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Framework for Super-Labs Assessment

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Abstract

This deliverable includes the presentation of the Assessment Framework for Transition Super Labs covering the Transition Readiness Assessment, the assessment of the efficiency and success of the Transition Process towards climate neutrality and an Evidence-based use case impact assessment methodology.

Project Partners

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List of Acronyms

AHP	Analytic Hierarchy Process
KPI	Key Performance Indicator
MCA	Multicriteria Analysis
OIC	Open Innovation Community
RD&D	Research, Development & Demonstration
SD	System Dynamics
SUMP	Sustainable Urban Mobility Plan
TSL	Transition Super Lab

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Executive Summary

This deliverable is dedicated to the presentation of the Assessment Framework of the Transition Super Lab that covers different aspects of the assessment process including the Transition Readiness Assessment, the assessment of the efficiency and success of the Transition Process towards climate neutrality and an Evidence-based use case impact assessment methodology.

Its objective is to establish a strong connection between the requirements of Transition Super-Labs (TSLs) and the goals of the transition. To facilitate this, a holistic framework was developed, allowing regions to engage in continuous self-assessment towards achieving their transition objectives. This framework includes a customized lifecycle analysis that monitors the transition actions of TSLs and evaluates the impact of TSLs pilot use cases on the decarbonization transition of regions. Additionally, by identifying weaknesses and directing stakeholders' actions, the transition readiness of the ecosystem within TSLs will be enhanced. Furthermore, regions will be guided on achieving a paradigm swift and successful transition through the assessment of the transition process, the supportive tools and structures used.

The deliverable, developed within the Work Package 5, starts with the presentation of the objectives and the methodological overview of the Assessment Framework in Chapter 2 and continues in Chapter 3 with the Transition readiness assessment methodology describing the 6 elements and 22 sub-elements representing transition ecosystems characteristics. The elements of an ecosystem that can be characterised as transition ready should cover aspects of governance & fusion, openness & greenness, transparency and cross-sectorial collaboration, regulations and economy, infrastructure, technology & tools and civil society and stakeholders. The qualitative assessment of readiness will be performed through the Transition Readiness Self-Assessment Tool and will result in a transition readiness score and the identification of the weak points for each TRANSFORMER region.

The next part of the report (Chapter 4) focuses on the TRANSFORMER Transition model and the assessment of the efficiency, and the success of the transition process followed by the TSLs through milestones achievement monitoring. Chapter 5 provides detailed explanations of the evidence-based use case impact methodology including both KPIs and CO_2 quantification.

The deliverable ends in Chapter 6 with conclusions, highlighting the contribution of the Assessment Framework in building a bridge among all the tasks of WP5. The activities of Task 5.2: Impact Evaluation of TSLs pilots in regions and implementation and Task 5.3: Tools and structures assessment will be guided by the Assessment Framework and consequently the results of these two tasks will feed the refinement of the Assessment Framework by the end of the TRANSFORMER project.

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1 Introduction

To achieve climate neutrality, we must change the way the economies are organized. European regions face a wide range of risks and opportunities as a result of physical environmental change and societal responses to that change, especially climate change and the move toward a net zero emissions economic system.

A Transition Super Lab is an ecosystem of actors organized to accelerate the transformation towards climate neutrality through innovation and cross-sectorial synergies on a regional scale. It benefits from collaborative governance, operates in accordance with systemic transformation principles and utilizes transition-enabling methods and tools in order to create added value to cross-sectorial initiatives for economic transformation and to provide feasible solutions to complex regional transformation challenges.

TSL approach adapts and applies enriched living lab methodologies in order to develop together with all transition relevant stakeholders from the quadruple helix and civil society a vision for a regional transformation and a portfolio of large-scale systemic solutions for climate neutrality, net-zero emissions and a resilient future. The systemic transformation within TSL catalyses large and diverse communities to innovate for systemic changes that accelerate transition at scale.

Many respected institutions, including the Bank of England[1], the G20 Financial Stability Board (FSB), and the European Systemic Risk Board[2], have recently raised concerns about the financial stability of regions that will follow a late and abrupt transition to a low-carbon economy. They have emphasized that the lack of appropriate data and the failure to use an Assessment Framework throughout the whole transition process will be a significant impediment to policy and decision-makers (among others) in properly understanding risks and impacts and responding to the transition challenges. Closing this significant gap is now an urgent priority.

This document presents a holistic Assessment Framework that will facilitate Transition Super Labs to accomplish the transition towards climate neutrality. It is based on a set of indicators that can provide a systematic overview of the change that is occurring (or not occurring) in critical underlying processes. It could be used for both reporting and planning purposes at the regional levels, and the present document outlines where and how this should be done. This document describes the early structure of the

[1] Bank of England-Financial Policy Committee, (2022), Financial Stability Report, https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2022/financial-stability-report-july-2022.pdf

[2] European Central Bank, (2022), Financial Stability Review, https://www.ecb.europa.eu/pub/financial-stability/fsr/html/ecb.fsr202211~6383d08c21.en.html#toc15

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Assessment Framework that will be enriched and fine-tuned by the end of the project with the lessons learned from its implementation in the 4 TRANSFORMER TSLs.

Net zero emission solutions frequently demand cross-sector collaboration. Measuring and assessing progress toward climate neutrality must capture the underlying complexity in order to inform policy-making in a timely and sufficient way.

This Deliverable is structured as follows: in a first step, the objectives of the Assessment Framework are presented and the methodological approach that was followed for developing the Transition Assessment Framework is described (Chapter 2). The methodologies that were developed to cover the three main elements of the Assessment Framework are elaborated in detail in the following chapters: The Transition Readiness Assessment (Chapter 3), Assessing the efficiency and success of the Transition Process towards climate neutrality (Chapter 4) and the Evidence-based use case impact assessment methodology (Chapter 5). The Deliverable concludes with a summary of the results (Chapter 6).

