trackable metrics, thereby completing the cycle from ideation to evidence-based validation. Designed for transferability, it offers a modular solution integrable into WordPress-based platforms like the Innovation Portal.

1. Introduction

1.1. Background and context:

For Smart Transitions and community needs in the Project context: task 2.3 is situated within the project's implementation phase, in relation to pilots specifically at the time of existing activities in the designated test areas. At this point, partners were already actively applying the Smart Villages

approach to address local challenges, often using various digital tools developed in other project activities and integrated into innovation portal. The strategy to develop a parallel tool to conform to this task description would be time and context sensitive in terms of application in pilot areas and in relation to already developed tools and guides on Innovation portal.

Therefore Task 2.3 and this deliverable make two primary contributions to the project: first, it consolidates and structures these diverse digital tools into a cohesive user-oriented framework to help the smart communities achieve their smart transition goals. Second, it specifically addresses the gaps concerning the community data approach, that were identified in Deliverable D2.1.1, including data utilization and impact assessment operationalised in developing transferable data community component within Innovation portal.

1.2. Defining the Challenge:

The development process described in this deliverable responds to the objectives addressed in workpackage on test areas network (WPTAN) and workpackage on information technology (WPIT), particularly the goal of creating a digital solution that supports user engagement, co-creation, and socio-economic-environmental evaluation. The main challenge lays in delivering a component that is technically robust and transferable, while also being aligned with the needs of test areas and project partners.

Though task 2.3 is linked to workpackage on(WPTAN the activity aligns with development activities within WPIT:

- Synergy development where the solution acts as a shared digital infrastructure supporting both community-level operations and innovation platform integration.
- Support for smart actions, by transforming raw community data into insights.
- Calculation of socio-economic returns, that enable impact assessments.

This process also directly addresses the challenges and priorities identified in Deliverable D2.1.1: Community-based data approach, particularly by:

- Providing a practical interface for data analysis grounded in real usage needs.

- Enabling community-led data reflection, such as through engagement visualizations and sentiment trends.
- Supporting data portability and transparency through imports and optional public-facing elements.
- Offering a flexible and adaptable structure, allowing partners to customize, extend, or replicate the solution in various regional contexts.

In terms of shared collaboration goals, the tool delivers on the expectations set out in the WPIT workplan by:

- Promoting interoperability and reuse among project partners.
- Supporting collective learning through shared metrics and comparable data structures.
- Enabling joint identification and validation of digital solutions for smart communities.

In summary, the component developed through Task 2.3 plays a key role in enabling community-based digital solutions with measurable socio-economic impact and alignment with SmartCommUnity's strategic objectives.

1.3. Addressing the Gap

A critical gap identified in concerns the lack of structured utilization of data from pilot areas and the absence of mechanisms for calculating and communicating impacts. While many test areas have engaged in participatory planning and co-creation activities throughout he project implementation, there has been no process to translate these efforts into measurable outcomes. This means that although services are being designed and implemented with community input, the full cycle—from ideation to demonstrable impact—remains incomplete. The SEROI+ methodology directly responds to this need by embedding impact estimation into the design process, requiring stakeholders not only to define goals and co-create services, but also to articulate expected impacts and identify measurable indicators. By doing so, SEROI+ supports the transition from creative co-design to evidence-based validation, enabling rural communities to demonstrate the real-world value of their innovations and share their success more effectively. This structure is further operationalized through

the Data Community component, which acts as a practical tool for capturing and visualizing impact data, ensuring the full co-creation-to-impact assessment cycle is both actionable and transferable.

Responding to D2.1.1 Community-based data approach by closing the loop from ideation and community engagement to impact, the integration of new special tool the innovation platform ensures that local digital solutions are also evidence-based, scalable, and policy-relevant.

The Data Community Component enables pilot areas to visualize datasets, assign socio-economic-environmental criteria, and track time-series data via standard indicators. It aligns with the SEROI+ methodology and embeds the capacity for ongoing impact evaluation into the very structure of the co-created solution.

1.4. Structure of the Deliverable

This deliverable is structured into four main chapters and an annex, providing a coherent narrative from context and rationale to methodology, implementation, and applied outcomes.

Background and Context: introduces the position of Task 2.3 within the broader SmartCommUnity project, emphasizing the need to align existing Smart Villages tools with real pilot area activities.

Defining the challenge: clarifies the objective of the task—to co-develop a user-oriented tool that engages stakeholders in identifying digital solutions through co-creation and evaluates their socio-economic and environmental impacts.

Addressing the gap: explains the identified shortcoming from Deliverable D2.1.1—namely, the lack of structured impact assessment from co-created solutions—and introduces the SEROI+ methodology and the new Data Community Component as responses.

Leveraging existing approaches and infrastructure: outlines how the tool builds upon and integrates with already-developed SEROI+ methodology and digital resources from the Innovation portal, enabling structured, participatory development.

Existing methodology: SEROI+ - presents the underlying SEROI+ framework and explains how its first three steps (goals, stakeholders, co-creation) are already reflected in the innovation tools, while the fourth (impact and indicators) remains underdeveloped.

The Smart-Alps.eu Innovation Portal: The Central Ecosystem - describes how the Innovation Portal and its integrated tools—such as the Co-creative Toolbox and Interactive Guide, TA Analyser and Smartness Assessment —facilitate structured stakeholder engagement.

Conceptualizing and implementing the Data community component: introduces and develops the new Data community web component that completes the co-creation-to-impact cycle by visualizing data and measuring real-world outcomes.

Rationale: bridging the Gap Identified in D2.1.1 - Articulates the need for showcasing community-generated data and quantifying the impacts of digital solutions as identified.

The Data community Approach: Concept and principles - explains the underlying design logic of the Data Community Component, grounded in community ownership, inclusivity, interoperability, and contextual impact representation.

The Data community component: A Proof of Concept (PoC) demonstrates the technical and functional structure of the component, enabling pilot areas to manage datasets and connect them to meaningful socio-economic and environmental indicators.

Design for transferability: Highlights the modular, open, and replicable nature of the Data community component, allowing it to be adopted by other rural regions beyond the original pilot sites.

Challenges remaining section explains that data flow and architecture design are generally lacking in pilot areas (project's or elsewhere) and how this is mitigated with generalistic approach.

Conclusion: Provides a synthesis of the deliverable's achievements, evaluates its response to project goals, and discusses the broader value for communities and future development potential.

Annex: User Manual for Data CommUnity Plugin - Offers a step-by-step technical guide for installing and using the plugin within the Innovation Portal, enabling users to visualize local data and track community-level impacts.

2. Leveraging Existing Approaches and Infrastructure

The development of the user-oriented community tool did not occur in isolation but rather built upon a foundation of existing methodologies, digital tools, and collaborative frameworks established within the SmartCommUnity project and previous initiatives. Recognizing that many necessary elements

were already in place, the strategy focused on integrating and structuring these components to support pilot activities and provide a cohesive approach aligned with the project's goals. This chapter outlines these foundational elements, explaining how they were leveraged to create a structured yet flexible pathway for smart transitions in rural areas.

Vital to this approach is the SEROI+ methodology, which provides a structured framework guiding users through key stages: defining goals, mapping and engaging stakeholders, co-creating solutions, and measuring value. While SEROI+ was initially designed for participatory engagement in workshops, its principles can be adapted to support the often asynchronous and sometimes sporadic nature of real-world pilot implementations. The Smart-Alps.eu Innovation Portal serves as the primary digital ecosystem where these elements converge. Its Interactive Guide and SmartVillages Co-creative Toolbox, among other features, offer practical tools to guide project partners, regional stakeholder groups (RSGs), for structured pilot actions.

The pilot actions themselves play a crucial role, providing the real-world context for applying the tools and methodology, grounding the theoretical framework in practical implementation. However, as noted in Deliverable D2.1.1 and observed during project coordination, challenges exist. These include difficulties in aligning pilot activities (often constrained by timing and specific local focus) with the structured approach, and gaps in community data initiatives and utilization.

Despite these challenges, the integration aims to foster collaboration by creating an integrated toolset (as detailed further in Chapter 3) and facilitating the sharing of methodologies, data approaches, and tools across partners. This chapter details the existing SEROI+ framework and the components of the Innovation Portal that support the initial stages of the smart transition process, setting the stage for the introduction of the Data Community component designed to address the identified gaps in impact measurement and data utilization.

2.1. Existing Methodology: SEROI+

The SEROI+ methodology—Social, Economic, and Environmental Return on Investment —is a structured framework that combines strategic goal-setting, stakeholder engagement, participatory co-creation, and value-based impact assessment (https://seroi.plus/about/). Originally developed in Interreg Europe ERUDITE project specifically for use in public innovation and policy projects and use as participatory methodology throughout several multi-actor type projects. SEROI+ supports

communities, private entities and public authorities in designing and evaluating digital or social innovations aligned with local needs. It emphasizes a return-on-investment approach that extends beyond economic profit to include social and environmental value, while incorporating the perspective of end users through participatory co-creation processes.