2 TRANSFORMER Assessment Framework for Transition Super-Labs

2.1 Objectives of the Assessment Framework

The assessment of the TSLs is an indispensable feature of the 'learning by doing approach' that will guide regions on how to achieve a speedy and successful transition.

The development of a common holistic framework for this assessment contributes to the coordination of the activities for pilot evaluation, including assessment criteria, adaptation of assessment methods, and the refinement, and harmonization of data analyses methods and data management that are aligned to the regional SWOT analyses that are developed as feasibility studies (WP2) and the setting-up of TSLs uses cases (WP3) from an evaluation perspective.

The Assessment Framework was built by combining valuable input collected through:

- the desktop research on LLs assessment methodologies and Transition assessment techniques
- the coalition building activities of WP3 (interviews, workshops, stakeholders mapping etc) and training activities performed by ENoLL (mapping canvas of the TSLs) that contribute to better understanding the pilots' context, needs, key parameters for success and cross-sectorial collaborations
- the pilot use cases as they were defined in WP3
- the experience of TLS predecessors included in ''D2.1-Summary of data collection on TSL predecessors''

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The aim of the Assessment Framework isn't limited to impact assessment and the evaluation of supportive tools and structures but creates a bridge between TSLs requirements and transition goals and provides to TSLs a valuable asset that will enable regions to increase the innovation readiness of their ecosystem and perform a continuous self-assessment towards the achievement of their transition objectives.

The objectives of the Assessment Framework are to:

- Create the bridge between TSLs requirements & transition goals
- Provide a holistic framework that will enable regions to perform a continuous self-assessment towards the achievement of the transition objectives by monitoring the TSLs transition actions through a customized lifecycle analysis
- Evaluate the impact of Transition Super-Labs on the decarbonization transition of regions
- Assess the Transition Super-Labs supportive tools and structures
- Increase innovation readiness of the ecosystem within the TSLs by defining weak points for directing the actions of stakeholders
- Guide regions on how to achieve a speedy and successful transition through the transition process assessment

The Transition Assessment Framework will guide TSLs through-out the assessment activities, providing a synopsis of criteria, methods, data analysis tools and data management processes for the evaluation and validation sub-activities. Through the implementation of the Transition Assessment Framework, the TSLs will be able to coordinate their activities and set clear timelines, responsibilities and tasks for all participating parties, minimizing effort towards the achievement of the transition towards climate neutrality. Finally, the Transition Assessment Framework will support TSLs in reporting their assessment processes and outcomes and ensure the harmonization of the assessment activities among TSLs to achieve and support cross-TSLs assessment.

2.2 Methodological Approach for developing the Transition Assessment Framework

The Assessment Framework will cover:

- Transition Readiness Assessment
- Assessing the efficiency and success of Transition Process towards climate neutrality
- Evidence based use case impact assessment methodology

The main questions that the TSL will be able to answer after the implementation of each of the above assessment methodologies are the following respectively:

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- Is the region's ecosystem ready for delivering transition?
- Is the transition process performed by the ecosystem successful?
- Do the pilot use cases contribute to the transition achievement towards climate neutrality?

Evaluation Framework Methods: Different methods could be applied during the Evaluation Framework implementation such as baseline measurement, KPIs quantification, Traceability Matrix, Multicriteria Analysis (MCA), and Analytic Hierarchy Process (AHP).

3 Transition Readiness Assessment

The transition readiness assessment of a region is built upon the following elements:

- ✓ Systemic approach to cross-sectorial transition ecosystem definition *("what is a transition ready ecosystem?"*)
- ✓ Elements representing transition ecosystems characteristics (What we need to have for being a transition ready region?)
- ✓ Qualitative Assessment of readiness (benchmarking and qualitative assessment of the existence of enablers & of the absence of barriers of transition in different sectors)
- ✓ Weak points definition (what to do for accelerating readiness?)

3.1 Systemic approach to cross-sectorial transition ecosystem definition

The transition readiness assessment follows an ecosystem-based approach to define a cross-sectorial transition ecosystem and identify the main elements of a region that affect its readiness and capability in deploying innovation and achieving a speedy and successful transition towards climate neutrality.

The concept of "ecosystem" originates from the field of ecology[3]. Biologists and natural scientists use this term to describe a system comprising a habitat, all living organisms, and all non-living physical and chemical elements in the observed environment. The comparison to a "system" is crucial because it ensures the comprehensive functioning of an ecosystem, driven by the following key characteristics: interaction among living organisms, management of assets that encompasses the stages of creation, operations, reuse, destruction, release, and abolishment of assets and objects within the habitat, the establishment of energy and nutrition cycles to support life and survival while preserving values and benefits for all ecosystem members.

[3] Flügge, B. (2017). The Mobility Ecosystem. In Smart Mobility - Connecting Everyone: Trends, Concepts and Best Practices (pp. 47–68). https://doi.org/10.1007/978-3-658-15622-0_3

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According to Scott Slocombe (1993) ecosystem-based approaches contribute to improving regional-scale planning and management processes comprising interacting ecological, economic and social components[4] and moving away from a limited consideration of natural systems and society as separate entities[5]. Social-ecological ecosystems are therefore complex ecosystems that should be analysed in a holistic, integrated way[6] and this explains the reason that the new EU Strategy on Adaptation to Climate Change identifies ecosystem-based approaches as a cross cutting priority[7].

By representing TSLs within an ecosystem approach, it promotes collaboration, resource optimization, learning, and adaptive management. An ecosystem offers the ability to connect data, relationships, knowledge and expertise. This approach enhances the collective effort to accelerate the transition towards a sustainable and resilient future. It recognizes how these sectors are interconnected and interdependent, and their integration is crucial for achieving holistic and effective climate solutions. The ecosystem approach emphasizes the importance of collaboration and synergies among these sectors, leveraging their respective strengths and resources to drive sustainable transformations. By fostering a systemic view, the ecosystem approach ensures that efforts are coordinated, knowledge is shared, resources are accessible, and actions are aligned, leading to a more integrated and impactful approach to address climate challenges.

Thus, adopting the cross-sectorial ecosystem approach enables the TSLs to bridge the gap between all the stakeholders, processes and systems involved in every transition step and to facilitate a more efficient collaboration between them, with greater transparency, inclusiveness and better management processes[8, 9].

[4] Scott Slocombe, D. (1993), Implementing Ecosystem-Based Management, BioScience, Vol. 43, No. 9, pp. 612-622, Oxford University Press
[5] Delacámara, G., G. O'Higgins, T., Lago M. & Langhans S., Ecosystem-Based Management: Moving from Concept to Practice, Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity pp 39–60
[6] Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science, 325*(5939), 419–422.
[7] European Commission (2021), Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change
[8] Equus Software. (2018). Applying an Ecosystem Approach to Global Mobility Management. https://www.equusoft.com/wp-content/uploads/2018/05/Ecosystem-Approach-to-Global-Mobility-WP-1.pdf
[9] Rockström et al. (2009), Planetary Boundaries: Exploring the Safe Operating Space for Humanit, Ecology and Society 14(2): 32

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3.2 Elements representing transition ecosystems characteristics

Figure 1 depicts the elements and sub-elements that a transition-ready ecosystem consists of; specifically, it consists of 6 elements and 22 sub-elements.

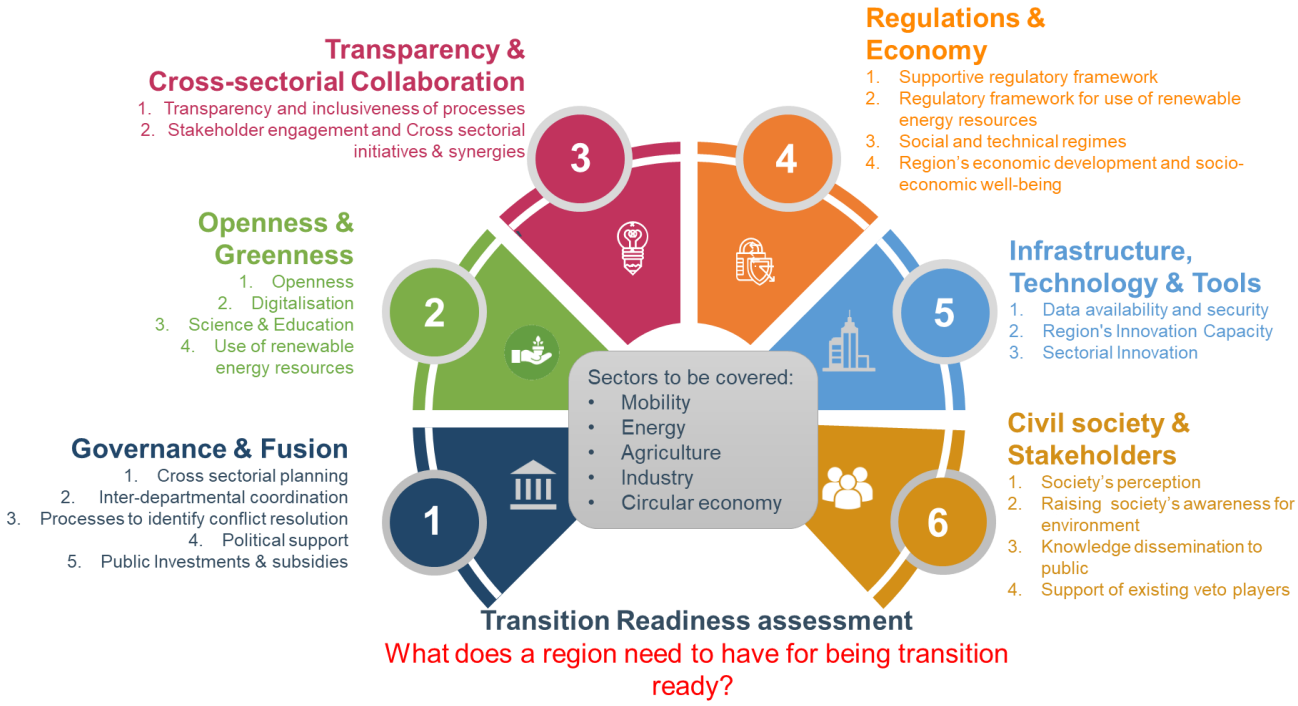

Figure 1: Elements and sub-elements of a Transition ready ecosystem (own design)

The elements of an ecosystem that can be characterised as transition ready should cover aspects of governance & fusion, openness & greenness, transparency and cross-sectorial collaboration, regulations and economy, infrastructure, technology & tools and civil society and stakeholders. Each element and sub-element were selected through extended literature review on what are the main characteristics of a sustainable ecosystem that aims to achieve systemic transformation through innovation. Many of these characteristics were also found in the experiences of TLS predecessors included in ''D2.1-Summary of data collection on TSL predecessors'' and/or they were identified by TRANSFORMER regions as current difficulties towards the development of a successful TSL. The elements and sub-elements are described in detail in the following subsections.