At the foundation of the methodology is a rational progression of four steps:

Step 1: Define the Goal: SEROI+ begins with defining the purpose of the initiative. This step ensures that the intervention responds to a genuine local need, is specific enough for targeted action, and can be translated into tangible outcomes. This step corresponds to Test Area Analyser and Smartness assessment to ensure a good understanding of possible gaps or opportunities within the selected test ares.

Step 2: Map and Engage Stakeholders: Once the goal is established, stakeholders are identified, mapped, and analysed in terms of their influence, relevance, motivation, and orientation. The methodology encourages nuanced understanding of stakeholders' interests and conflicts, which helps establish trust and clarity ahead of co-creative processes. The innovation platform supports this step through structured stakeholder mapping templates embedded in the interactive guide and toolbox features.

Step 3: Co-create Services and Solutions: The third step centers on inclusive co-creation workshops and participatory techniques—ranging from world cafés and storyboarding to personas and brainstorming—aimed at conceptualizing services or digital solutions. The co-creation results are input into the SEROI+ tool in an open format that captures the nature of the solution, its core components, user interactions, and potential deployment context. This component is strongly aligned with the tools embedded in the Smart-Alps.eu Innovation Platform, particularly the Smart Villages Co-creative Toolbox and the Structured Application Guide, which walk users through similar creative processes and support asynchronous iteration across pilot areas.

The Smart-Alps.eu Innovation Portal has effectively operationalized these first three steps. Stakeholder engagement and solution design are facilitated through integrated digital environments and guides, allowing regional groups (RSGs) to iterate solutions and maintain alignment with Smart Village principles. Test area analyses, smartness assessments, and best practice sharing tools all contribute to embedding co-creation into real-world territorial transitions.

Step 4: Impacts and Indicators

The fourth and final step in SEROI+ is the systematic identification of impacts and indicators—a step that is currently underdeveloped in most existing co-creation and innovation cycle tools, including the Interactive Guide and Toolbox.

This stage is designed to clarify the value created by the co-created solutions, asking: *Which goals are affected? Through which services? For which stakeholders? And what changes are expected as a result?* Impacts can range from increased employment or better collaboration, to reduced emissions or improved service delivery. However, while these effects are often discussed in workshops and conceptualization processes, they are rarely translated into measurable outputs in the creative tools available to pilot areas.

SEROI+ is especially helpful with addressing this through a structured focus on indicator design. For each impact, a single, relevant and robust indicator must be selected. These indicators must be:

- Relevant to the impact and goal;
- Robust, i.e., not overly dependent on external or volatile conditions;
- Quantifiable and measurable over time;
- Traceable back to the activity or service generating the impact;
- Continuously available or at least periodically trackable;
- And if necessary, statistically significant or proxy indicators can be used.

However, repeating, these impact-indicator pairs were not presented in the tools of the Innovation Platform. While the tools guide stakeholders toward designing valuable services, they do not systematically support defining how that value is measured post-implementation. This is the precise gap that Deliverable 2.3.1 seeks to address by integrating the Data Community Component, which was specifically conceived to connect co-creation outputs with impact monitoring.

2.2. The Smart-Alps.eu Innovation portal: The central ecosystem

The Smart-Alps.eu Innovation Portal serves as the central digital ecosystem for the SmartCommUnity project and the broader Smart Villages network in the Alpine Space. It integrates various tools, resources, and community features designed to support stakeholders through the different stages of their smart transition journey. It acts as the primary interface for accessing structured approaches, engaging with peers, finding inspiration, and utilizing practical tools for analysis and co-creation.

The main functionalities and components integrated within the portal include:

- **Interactive Guide:** A structured learning and guidance resource designed to inspire and train users with Smart Community tools. It incorporates steps like "Know," "Define," "Inspire," and "Involve," using gamification elements (karma points) to encourage engagement and progression during the usage and teaching process.

Figure 1: Interactive guide basic steps

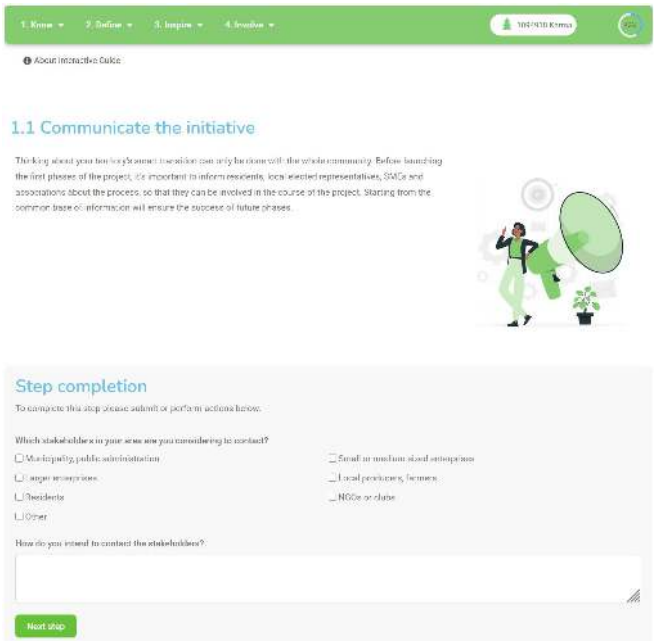

Figure 2: First simple step if the Interactive guide example

Smart Villages Co-creative Toolbox (or Smart Toolbox): A component supporting participatory processes. It includes questionnaires and structured methods to help communities define their specific needs, suggests appropriate co-creation techniques, guides stakeholder involvement, and links to relevant good practices. Please note that this cocreative box is specifically designed after SEROI+ steps, also including the review of impacts and indicators.

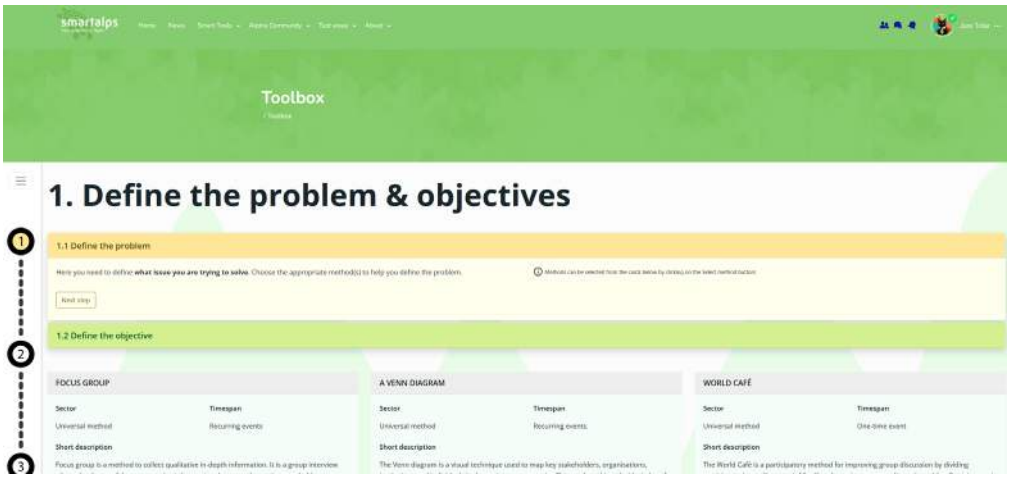

Figure 3: View of the integration of the already developed Toolbox into our Smart Platform

- Smartness Assessment: A diagnostic tool enabling communities to evaluate their current "smartness" level across various dimensions (e.g., economy, mobility, environment, living, governance, people). This helps identify strengths, weaknesses, and potential areas for intervention.

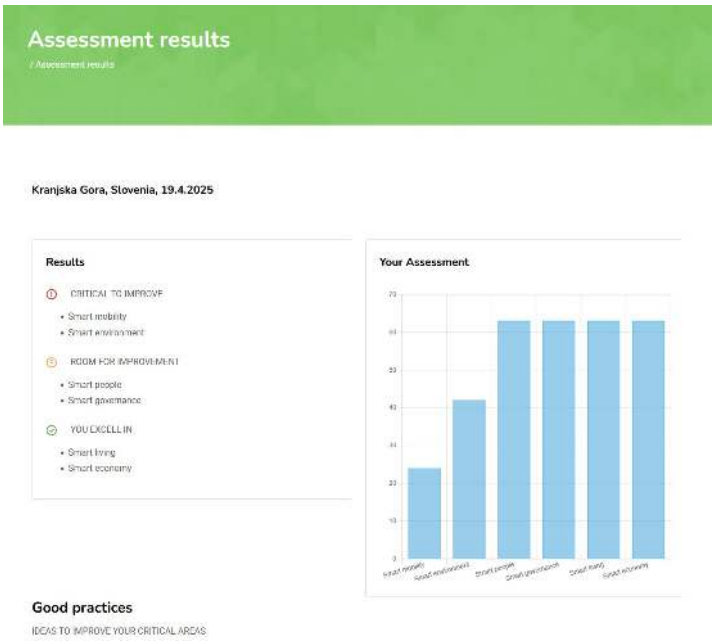

Figure 4: Smart Assessment results are key for understanding the position and context of pilot areas within 6 smartness dimensions.