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3.2.1 Governance & Fusion

The Governance & Fusion element of a TSL aims to orchestrate seamless cross-sectorial planning to develop holistic climate-neutral strategies and policies for designing and implementing climate initiatives. As region's challenges are interconnected and cannot be effectively addressed by a single sector, cross-sectorial planning breaks down silos and pave the way for a TSL to innovate and provide comprehensive and holistic solutions for addressing climate change challenges. Through cross-sectorial planning, the region optimizes outcomes and minimizes conflicts or unintended consequences that may arise from sector-specific approaches. This aspect is further enhanced through inter-departmental coordination mechanisms to oversee climate action implementation. To manage potential conflicts that might arise in such a complex setting, efficient and fair conflict resolution mechanisms should be further established for harmonizing stakeholders' objectives, identifying shared goals and aligning actions to achieve sustainable, inclusive, and smooth operation of a TSL. Finally, political support is critical for pushing forward ambitious climate agendas, influencing policy frameworks, and securing necessary resources through public investments and subsidies that incentivise and fund the TSL's transformational efforts and operation[10].

Definition: Governance & Fusion refers to the integration of various sectors in the planning, and the inter-departmental coordination for implementing climate-neutral solutions. It also encompasses aspects such as public investment, conflict resolution mechanisms and political support.

3.2.2 Openness & Greenness

Openness refers to the degree of the region's accessibility, interconnectivity, and permeability to external environment and ensures the uninterrupted flow of knowledge, ideas and resources between them and within the TSL. Openness could be interpreted as a combination of different dimensions including breadth and depth[11], freedom[12,13], number of phases and actors[14]. Networking with external national and international institutions that are characterised by heterogeneity in skills and high expertise and are free to participate and collaborate in more than one phase of the transition process would indicate the more

[10] Ciasullo, M.V., Troisi, O., Grimaldi, M. et al. Multi-level governance for sustainable innovation in smart communities: an ecosystems approach. Int Entrep Manag J 16, 1167–1195 (2020). https://doi.org/10.1007/s11365-020-00641-6

[11] Idrissia et al., (2012), SMEs' degree of openness: The case of manufacturing industries. Journal of Technology Management & Innovation, 7 (2012), pp. 186-210 http://dx.doi.org/10.1016/j.jenvman.2019.109564 | Medline

[12] Herzog, 2008, Open and closed innovation – Different cultures for different strategies. Gabler, (2008),

[13] Aslesen and Freel, (2012), Industrial knowledge bases as drivers of open innovation?. Industry & Innovation, 19 (2012), pp. 563-584 http://dx.doi.org/10.17226/9831 | Medline

[14] Lazzarotti and Manzini, (2009), Different modes of open innovation: A theoretical framework and an empirical study. International Journal of Innovation Management, 13 (2009), pp. 615-636

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far reaching and sustainable openness[15]. Digitalization plays a pivotal role in this regard, boosting connectivity through platforms and tools for efficient collaboration and facilitating data access and decision-making. As digital transformation removes silos and allows stakeholders to collaborate into innovation creation, the integration of digital technologies and infrastructures transforms and improves the connectivity and value creation within the ecosystem[16]. However, digital transformation may also create new borders and exclusion mechanisms that should be addressed and dealt with (e.g., citizens who don´t know how to use digital tools). Towards this direction, it is essential for a region to invest in educational programs that enhance stakeholders' and society's understanding for climate issues and potential solutions and in parallel increase their digital competence, keeping them informed and consequently engaged throughout the transition process[17]. Concurrently, focusing on science means having dedicated institutions for independent scientific advice on climate policy and institutions that conduct renewable energy RD&D activities as the transition should be supported by rigorous research and objective facts. Finally, to invest in "greenness", the region should increase the share of renewable energies in gross final energy consumption, aligning thus its operational practices with broader sustainability goals[18] (data based on the EU ranking of 2021)[19].

Definition: Openness & Greenness refers to region's networking with external environment, digital technologies to leverage collaboration and data access, scientific capacity and educational programs, and the use of renewable energy resources in the pursuit of climate neutrality.

3.2.3 Transparency & Cross-sectorial Collaboration

Transparency & Cross-sectorial Collaboration plays a crucial role in the functioning of a TSL. Transparent and inclusive governmental processes form the backbone of a TSL operation. Based on democratic principles, they empower stakeholders to be informed, engaged, and involved in shaping decisions that affect them, leading to more inclusive, participatory and sustainable TSL operations. Ensuring transparency in all transition steps as described in Chapter 4, guarantees that all actions and outcomes of each process are openly shared among stakeholders, fostering a culture of trust and accountability among

[15] Öberg, C. and Allen T. A., (2019). The openness of open innovation in ecosystems – Integrating innovation and management literature on knowledge linkages, Journal of Innovation & Knowledge, Vol. 4. Issue 4. pages 211-218
[16] Robertsone, G., Lapiņa, I. (2023). Digital transformation as a catalyst for sustainability and open innovation, Journal of Open Innovation: Technology, Market, and Complexity, Volume 9, Issue 1
[17] Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, EUR 31075 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-52452-6, doi:10.2760/54, JRC129319.
[18] Wang, R., Li, F., Hu, D., & Larry Li, B. (2011). Understanding eco-complexity: Social-Economic-Natural Complex Ecosystem approach. Ecological Complexity, 8(1), 15–29. https://doi.org/https://doi.org/10.1016/j.ecocom.2010.11.001
[19] Eurostat (2021), Share of energy from renewable sources, https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ren/default/table?lang=en

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all parties[20]. This transparency allows for a thorough examination, constructive critique, and collective learning, creating an environment conducive to innovative and effective climate solutions. A region that operates through transparent processes enforces stakeholders' engagement in participatory approaches and provides fruitful ground for the development of cross-sectorial initiatives and synergies that aim to bring together the transition-related stakeholders from the quadruple helix to work towards common goals and solutions. The integration of different perspectives, expertise, and resources from various sectors fosters a sense of ownership and commitment among stakeholders, enhancing the potential for the long-term success of the TSL 's initiatives[21]. By leveraging the strengths of different sectors, the TSL builds upon new ideas and opportunities, gearing the transition capacity of the ecosystem[22].

Definition: Transparency & Cross-sectorial Collaboration refers to the commitment to maintaining clear and open governmental processes, while fostering initiatives that enhance stakeholder's engagement and bridge different sectors to achieve synergistic solutions towards climate neutrality.

3.2.4 Regulations & Economy

The Regulations & Economy element of TSL highlights the critical role of policies, legal frameworks, and economic factors in facilitating a sustainable transition. A supportive regulatory framework for transition establishes an environment that aligns with the TSL's mission, providing guidelines and measures that accelerate the transition towards climate neutrality. Specific regulations regarding the use of renewable energy resources further reinforce the region's commitment to sustainability, encouraging the adoption of cleaner energy sources and facilitating the shift away from fossil fuels. Although transition characteristics vary between regions, the existing socio-technical regimes often block the way towards innovation. The opening-up -technical regimes is critical for the creation of new opportunities that will accelerate the transition towards climate neutrality[23]. Socio-technical transitions require changes not just in technology, but also in practices, rules, and shared assumptions across a variety of societal sectors (e.g., societal acceptance and behaviour change). Moreover, the region's economic development, socio-economic well-being, prosperity and resilience should be assessed for ensuring the economic viability of

[20] Baccarani, C., & Golinelli, G. M. (2014). Le parole dell'innovazione (The words of innovation). Sinergie, 94 (May-Aug), 9–14.
[21] Oomens, I. M. F., & Sadowski, B. M. (2019). The importance of internal alignment in smart city initiatives: An ecosystem approach. Telecommunications Policy, 43(6), 485–500. https://doi.org/https://doi.org/10.1016/j.telpol.2018.12.004
[22] Reggi, L., Dawes, S. (2016). Open Government Data Ecosystems: Linking Transparency for Innovation with Transparency for Participation and Accountability. In: ,et al. Electronic Government. EGOV 2016. Lecture Notes in Computer Science(), vol 9820. Springer, Cham. https://doi.org/10.1007/978-3-319-44421-5_6
[23] Geels, W. F. (2020). Transformative innovation and socio-technical transitions to address grand challenges, European Commission- Directorate-General for Research and Innovation (Working paper)

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the climate transition actions. The Regulations & Economy element provides the structural and economic foundation that supports the region's transformative agenda[24].

Definition: Regulations & Economy refers to the integration of supportive regulatory frameworks, social and technical regimes, and regulations related to the use of renewable energy resources, while considering the region's economic development and socio-economic well-being, in the pursuit of climate neutrality.

3.2.5 Infrastructure, Technology & Tools

The Infrastructure, Technology & Tools that a region can utilise in its operations are included among the facilitators of the transition towards climate neutrality, creating a dynamic and enabling environment for the collaborative creation of sustainable, climate-neutral solutions[25]. Data availability plays a critical role in the context of climate transition and digitalisation as it contributes to the identification of the region's challenges and the development of suitable solutions for addressing the region's needs through data-based decision making and tracking progress processes. To ensure data availability and security, the region needs to establish a secure, trustworthy, and resilient digital infrastructure that protect data privacy through suitable methods (e.g., anonymization) and empowers end users to understand how their data is used and the added value for them. Data governance regulations must also be defined to ensure clarity about data ownership and accessibility[26]. A rich data pool supported by reliable and robust data infrastructure increase region's capacity for innovation enabling its ability to exploit existing knowledge, skills and resources that can create a sustainable competitive advantage by driving innovation activities in a constantly changing environment towards the achievement of climate transformation. To address the causes or the impacts of climate change and achieve a successful transition towards climate neutrality innovative technologies relied on knowledge from different fields are required. Due to the technological complexity, there is high degree of risks and uncertainties[27]. This could be eliminated if the technologies are well embedded in sectorial innovation enabling the technological advancements and the development of cross-sectorial solutions[28].

[24] Wang et al., (2011)
[25] Ahlers, D., Wienhofen, L.W.M., Petersen, S.A., Anvaari, M. (2019). A Smart City Ecosystem Enabling Open Innovation. In: Lüke, KH., Eichler, G., Erfurth, C., Fahrnberger, G. (eds) Innovations for Community Services. I4CS 2019. Communications in Computer and Information Science, vol 1041. Springer, Cham. https://doi.org/10.1007/978-3-030-22482-0_9
[26] Reggi and Dawes, (2016)
[27] Wu,Y., Gu,F. Y. Ji, J. Guo, Y. Fan, (2020), Technological capability, eco-innovation performance, and cooperative R&D strategy in new energy vehicle industry: evidence from listed companies in China, Clean. Prod., 261, pp. 121-157
[28] Ahlers et al., (2019)

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Definition: Infrastructure, Technology & Tools refer to the essential physical and digital assets and advanced technologies that facilitate innovation. This encompasses the availability of secured data, the innovation capacity of the region, and the potential for innovation within various sectors.

3.2.6 Civil Society & Stakeholders

The Civil Society & Stakeholders play a vital role in the broader societal engagement for achieving climate neutrality. The perception of society is a crucial factor that can influence the acceptance and effectiveness of climate initiatives. Therefore, understanding and positively influencing these perceptions are essential aspects in the transition process. Increasing society's environmental awareness is another key component, involving educational efforts aimed at enhancing understanding of climate change and the imperative for action. A crucial part of this effort also involves the knowledge dissemination to the public. By fostering the diffusion of a shared vision and sustainable goals towards the achievement of climate neutrality, public awareness is enhanced, and fostering societal buy-in for the transformation[29]. Finally, involvement and support of existing "veto" players[30], defined in transition as influential individuals or groups capable of significantly impacting[31].

Definition: Civil Society & Stakeholders refer to the engagement of the broader society and all relevant stakeholders in the process of achieving climate neutrality. This includes understanding and shaping society's perception, raising environmental awareness, disseminating knowledge to public and identifying and engaging veto players.