- Test Area Analyser: this tool is designed for analysing and potentially visualizing data related to or generated by the project's designated Test Areas (TAs), supporting the understanding of local contexts and the monitoring of pilot activities using existing Open Street Maps datasets and additionally supports the summarisation of results by AI with general or 6 smartness dimensions focus.

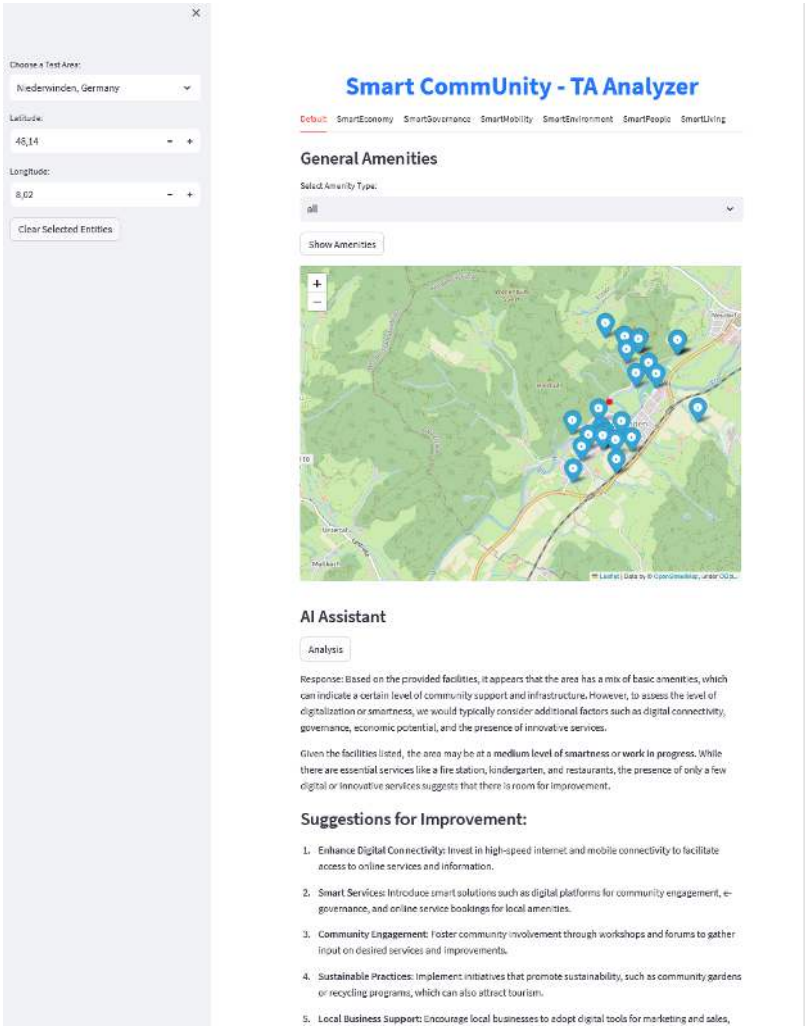

Figure 5: Test Area analyzer is a powerful tool using existing OSM datasets

- Good Practices: A repository or catalogue showcasing successful Smart Village initiatives and solutions from across the Alpine region and potentially beyond. It includes map-based browsing and functionality for users to submit their own examples, fostering knowledge sharing and inspiration.

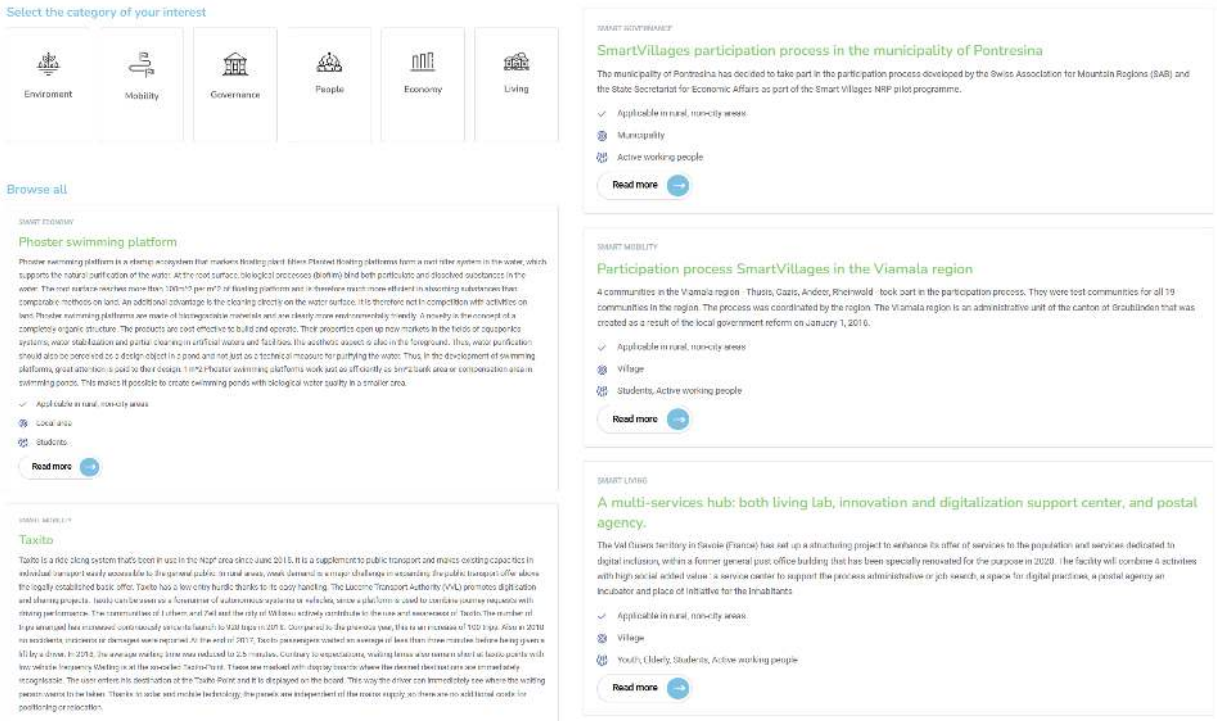

Figure 6: Good practices list and categorisation according to 6 smartness dimensions

Figure 7: Map of good practices locations

- AI Knowledge Base / Resources: a chatbot, trained on SmartVillages and SmartCommUnity materials, provides access to information, resources, and answers related to Smart Villages concepts, tools, and project activities.

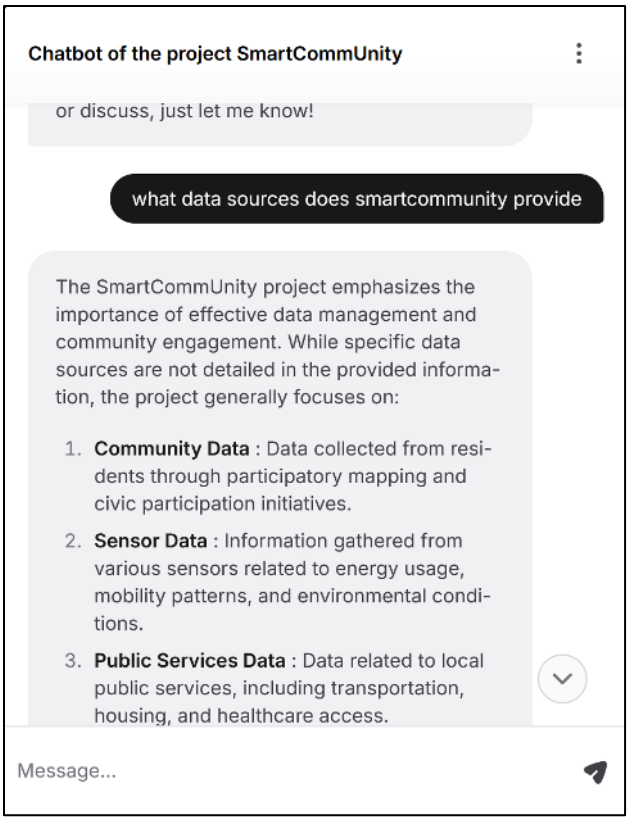

Figure 8: Example chat with AI knowledgebase

- Online Community Features: Facilitating networking and collaboration among users (PPs, RSGs, pilot representatives, other interested stakeholders) and includes features like a newsfeed for updates, dedicated groups for specific topics or regions, user profiles (potentially with 'friends' functionality), and forums for discussion.

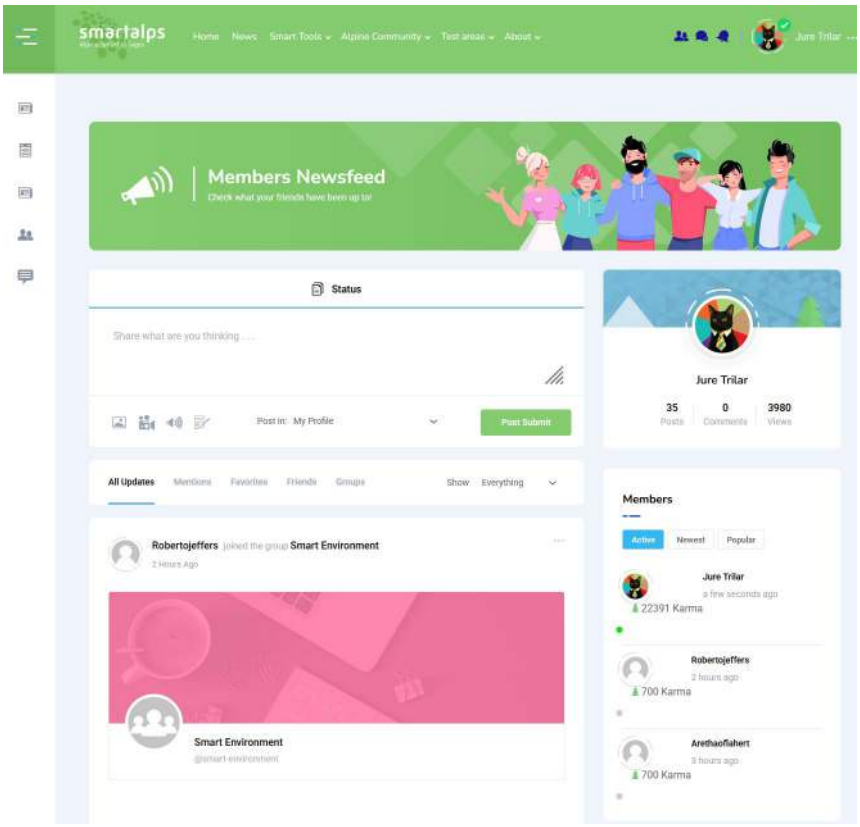

Figure 9: Timeline within Alpine Community social forums

Together, these tools form a comprehensive digital environment is aligned wiht the first steps of the SEROI+ methodology (Goals, Stakeholders, Co-create) by providing resources for understanding context (Smartness Assessment, TA Analyser), finding inspiration (Good Practices), structuring engagement (Interactive Guide, Toolbox), and facilitating collaboration (Online Community). The portal thus acts as the essential backbone for applying the Smart Villages / Smart Community approach in a structured, informed, and collaborative manner within the project.

3. Conceptualizing and Implementing the Data Community Component

3.1. Rationale: Bridging the Gap Identified in D2.1.1

Based on the findings of Deliverable D2.1.1 *Community Data Based Approach*, it is evident that rural and remote areas across Europe can greatly benefit from increased visibility and accessibility of their data and related results. The report emphasizes community ownership of data and the importance of data ecosystems—all of which point to the need for pilot areas, or Test Areas (TAs), to act not only

as centers of data generation and experimentation but also as active promoters of their findings, solutions, and best practices.

A key conclusion is the *need for showcasing pilot data and calculating impacts*, which is essential for demonstrating the real-world value of community-based and pilot actions data approaches. Moreover, in order to complete the co-creation-to-impact process cycle, started with the co-creation and assessment tools of the Innovation platform, (future) pilot areas must be equipped with tools to effectively communicate their progress and outcomes to a wider audience. This includes stakeholders at local, national, and European levels, as well as other rural communities seeking inspiration and guidance.

To address this, one of the most practical and scalable solutions proposed was the design and development of a dedicated Data Community web Component. This component serves as a digital interface for presenting data outputs, measuring and visualizing impacts, and enabling interactive exploration of community-generated datasets. It acts as both a knowledge-sharing and engagement opportunity, aligned with the principles of open data and community-driven innovation while allowing for transferability in other related contexts.

3.2. The Data Community Approach: Concept and Principles

The Data Community Approach developed under the SmartCommUnity project builds upon the findings and guidelines of Deliverable D2.1.1, which identifies the need for community-centric, and impact-oriented data practices in rural and remote areas. It aims to operationalize the idea that data is not merely a technical resource, but a shared community asset that, when appropriately governed and visualized, can empower local actors to co-create smart solutions and evaluate their real-world value.

Underlying Principles

The Data Community Approach is grounded in key principles emerging from both the SmartCommUnity process and broader EU data governance initiatives:

- Community Ownership and Sovereignty: Inspired by D2.1.1 and the CARE principles, this approach supports the notion that communities should retain control over the data they

generate, ensuring it serves local interests rather than external exploitation. It is a counterbalance to "data colonization" and ensures trust in data practices.

- Inclusivity and Accessibility: By offering multiple access modes—dashboards, APIs, chatbots—the data component caters to diverse user groups, from technically skilled actors to residents with limited digital literacy.

- Open and Interoperable by Design: To facilitate knowledge sharing and replication, the component aligns with EU Data Spaces logic and promotes openness, interoperability, and harmonization of formats and processes.

- Context-Specific Visualization and Use: Visualization tools are designed to present data in relevant, human-centered formats, enabling users to link services to real-world benefits (e.g., reduced energy use, improved mobility, cultural heritage preservation).

- Empowerment through Data Literacy and Support Roles: As emphasized in D2.1.1, tools alone are not enough. The approach foresees training and support via rural data stewards or digital facilitators, who act as mediators between the data systems and the local population.

At its core, the Data Community approach connects three critical components with linking data, community, and impact:

1. Community-generated and -relevant data
2. Digital solutions co-created through participatory processes
3. Measurement of social, economic, and environmental impacts

This approach aligns closely with the beforementioned SEROI+ methodology (Social, Environmental, and Economic Return on Investment), and co-creation-to-impact cycle defined in previous tasks. The goal is not only to capture and display data, but to enable communities to understand, interpret, and act upon it, thereby strengthening their digital and social resilience.

Types of Data Considered

Drawing from D2.1.1, the data sources relevant to the Data Community Approach are intentionally diverse and aligned with rural priorities:

1. Community Data: Manually collected or crowd-sourced data through participatory mapping, civic tech platforms, or direct input from residents. This includes insights into housing, public service access, connectivity, and more.

2. Sensor and IoT Data: Data from local infrastructures—such as energy meters, mobility counters, weather stations, and environmental monitors—that enable real-time insights into community performance and trends.

3. Public Services Data: Administrative data from local authorities, often underutilized, that can inform community services such as healthcare, education, or municipal operations.

4. User Feedback and Qualitative Inputs: Input from surveys, workshops, and digital feedback forms (including integration with AI chat interfaces), helping to capture subjective experiences and local priorities.

This combination reflects the typology proposed in D2.1.1, distinguishing between data on people, data on the economy, data on territory and environment, and community-controlled infrastructures. It enables the representation of context-specific indicators and impact narratives that are both meaningful and actionable at local level.

Building Toward Impact

Ultimately, by linking data to co-created solutions and their outcomes, the approach ensures that local action can be measured, communicated, and scaled. It enables Smart Villages to not only develop digital tools but also to prove their value and share their insights, encouraging replication by other areas and supporting the overall mission of a digitally inclusive and smart rural Europe.

3.3. Approach to visualising and quantifying Impacts

This section outlines the practical methodology employed within the SmartCommUnity project for calculating, quantifying, and ultimately displaying the socio-economic and environmental impacts resulting from pilot activities. Central to this approach is the operationalization of the final step of the Social, Economic, and Environmental Return on Investment Plus (SEROI+) framework, addressing a previously identified gap in structured impact assessment. The newly developed Data Community component serves as the primary digital interface for this process, transforming impact measurement from a conceptual requirement into an actionable and visible outcome for stakeholders.

3.3.1 Operationalizing data to demonstrable value

The approach detailed here fulfills the crucial fourth step ("Impacts and Indicators") of the SEROI+ methodology. While the initial three steps – defining goals, mapping and engaging stakeholders, and co-creating services – are effectively supported by existing tools within the Smart-Alps.eu Innovation Portal, such as the Co-creative Toolbox and Interactive Guide, the systematic measurement and communication of resulting impacts remained underdeveloped. The lack of structured impact assessment mechanisms was highlighted as a critical gap in Deliverable D2.1.1. This methodology, facilitated by the Data Community Component, provides the necessary structure and tools to bridge this gap, effectively completing the co-creation-to-impact assessment cycle envisioned by the project.

The core purpose focuses on demonstrating the tangible *value* generated by the project's interventions across social, economic, and environmental dimensions. This aligns directly with the foundational principle of SEROI+, which emphasizes quantifying returns beyond purely financial metrics to encompass broader societal and ecological benefits. Demonstrating this multifaceted value is essential for securing ongoing stakeholder buy-in, justifying investments, informing future project design, and enhancing the policy relevance of smart village initiatives and SmartCommUnity project.

The Data Community component developed functions as more than just a data visualization tool; it serves as the technological embodiment of SEROI+ Step 4. It translates the methodological imperative for impact assessment into a practical, user-oriented digital solution. This integration ensures that the definition of expected impacts and the selection of relevant indicators during the co-creation phases can be directly linked to data collection and subsequent measurement displayed within the component.

By defining specific indicators based on SEROI+ criteria (relevance, robustness, measurability, traceability and tracking their progress over time via the Data Community Component, communities gain valuable insights into the effectiveness of their implemented solutions. This transforms impact assessment into an ongoing process of reflection and improvement, enhancing the overall effectiveness and resilience of the smart transition efforts.