3.3 Qualitative Assessment of readiness

The Transition Readiness Self-Assessment Tool provides a structured framework to evaluate what a region needs to have for being ready in transition to innovation. It considers various dimensions such as governance structure, policy framework, stakeholder engagement, technological infrastructure, economic and social readiness. Through dedicated questions for each sub-element the tool assesses the region's coordination, collaboration, and transparent processes, as well as its policy alignment and stakeholder inclusivity. It also evaluates the region's technological capabilities and social awareness. The Transition Readiness score is calculated as a weighted average of each question's response, reflecting the region's readiness at the total, element, and sub-element levels.

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[29] Kourtit, K., Nijkamp, P., & Arribas-Bel, D. (2012). Smart cities perspective-a comparative European study by means of self-organizing maps. Innovation: The European Journal of Social Science Research, 25(2), 229–246. https://doi.org/10.1080/13511610.2012.660330

[30] In game theory "A Veto player is a stakeholder whose utility maximization objective has the most prominent impact on the outcome of a conflict".

[31] Darbandsari P, Kerachian R, Malakpour-Estalaki S, Khorasani H. An agent-based conflict resolution model for urban water resources management. Sustain Cities Soc [Internet]. 2020;57(March):102112. Available from: https://doi.org/10.1016/j.scs.2020.102112

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This comprehensive scoring approach allows for a thorough assessment, enabling targeted interventions to enhance specific areas of readiness. Table 2 in the Annex includes the identified questions for assessing transition readiness in a region.

The finalization/validation of the sub-elements will take part in two steps by the end of M12:

- Validation of sub-elements: An expert workshop including partners from RUB, RC, BMR, FIT, Uni Warsaw and ENoLL will be organized by CERTH to assess the importance of sub-elements. Using consensus-building methods like the Delphi approach, experts will provide individual ratings and engage in iterative rounds to reach a collective understanding. The workshop will culminate in the selection of final sub-elements based on the level of consensus achieved. This participatory approach ensures that the chosen sub-elements for the assessment tool are considered important by the expert panel, enhancing the credibility and validity of the subsequent transition readiness assessment.
- Validation of the content of the dedicated questions for each sub-element and prioritization of elements: a second workshop will be conducted by CERTH with the same group of experts to validate the content of the questions. The experts will be asked to evaluate if the description of the answer in each level (1: lower level, 5: higher level) is the most appropriate based on their knowledge and expertise. For example, if an answer's description provided in level 5 does not portray the best possible scenario for a region, the experts have the option to redefine it. Moreover, the self-explanatory character of the answers will be assessed during the workshop and suggestions for improvement will be taken into account. Finally, during this second workshop weights will be assigned to the elements/sub-elements that will be used during the calculation of the transition readiness of each region. Methodologies such as the Analytic Hierarchy Process (AHP) will be employed during the workshop. The experts will participate in pairwise comparisons and utilize the AHP framework to determine the relative importance or weight of each element/sub-element. The workshop will provide a collaborative environment for experts to discuss and reach a consensus on the content of the qualitative assessment and the assigned weights. By incorporating expert judgments using established methodologies like AHP, the quantitative assessment tool will reflect the relative significance of the elements/sub-elements in driving the transition readiness, enhancing the accuracy and robustness of the assessment.

As soon as the sub-elements and their content are validated, a third workshop will be held with TSLs in order to get them familiar with the refined Transition Assessment Framework and how they should use it.

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3.4 Definition of the weak points of the transition readiness

The Transition Readiness scores will be calculated for each region within the project, and general statistics such as the mean, median, standard deviation, minimum, and maximum will be derived from these scores. The scores of the elements and sub-elements for each region will be calculated by comparing their respective scores with the mean minus the standard deviation. Elements and sub-elements with scores below this threshold will be identified as weak areas requiring attention and improvement while points with values over the mean plus the standard deviation will be identified as strong points.

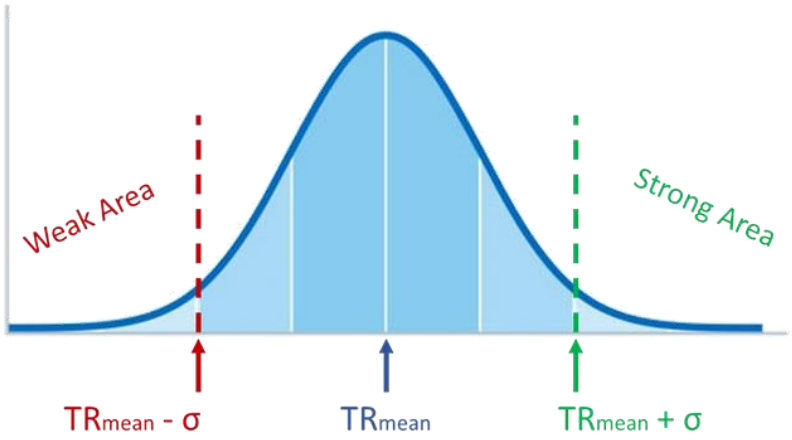

Figure 2: Weak and strong points identification based on their Transition Readiness score

This analysis allows for a comparative assessment with benchmark and other region's transition readiness, highlighting areas of concern that fall below the average performance and providing best practices of the most transition ready regions. This latest will be valuable input for the Knowledge Hub (Task 4.3) to guide TSLs on how to achieve a speedy and successful transition.

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4 Assessing the efficiency and success of Transition Process towards climate neutrality

There are different approaches for assessing the successful implementation of innovation such as the system dynamics, the open innovation community and the NESTA innovation model (spiral).