3.3.2 Calculating impact: leveraging data community

The primary method for calculating impact within this framework involves the systematic comparison of datasets gathered from pilot areas *during* or *after* the implementation of specific smart solutions against corresponding baseline datasets collected *before* these interventions began. This comparative analysis aims to identify and quantify cumulative differences or specific changes over time that can be attributed, at least in part, to the project's activities.

The calculations draw upon the diverse range of data sources identified as relevant within the Data Community Approach. These include beforementioned community-generated data (e.g., surveys, participatory mapping), sensor and IoT data (e.g., energy meters, environmental monitors), public services data (e.g., administrative records), and user feedback or qualitative inputs.

A key capability enabled by this approach is temporal analysis. By collecting and comparing data periodically, pilot areas can track the evolution of selected indicators over the project's duration or specific intervention periods. The fundamental focus of the calculation is on the *change* or *difference* – the delta – between the baseline or control state and the post-intervention state observed in the pilot area. This measured delta represents the quantifiable impact attributed to the initiative.

The credibility and meaningfulness of any calculated impact are intrinsically linked to the quality, relevance, and consistency of the baseline data. Establishing a comprehensive and accurate baseline *before* interventions commence is therefore a critical prerequisite for reliable impact assessment. Without a solid starting point for comparison, the measured changes lack context and their significance cannot be properly evaluated.

It is also important to acknowledge the inherent challenge of attribution in real-world settings. While the comparative method effectively identifies *correlation* – demonstrating that changes occurred following an intervention – definitively proving direct *causation* can be complex. External factors unrelated to the project (e.g., broader economic trends, policy changes, unforeseen local events) can also influence the measured indicators. While acknowledging potential confounding factors, the framework aims to provide the most robust possible evidence for the impact generated.

3.3.3 Illustrative Impact Indicators for Smart Communities

To provide concrete guidance for pilot areas utilizing the Data Community Component, several illustrative examples of quantifiable impact indicators relevant to project contexts are presented below. These examples demonstrate how impacts can be calculated from data comparisons and presented using standardized metrics, drawing upon established methodologies and data sources.

Example 1 (Environmental): CO2 Emissions Reduction

- *Impact:* Reduced greenhouse gas emissions resulting from the adoption of renewable energy sources (e.g., solar installations) or the implementation of energy efficiency measures.
- *Indicator:* Kilograms of CO2 equivalent (kg CO2e) saved per kilowatt-hour (kWh) of green electricity generated or per unit of energy saved through efficiency measures.
- *Quantification Example:* Based on recent European Environment Agency data, the average greenhouse gas emission intensity of electricity production in the EU has significantly decreased.[8] Using a recent reference value, one could state: "For every 1 kWh of solar electricity generated by an estimated **0.233 kg of CO2e** emissions are avoided (based on the 2022 EU average grid intensity, acknowledging ongoing improvements and regional variations[1])." Factors from sources like the International Energy Agency (IEA) provide comprehensive global and regional data.[2]
- *Data Source/Reference:* European Environment Agency (EEA) Greenhouse Gas Data Viewer[1], IEA Emissions Factors database.[2]
- *Calculation within Component:* The component can calculate total savings by multiplying the total green energy generated (kWh) by the relevant CO2e factor (kg CO2e/kWh). This can be displayed as a cumulative total or tracked over time. (Total Green kWh Generated) * (CO2e Factor per kWh) = Total CO2e Saved.

Example 2 (Socio-Economic): Enhanced Employability via Digital Skills

[1] Greenhouse gas emission intensity of electricity generation https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emission-intensity-of-1

[2] Emissions Factors 2024 - Data product - IEA, 2025, https://www.iea.org/data-and-statistics/data-product/emissions-factors-2024

- *Impact:* Improved employment outcomes and potential earnings for community members who participate in digital literacy or specific vocational skills training programs facilitated or supported by the project. Demand for digital skills is high across nearly all job sectors.[3]

- *Indicator:* Percentage point change in the employment rate among trainees after completion; Percentage increase in average earnings for employed trainees compared to baseline.

- *Quantification Example:* Evidence from targeted programs demonstrates significant impact: "Following participation in a project-supported digital skills program, the employment rate among participants increased by 18 percentage points compared to their pre-training status, aligning with results from a World Bank pilot in Lebanon.[4]" Alternatively, focusing on earnings potential: "Acquiring foundational digital skills can substantially increase earnings, with research suggesting that moving from a job requiring no digital skills to one requiring basic digital proficiency can increase pay significantly, potentially up to 45% in certain US contexts.[13]"

- *Data Source/Reference:* Pre- and post-training surveys conducted with pilot participants; Comparative data from studies by the World Bank [4], OECD [5], or national bodies like the National Skills Coalition.[3]

- *Calculation within Component:* The component can calculate the change in employment rate: (Post-Training Employment Rate) - (Baseline Employment Rate) = Change in Employment Rate (percentage points). This can be displayed numerically or visually.

Example 3 (Economic): Local Business Growth & Entrepreneurship linked to Connectivity

[3] New Report: 92% of Jobs Require Digital Skills, One-Third of Workers Have Low or No Digital Skills Due to Historic Underinvestment, Structural Inequities - National Skills Coalition https://nationalskillscoalition.org/news/press-releases/new-report-92-of-jobs-require-digital-skills-one-third-of-workers-have-low-or-no-digital-skills-due-to-historic-underinvestment-structural-inequities/

[4] documents1.worldbank.org
https://documents1.worldbank.org/curated/en/099714205022428058/pdf/IDU18de6d0dd130d5146e2181b51803ab8411275.pdf

[5] The Impact of Literacy, Numeracy and Computer Skills on Earnings and Employment Outcomes | OECD, https://www.oecd.org/en/publications/the-impact-of-literacy-numeracy-and-computer-skills-on-earnings-and-employment-outcomes_5jm2cv4t4gzs-en.html

- *Impact:* Stimulation of the local rural economy through increased rates of new business formation, growth of existing enterprises, and potentially higher local GDP, particularly where improved digital connectivity (e.g., broadband) is a factor enabled or leveraged by the project.

- *Indicator:* Percentage change in the number of new business registrations annually; Percentage point change in the self-employment rate; Average revenue or employment growth rate of existing local businesses.

- *Quantification Example:* Research strongly links broadband availability and adoption to rural economic dynamism: "Rural counties with high broadband adoption rates (over 80%) demonstrate significantly higher economic activity, including 213% higher business growth rates and 10% higher self-employment growth rates, compared to similar counties with low adoption.[6]" Furthermore, "Studies indicate that improved broadband access in rural areas causally increases new business launches, with a notable positive effect on women-owned nonemployer businesses.[7]"

- *Data Source/Reference:* Local/regional business registration databases; Community surveys on self-employment and business activity; Economic impact studies, particularly those by the Center on Rural Innovation (CORI) [6], and academic research[8].

- *Calculation within Component:* The component can track and compare metrics like the number of business registrations or self-employment rates in pilot areas against baseline data or data from comparable non-pilot rural areas. Results can be displayed as growth rates or absolute changes.

Example 4 (Social): Social Return on Community Initiatives

- *Impact:* Generation of broader social value – such as increased community cohesion, empowerment, trust, local economic multiplication, or enhanced well-being – resulting from

[6] New Research Proves That Providing Fiber Broadband Experiences, https://ruralinnovation.us/press-releases/new-research-proves-that-providing-fiber-broadband-experiences-to-rural-communities-boosts-income-entrepreneurship-and-business-investment/

[7] How important is broadband access for rural entrepreneurs?, https://aae.wisc.edu/2023/01/15/how-important-is-broadband-access-for-rural-entrepreneurs/

[8] How important is broadband access for rural entrepreneurs?, https://aae.wisc.edu/2023/01/15/how-important-is-broadband-access-for-rural-entrepreneurs/

community-led initiatives like energy cooperatives, shared digital platforms, or participatory planning processes facilitated by the project.

- *Indicator:* Calculated Social Return on Investment (SROI) ratio; Specific quantitative metrics contributing to social value (e.g., number of people actively engaged, volunteer hours contributed); Qualitative assessments of community satisfaction or empowerment.

- *Quantification Example:* While full SROI analysis is complex, benchmark values illustrate the potential: "Community-led energy projects, similar to those potentially fostered by SmartCommUnity, have shown substantial social returns. For instance, UK-based studies suggest potential SROI ratios of approximately 9:1 for community initiatives tackling fuel poverty.[9]" Additionally, such projects can have significant local economic multiplier effects: "Research commissioned by the UK government found that community energy schemes generate 12 to 13 times the local economic value compared to equivalent commercial energy installations.[9]"

- *Data Source/Reference:* Formal SROI analysis frameworks and accredited reports [9]; Specific case studies and research on community energy impacts (e.g., Bristol University study referenced in [9]).

- *Calculation within Component:* While the component may not perform a full SROI calculation itself, it can display key input metrics (e.g., investment, volunteer hours) alongside key monetized or quantitative outcome indicators (e.g., energy savings value, number of beneficiaries reached). This allows for a simplified presentation of value generated relative to investment, potentially displaying a derived ratio or key performance indicators contributing to overall social value.