As an innovation system is a complex and dynamic system that continuously evolves, a need for shift from static and descriptive methods to more dynamic and forward-thinking ones has emerged. Towards this direction, the last years system dynamics technique has been used to model innovation systems besides the modelling of intricate socio-economic systems that has been extensively employed for.

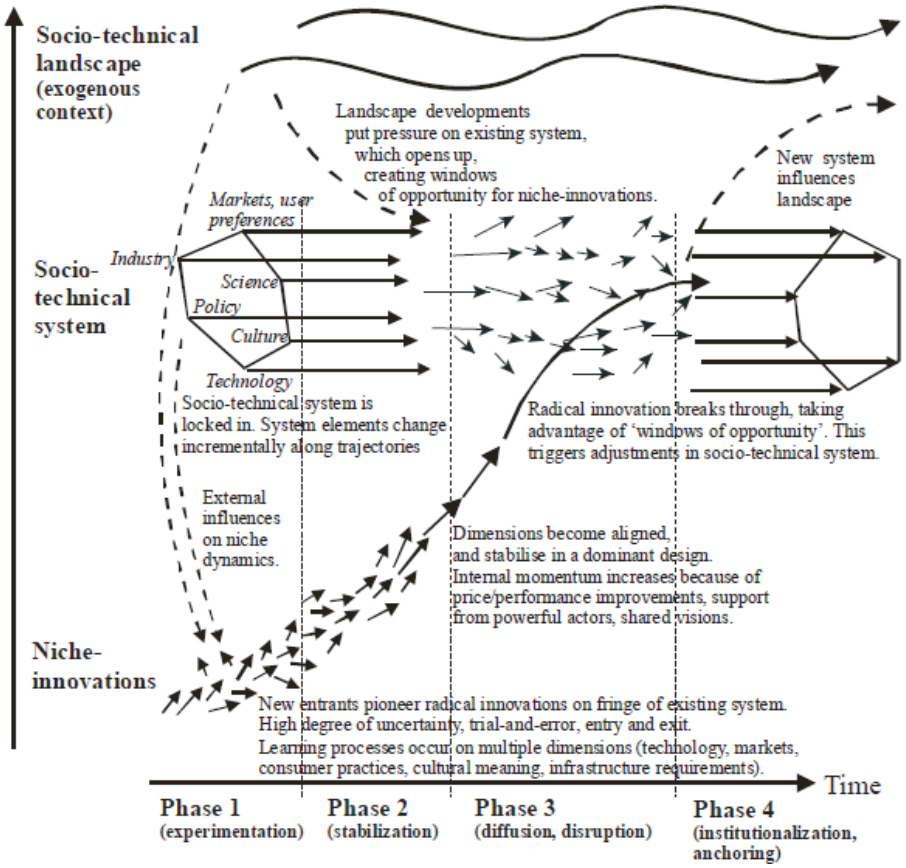

Figure 3: Multi-level perspective on socio-technical transitions (Source: Geels, 2020)

System Dynamics (SD) modelling has been established as a method and tool for three main purposes: i) to identify feedback loops to uncover the primary mechanisms of growth, balance, and erosion (or stagnation) that drive the dynamic behaviour of socio-economic systems, ii) to replicate - that is, simulate - the system's dynamic behaviour using differential equations, and iii) to test and develop more effective policies that lead to enhanced system performance. In this context, the modelling process in system

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dynamics is a cyclical one, involving five main stages: problem definition, dynamic hypothesis creation, model formulation, model testing (or validation), and policy formulation/evaluation[32].

In the literature, open innovation is characterized as a strategy that allows organizations to tap into external expertise and technological capabilities that are not internally accessible. This approach aims to decrease innovation expenses and simultaneously distribute the associated risks[33]. The three main open innovation processes consist of: the outside-in process, also known as technology exploration or inbound innovation[34] [35]; the inside-out process, also defined as technology exploitation or outbound innovation; and the combination of both.

Open Innovation Community (OIC) follows a a crowdsourced participatory innovation approach that: (1) facilitate a debate generation and consensus building; and (2) validate the results of the examined innovation. The added value of OIC (in relation to other stakeholder platforms) stems from: (i) its explicit focus on urban policy issues and the policy requirements of emerging mobility solutions; (ii) the incorporation of international members, bringing together relevant experiences and insight. The OIC gathers stakeholders such as expert communities, local practitioners and policy-makers as well as innovators from the private side. Also, networks and associations of these groups can be involved, given their inherent expertise and multiplicator capacity. The Open Innovation Community adopts a Communities of Practice structured approach aimed at enhancement, transfer and take-up of innovation findings contributing. It also serves as a dissemination audience to maximise the innovation impacts. The OIC approach was successfully implemented in SPROUT project[36] with an explicit focus on urban transport policy issues involving urban mobility policy makers, economic operators, and researchers in the form of an Open Innovation Community on Urban Mobility Policy.

[32] Uriona Maldonado, Mauricio & Grobbelaar, Sara. (2017). System Dynamics modelling in the Innovation Systems literature.
[33] Enkel, E., Gassmann, O. and Chesbrough, H. (2009), “Open R&D and open innovation: exploring the phenomenon”, R&D Management, Vol. 39 No. 4, pp. 311-316.
[34] Dahlander, L. and Gann, D.M. (2010), “How open is innovation?”, Research Policy, Vol. 39 No. 6, pp. 699-709.
[35] van de Vrande, V., de Jong, J.P.J., Vanhaverbeke, W. and de Rochemont, M. (2009), “Open innovation in SMEs: trends, motives and management challenges”, Technovation, Vol. 29 Nos 6-7, pp. 423-437.
[36] SPROUT project (https://sprout-civitas.eu/)