Table 1: Summary of Illustrative Impact Indicators

Impact Area	Indicator Example	Quantification Example	Data Source/Reference Example

[9] Unlocking the Potential of Community Energy - Power to Change, https://www.powertochange.org.uk/evidence-and-ideas/news-and-events/unlocking-the-potential-of-community-energy/

Environmental	CO2 Emissions Saved (kg CO2e) per kWh	Every 1 kWh of green electricity produced avoids ~0.233 kg CO2e (based on 2022 EU avg grid intensity)	EEA [1], IEA [2]
Socio-Economic	Increased Employment Rate post-Digital Skills Training	Pilot program showed factor 1.18 change in employment rate among participants	World Bank Lebanon Pilot[6]
Economic	New Business Growth Rate in Connected Rural Areas	High-adoption broadband counties show 213% higher business growth rate compared to low-adoption counties	World Bank[4], OECD[5], Skills Coalition[4]
Social	Social Return on Community Investment (SROI Ratio)	Community energy fuel poverty initiatives demonstrated ~9:1 SROI; Local economic value 12-13x commercial	Bristol Uni Study[8] / Gov Research[9]

Furthermore, understanding impact requires acknowledging different time horizons. Some effects, like the immediate CO2 savings from a newly installed solar panel, are relatively straightforward to measure in the short term. However, other significant impacts, such as the full economic transformation resulting from widespread broadband adoption or the long-term career progression enabled by digital skills training, unfold over months or years. The impact assessment approach and the tracking capabilities of the Data Community Component must therefore be designed to accommodate both short-term outputs and the monitoring of longer-term outcomes to capture the full spectrum of change. This narrative element is vital for communicating the community dimension of the project's success.

3.4. The Data Community Component: A Proof of Concept

This section details the proof-of-concept (PoC) implementation of the Data Community Component, developed under Task 2.3. This component serves as a tangible output of the Data Community approach, designed to address the challenges of data visibility and impact assessment identified in D2.1.1. As a user-oriented tool, the PoC provides a practical web interface, realized as a WordPress plugin, suitable for integration within platforms like the Smart-Alps.eu Innovation Portal. Its core aim is to empower communities by enabling them to showcase relevant data and connect it to demonstrable impacts

The web component integrates visual representations of pilot area contributions, datasets, and offers access to thematic areas such as agriculture, education, cultural heritage, or energy. By making data more visible and actionable, pilot areas can not only strengthen their local impact but also contribute meaningfully to the creation of a transnational rural data ecosystem. In doing so, they reinforce their role as examplary regions, empowering other areas and supporting the broader mission of a digitally inclusive and smart rural Europe.

The Data Community Component serves as the crucial interface for presenting the calculated impacts and the underlying indicator data in an accessible and understandable visual format. This visualization capability is central to enabling community-led data reflection, supporting informed decision-making within the pilot areas, and facilitating the sharing of results and lessons learned with a wider audience. The Data Community Component allows users to map specific values from their datasets to these pre-defined, meaningful indicators, ensuring that the visualizations directly reflect the intended impact narrative.

3.4.1 Overall Purpose

The Data Community Component PoC is designed with a dual objective:

1. Showcase Datasets: To offer a clear, structured method for presenting datasets pertinent to the pilot areas (TAs). This includes data generated locally, sensor data, or relevant open data sources, making community information accessible and visually.

2. Demonstrate Impact Calculation: To operationalize the principles of impact assessment, the component facilitates the visualization and communication of socio-economic and environmental impacts derived from the underlying data, thereby demonstrating the value created by community initiatives.

3.4.2 Functionality

The PoC achieves its purpose through two primary functionalities:

1. Data Showcase: Users can create distinct "Community Items" within the WordPress backend. Each item is linked via a URL to an external JSON file containing time-series data. On the website's frontend, the component renders this data using interactive charts (e.g., Highcharts

line charts), allowing for intuitive visualization of trends from pilot area datasets or open data. This visual presentation enhances data understanding for a wider audience.

2. **Impact Demonstration Framework:** While the PoC doesn't incorporate a complex, automated calculation engine on the frontend, it provides the essential framework to *demonstrate* impacts based on underlying data and predefined methodologies. This includes:

    - **Methodology Process Flow Alignment:** The component directly supports Step 4 ("Impacts and Indicators" / "Measure Value") of the SEROI+ methodology. Within each "Community Item," users define Social, Economic, and Environmental criteria (including value, unit, and comments). These criteria explicitly link the showcased data (or calculations derived from it) to the project's Indicator Methodology, enabling the display of results from comparisons (e.g., key vs. baseline datasets).

    - **Indicator Framework:** The component facilitates the application of a structured indicator framework. Users select or define indicators relevant to their context, potentially drawing from established banks (like World Bank examples) and ensuring they meet criteria such as being Relevant, Robust, Measurable, and Traceable (aligned with SEROI+). The component allows mapping the displayed data or the manually entered criteria values to these indicators. For example, energy usage data visualized in a chart could be accompanied by a criterion stating the calculated CO2 savings or data on workshop attendance could be linked to a criterion

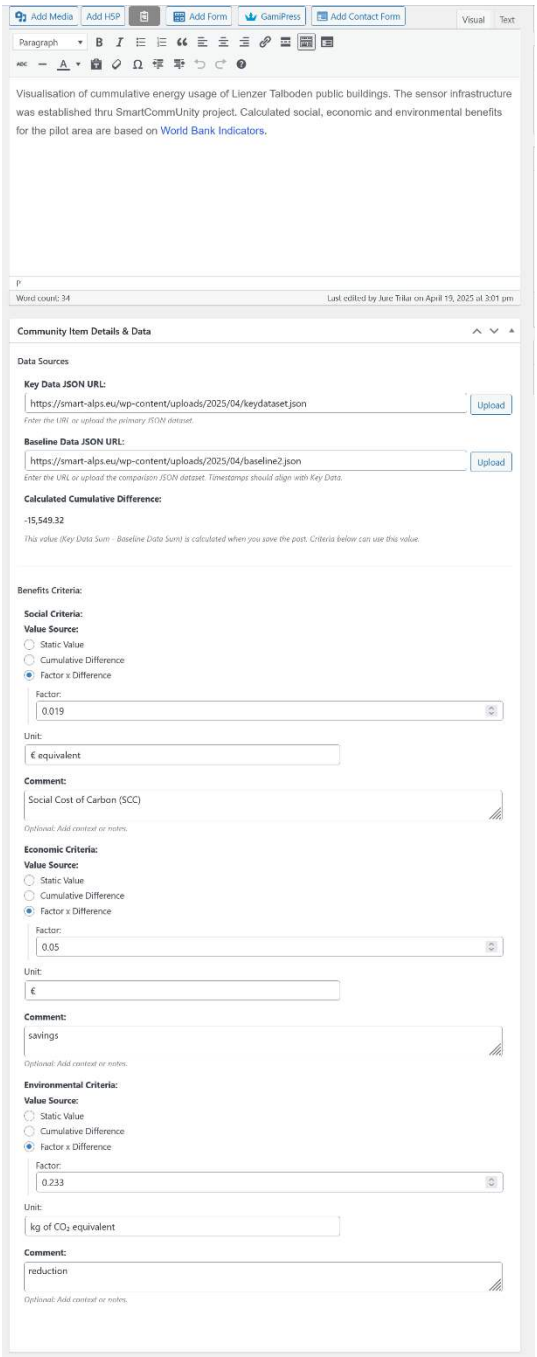

Figure 10: Administrator Data community item editing datasets and impact criteria calculation

showing an increase in digital skills or employability. This mapping translates raw or processed data into understandable impact statements.

3.4.3 User Interaction

Detailed instructions on how users interact with the Data Community Component PoC – covering installation, activation, managing "Community Items" (including data input for content, JSON URLs, and criteria according to the methodology), and utilizing the shortcode for frontend display – are provided in the User Manual located in the Annex of this deliverable.

This PoC represents a significant step towards providing communities with practical, user-oriented tools for data visualization and impact communication, directly addressing the needs identified within the SmartCommUnity project.

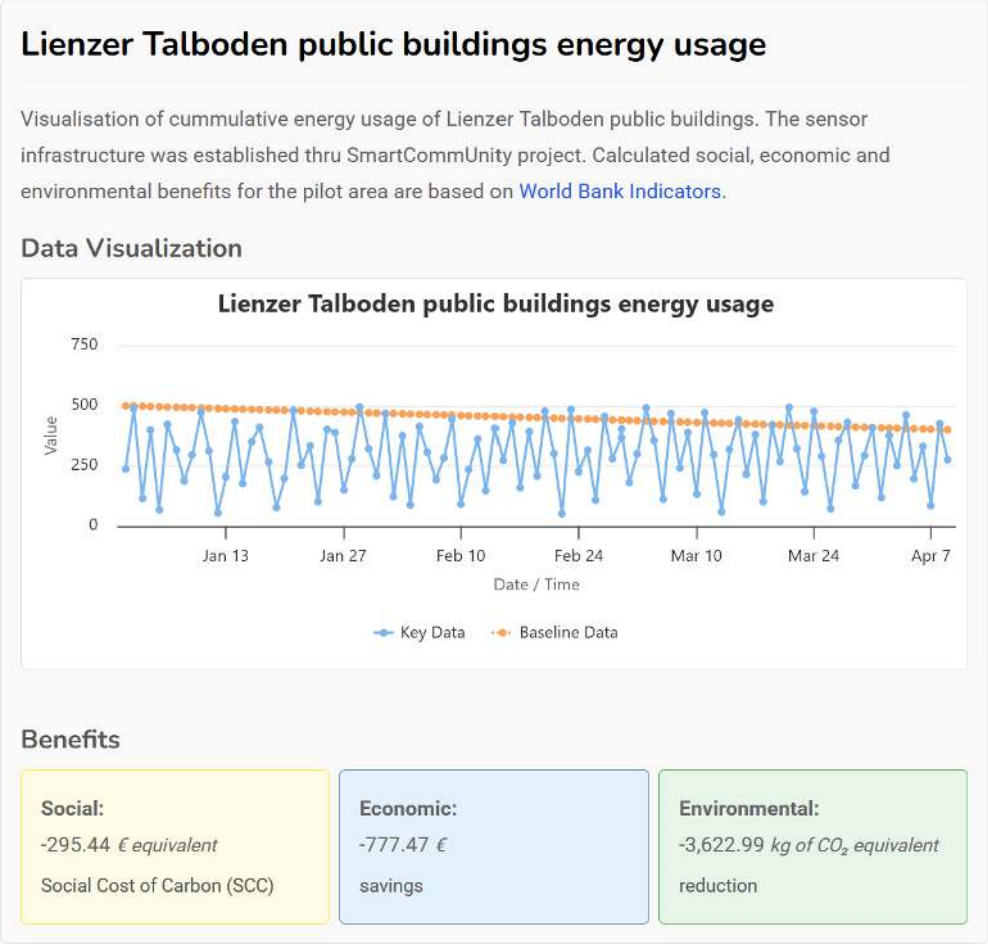

Figure 11: Front-end visualisation and impact assesment of Data Community component

Effectively, the Data Community Component functions as a vital communication tool. Raw data tables or complex statistical outputs are often impenetrable to non-experts. Visualization translates these

into narratives about value creation, and progress towards community goals. This is essential for engaging stakeholders effectively, building trust, demonstrating accountability, and hopefully influencing future policy decisions or securing further support.

3.4.4 Design for Transferability

An ambition of the Data Community component is to ensure its adaptability and reuse across different rural and remote contexts, both within and beyond the original project related efforts. To achieve this, the proof-of-concept was designed with modularity, flexibility, and interoperability in mind—aligned with the overarching goals of the Innovation Portal and the principles outlined in Deliverable D2.1.1.

Key features that support transferability include:

- Modular architecture: The web component is built as a standalone plugin that integrates smoothly into every existing WordPress-based site. This modularity allows for easy installation, customization, and localization across partner sites and future (rural) digital initiatives.

- Indicator framework flexibility: The use of a framework based on SEROI+ methodology and World Bank indicator sets, combined with customizable socio-economic and environmental criteria, ensures that the impact measurement system can be adapted to local priorities, data availability, and stakeholder needs.

- Open data alignment: The component leverages JSON-formatted datasets with standard key structures, enabling integration with other platforms and open data sources. This design choice promotes interoperability and ensures that communities with varying data maturity levels can still engage meaningfully.

- Scenario-based replicability: Several common rural development scenarios—such as energy monitoring, smart mobility hubs, or digital heritage archiving—were considered in the component's functionality and are supported by templates and documentation. This enables rapid replication and thematic adaptation by new users.

- Training and Documentation: The inclusion of a user manual and practical examples within the plugin package ensures that both technical and non-technical users can deploy and

benefit from the tool. Future updates can expand this guidance based on feedback from partner areas.

At the time of submission of this deliverable the Data community component was accepted as a part of the Horizon Smart ERA Smart Project Innovation Package technical component. As a part of this IT tools catalogue, it became available to other project's pilot areas in their smart transitions endeavours.

3.5 Challenges remaining

While the Data Community component provides a crucial mechanism for visualizing and linking existing data to impact indicators, significant challenges related to the *production* and *accessibility* of relevant data in pilot areas persist. These issues, initially highlighted in Deliverable D2.1.1 (Community-based data approach) and also detailed in Future Recommendations and Next Steps section in current Deliverable D2.2.2. Smart Transitions Activities and Meetings in Test Areas, remain fundamental obstacles to fully realizing data-driven smart transitions. Key challenges include:

1. Relevance and design of data flows: There's often a disconnect between community needs or project goals and the practicalities of data collection. Effective data flows need careful design and are fundamentally linked to specific models or business objectives. When solutions respond primarily to immediate community needs, these are frequently not conceptualized in ways that are inherently measurable or yield actionable data suitable for the indicators framework without significant additional effort. Data collection is not always considered from the outset as a core part of the solution design. This issues can be mitigated with additional preparation of data post-festum to demonstrate the impacts on pilot areas.

2. Data readiness and machine readability: The assumption that relevant data is readily available and easily accessible often does not hold true in real-world rural contexts. Specific challenges include:

    - Volume: Generating sufficient data volume is difficult. Pilot areas often lack extensive sensor infrastructure, relying instead on surveys or qualitative insights which are harder to quantify consistently and integrate into automated analysis.

- **Architecture:** While reference architectures like data spaces exist conceptually, implementing and populating them with meaningful, interoperable data at the local level remains complex and resource-intensive. The basic gathering of quality data is often challenging, let alone preparing it for robust numerical analysis.

3. **Accessibility and data sovereignty barriers:** The experience coordinating with initiatives like the Tirolean Data Hub illustrates accessibility issues. This hub aggregates valuable data (e.g., energy usage from Standort Tirol project partner across 15 municipalities), but accessing specific, usable datasets often involves navigating vendor lock-ins within local data spaces. Access may require subscriptions or fees, and the data shared might be static snapshots rather than real-time streams. While this respects the principle of data sovereignty – allowing data producers to set the terms of access, which may include commercial models – it creates practical barriers for projects like SmartCommUnity seeking to integrate diverse data sources for broader analysis and impact assessment.

Addressing these underlying challenges related to data generation, quality, standardization, and accessibility requires ongoing effort beyond the scope of the tool itself, involving strategic planning at the pilot level, capacity building, and potentially new initiatives focused specifically on data infrastructure and governance in rural Alpine areas.

4. Conclusion

The Data Community Component is designed as a proof-of-concept to accommodate and process this variety of data types, enabling a holistic view of changes occurring within the community

The development of the Data Community component, integrated within the context of the Innovation Portal and SEROI+ methodology, successfully addresses the core objectives of Task 2.3. The task aimed to co-develop a user-oriented tool supporting stakeholder engagement in identifying digital solutions and evaluating their socio-economic and environmental impacts. The resulting integrated approach achieves this by:

1. **Leveraging existing tools** for engagement and co-creation;
2. **Introducing the Data Community component** specifically for visualizing data and evaluating impacts.

Crucially, this work directly responds to the challenges and needs identified in **Deliverable D2.1.1 (Community-based data approach)**. The primary gap identified was the lack of structured mechanisms for utilizing community-generated data and assessing the impact of co-created solutions within pilot areas. The Data Community component provides this missing link. It offers:

- A **practical interface** for community-level data visualization and reflection.
- A method to **connect local data to meaningful impact indicators**, operationalizing the final step of SEROI+.
- Support for **data portability** through standardized formats.
- A **flexible and transferable structure** adaptable to various contexts.

By enabling the quantification and visualization of impacts derived from local data, the tool closes the loop from participatory planning to demonstrable value, ensuring that co-created solutions are not only community-driven but also evidence-based and policy-relevant, thereby fulfilling the strategic objectives outlined for WPTAN and WPIT regarding measurable results and shared digital infrastructure.

Annex: User manual for Data CommUnity plugin

Prepared For: Project Stakeholders & End-Users

Version: 1.3.0

4.1 Introduction

This manual provides instructions for using the Data Community WordPress plugin, a key component of the User-Oriented Community Tool. The plugin's primary function is to enable project members to manage and display specific datasets related to designated test area communities directly on the project website.

It allows users to:

- Create entries ("Community Items") for different data sources or community aspects.
- Link each item to a specific external JSON data files containing time-series data and baseline data.
- Define criteria scores/comments (Social, Economic, Environmental) based on the project's Indicator Methodology (refer to Deliverable Report Section 3 for details).
- Add descriptive content about the data or community context.
- Display this information, including an interactive time-series chart of the linked data, on relevant website pages using a simple shortcode.

This tool facilitates the visualization and communication of community data and potential benefits derived from project activities within the test areas.

4.2 Installation and Activation

The Data Community plugin follows the standard WordPress plugin installation process.

1. Prerequisite: Ensure you have Administrator or Editor privileges on the WordPress site.
2. Navigate to Plugins -> Add New in the WordPress admin dashboard.
3. Click Upload Plugin.
4. Choose the data-community.zip file provided with this deliverable.
5. Click Install Now.

6. Once installed, click Activate Plugin.

Upon activation, a new menu item named Data Community will appear in the left-hand admin sidebar.

4.3 Core Concepts

- Community Item: Represents a specific data source, indicator, or aspect related to one of the test area communities. Each item is managed like a specialized post within WordPress.
- Criteria (Social, Economic, Environmental): Fields within each Community Item where users input values, factors for calculation, units (e.g., "/100", "Score", "%"), and comments. Crucially, these inputs should directly correspond to the project's established Indicator Methodology. Users must refer to the methodology documentation to ensure consistency and accuracy when filling these fields.
- JSON Data URLs: A required links pointing to an external files (data.json or similar) that contains the raw time-series data, key datasets and baseline datasets, to be visualized.
- Content Area: Standard WordPress editor available for each Community Item to provide context, descriptions, or narratives related to the data.
- Shortcode ([data_community id="..."]): A simple code snippet used to embed the content, criteria, and data chart of a specific Community Item onto any WordPress post or page.

4.4 Managing Community Items

All management tasks occur within the Data Community section of the WordPress admin area.

4.4.1 Accessing the Plugin Section

1. Log in to the WordPress admin dashboard.
2. Click on the Data Community menu item in the left sidebar. This will display a list of all existing Community Items, similar to the standard Posts or Pages screen.

4.4.2 Adding a New Community Item

1. Navigate to Data Community -> Add New Item.
2. Title: Enter a clear and descriptive title for this item (e.g., "Test Area Alpha - Building Energy Use", "Community Hub Beta - Social Interaction Score").
3. Content Area: Use the main editor to add any descriptive text, background information, or interpretation related to this item or its data. This content will be displayed on the frontend.

4. Community Item Details (Meta Box): Locate the box labelled "Community Item Details" (usually below the main content editor).
    - Data JSON URL: Upload or enter the full, correct URL pointing to the JSON resource (external or internal) containing the time-series data for this item. Ensure this URL is publicly accessible. Include 1 or 2 datasets:
        - Key dataset is the data collected from pilot areas and is the primary reason for visualising and calculating impacts on frontend.
        - Baseline dataset is the data for comparison to calculate the difference before/after, with a feature or without,… It can be a criteria formed as a straight line (single value), formula of different dataset.

      Please note that important step is the key dataset and baseline dataset preparation, which is done outside of plugin or web components scope.
    - Criteria:
      For each criterion (Social, Economic, Environmental):
        - Enter the value based on the project's indicator methodology (seek Smart CommUnity deliverable D2.3.1 for full overview);
        - Or mark cumulative value calculation;
        - Or input factors for impact value calculation;
    - Enter the Unit (e.g., "/100", "Index", "kWh/capita") as defined by the methodology.
    - Optionally, add a brief Comment for context or specific notes related to the value, again guided by the methodology.

- Impact Criteria Categories

  The plugin is designed to facilitate analysis and expansion of scenarios under the three primary pillars of sustainability:

  - A. Environmental Impact
    Relevant indicators: energy consumption, water use, emissions, waste generation.
  - B. Social Impact
    Relevant indicators: community participation, educational attainment, public health metrics.
  - C. Economic Impact
    Relevant indicators: household income, employment rates, local spending, cost of living.

- These metrics can be completely customized based on the community's data strategy, indicators availability and reporting needs.
- Evaluation Approaches

  The plugin provides support for three principal evaluation methodologies:

  - A. Static Comparison
    Definition: Comparison of individual data points (e.g., daily or monthly) between key and baseline datasets.

    Use case: Identifying specific days or periods where impact deviated significantly from the norm.

    Example:
    Key (2025-01-01): 235.71 kWh
    Baseline: 200.00 kWh
    Difference: +35.71 kWh

  - B. Cumulative Comparison
    Definition: Summation of values across the full period of the dataset for both key and baseline.

    Use case: Evaluating total environmental load or economic output over time.

    Example:
    Cumulative Key Total (January): 8,000 kWh
    Cumulative Baseline Total (January): 7,000 kWh
    Net difference: +1,000 kWh

  - C. Calculated Approach
    Definition: Application of mathematical models or scoring formulas to assess relative impact.

    Use case: Deriving impact indices or weighted scores based on changes from the baseline.

    Example formula:

    *Impact Score = ((Key Value - Baseline Value) / Baseline Value) * 100*

- This approach is extendable via custom logic in the plugin's PHP or JavaScript files.

5. Publish: Click the Publish button (or Save Draft) in the top-right corner.

4.4.3 Editing an Existing Community Item

1. Navigate to Data Community -> All Community Items.
2. Hover over the item you wish to edit and click Edit.
3. Modify the Title, Content, JSON URLs files, or Criteria details as needed.
4. Click the Update button.

4.4.4 Deleting a Community Item

1. Navigate to Data Community -> All Community Items.
2. Hover over the item you wish to delete and click Trash.
3. Deleted items can be found in the Trash view if accidental deletion occurs, from where they can be restored or permanently deleted.

4.5 Displaying Community Data on the Website

To display the information associated with a Community Item on a public-facing page or post:

1. Find the Item ID:
    - Navigate to Data Community -> All Community Items.
    - Hover over the desired Community Item title. Look at the status bar at the bottom of your browser – the URL will contain post=XXX. Alternatively, click 'Edit' and check the URL in your browser's address bar for post=XXX. The XXX number is the Item ID.
    - The "Shortcode" column in the list view also displays the complete shortcode with the correct ID.
2. Edit Target Page/Post: Go to the WordPress Page or Post where you want to display the Community Item's data.
3. Insert Shortcode: In the page/post editor, place your cursor where you want the information to appear. Insert a Shortcode block (in Gutenberg) or switch to the Text/HTML editor and type the following, replacing XXX with the actual Item ID found in step 1:
4. [data_community id="XXX"]
5. Save/Update: Save or update the page/post.

4.6 Understanding the Frontend Display

When a page containing the shortcode is viewed, the plugin will render the following:

1. Title: The title of the Community Item (as an <h3> heading).
2. Content: The descriptive text entered in the main content editor for the Community Item.
3. Criteria: A list detailing the Social, Economic, and Environmental criteria (Value, Unit, Comment) entered for the item.
4. Data Visualization:
    - Chart: If the JSON data is fetched and processed successfully, an interactive Highcharts line chart visualizing the time-series data will be displayed.
    - Error Message: If the JSON URL is incorrect, the file is inaccessible, the data format is invalid, or no compatible data points are found, an error message will be shown instead of the chart.

4.7 JSON Data Requirements

For the chart visualization to work correctly, the JSON file specified in the Data JSON URL field must adhere to the following format:

1. Structure: The file must contain a single JSON array [...].
2. Array Elements: Each element within the array must be a JSON object {...} representing a single data point in the time series.
3. Required Keys per Object: Each object must contain:
    - A Time/Date Key: The key name should be one of time, date, or timestamp. The value should be a string representing a date or date-time that PHP's strtotime() function can understand (e.g., "YYYY-MM-DD", "YYYY-MM-DDTHH:MM:SSZ", "MM/DD/YYYY HH:MM").
    - A Value Key: The key name should be one of value, usage, cumulative_energy_usage_kwh, or daily_energy_usage_kwh ot similar. The value associated with this key must be a number (integer or float). The plugin uses this key name to attempt to set an appropriate Y-axis label on the chart.
4. Data Order: While the plugin attempts to sort the data by time before charting, providing data pre-sorted chronologically in the JSON file is recommended.

Example Valid Object within the JSON Array (simple example):

JSON: { "date": "2024-03-15", "daily_energy_usage_kwh": 155.7}

or

JSON: { "time": "2024-04-01T12:00:00Z", "value": 85.2}

4.8 Troubleshooting

- Shortcode Shows [data_community id="..."] Text: The plugin might be deactivated. Check Plugins -> Installed Plugins.
- Error: "Invalid Community Item ID...": Double-check the ID number used in the shortcode against the ID in Data Community -> All Community Items. Ensure the item exists and is published.
- Error: "No JSON URL configured...": Edit the corresponding Community Item and ensure a valid URL is entered in the "Data JSON URL" field.
- Error: "Error fetching data..." / "Received HTTP status...": Verify the JSON URL is correct, publicly accessible (try opening it in your browser), and that the web server hosting WordPress can reach the URL. Check for typos.
- Error: "Error decoding JSON data...": The file at the URL is likely not valid JSON. Use an online JSON validator to check the file's contents for syntax errors (like missing commas, incorrect brackets, etc.).
- Error: "Could not find compatible time/value keys..." / "Could not process data...": The JSON was fetched and decoded, but the objects inside the array do not contain the expected key names (time/date/timestamp and value/usage/etc.) or the value field is not numeric. Review Section 4.7 and correct the JSON file structure.
- Chart Shows "Loading chart..." Indefinitely: Could indicate a JavaScript error. Open your browser's developer console (usually F12 key) and check the "Console" tab for red error messages related to Highcharts or data-community-chart.js. This might point to conflicts with other plugins or the theme.

4.9 Further Assistance

For issues beyond basic troubleshooting or questions regarding the indicator methodology, please refer to the project documentation repository or contact the project WPIT technical developers (jure.trilar@fe.uni-lj.si or Jorge.Martinez-Gil@scch.at).