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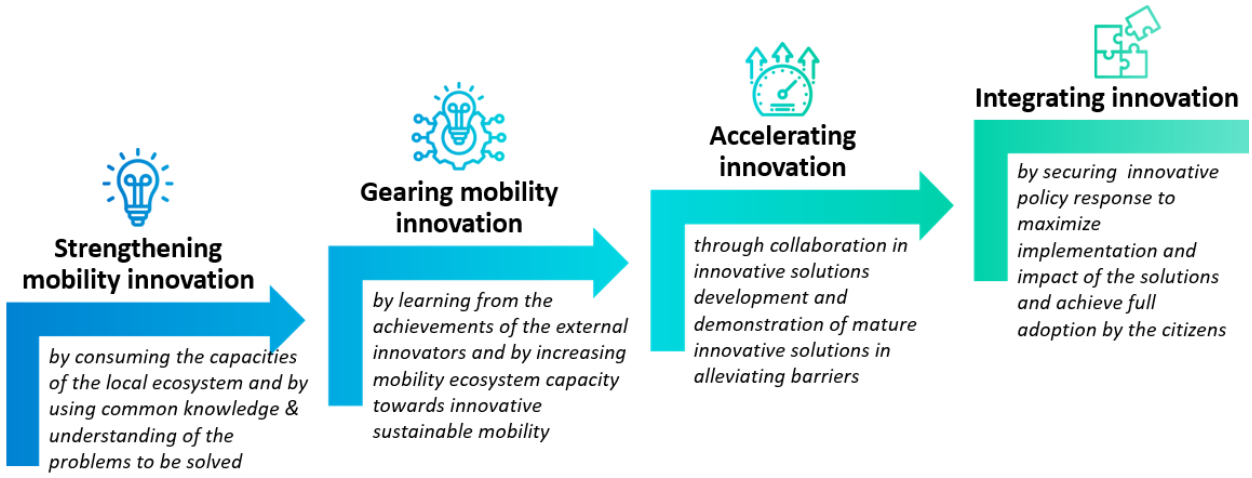

Figure 4: The Open innovation community approach in mobility context

While each innovation is a complex narrative of feedback loops, Nesta innovation spiral presents the structured phases that most innovations undergo. Nesta approach is dedicated to discovering, examining, and validating new approaches, instruments, and procedures (collectively referred to as innovation methods) to foster innovation from diverse sectors and global sources[37]. The steps and the innovation methods to be engaged in each step are depicted in Figure 5. Although NESTA model doesn't correspond to the complex and non-linear phases of the innovation creation, it was studied as state-of-the-art, as its phases provide valuable input for the development of the steps of the TRANSFORMER transition model as described below.

[37] NESTA, A compendium of innovation methods, Available at: https://media.nesta.org.uk/documents/Compendium-of-Innovation-Methods-March-2019.pdf

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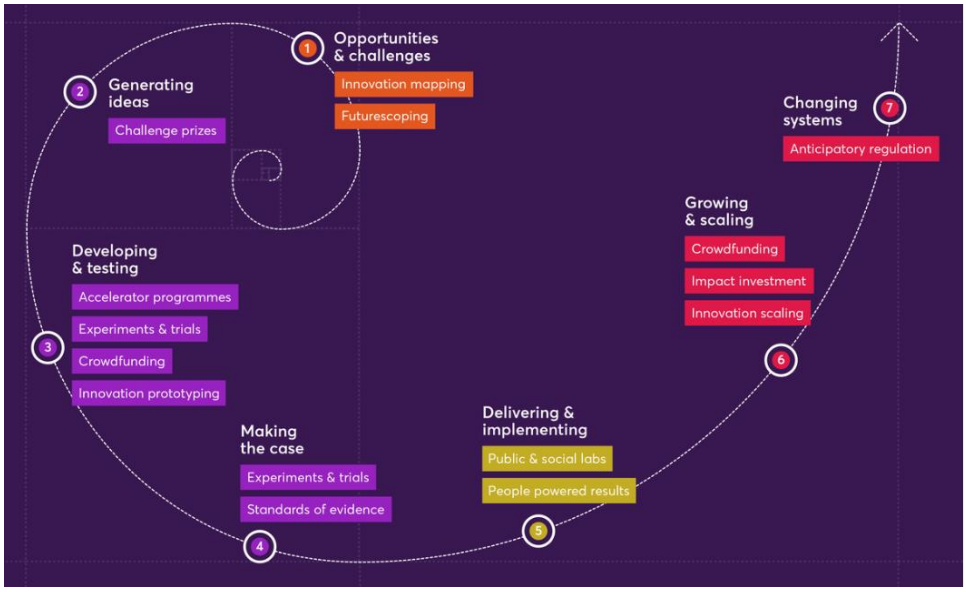

Figure 5: NESTA spiral (https://www.nesta.org.uk/feature/innovation-methods/)

As the cross-sectorial transition towards climate neutrality is an emerging topic that isn't widely studied, there is no literature related to the assessment of transition through innovation. As the System Dynamics of cross-sectorial innovation would be a method with high complexity, the TRANSFORMER transition model considers a combination of the open innovation community steps with NESTA innovation spiral. However, aspects related to systems dynamics have been integrated in TRANSFORMER model (e.g., identification of key stakeholders, relationships mapping) along with elements that exist in traditional planning methodologies (e.g., SUMPs).

The 4 steps of the TRANSFORMER transition model that a TSL should follow to achieve a paradigm shift towards a climate neutral transition based on the combination of open innovation process and NESTA innovation spiral is presented in Figure 6. It is important to ensure that data generated from each step of the process will be collected by the TSLs for the quantification of the milestones in a later stage (e.g., number of stakeholders engaged, identified weak points, defined "quick wins", number of suggested structural reforms, etc.). The TSLs will be asked to fill in the dedicated log files that will be created and uploaded in the project's SharePoint by CERTH. By quantifying the milestones, the formulation of best practices that will be integrated in Knowledge Hub will be feasible.

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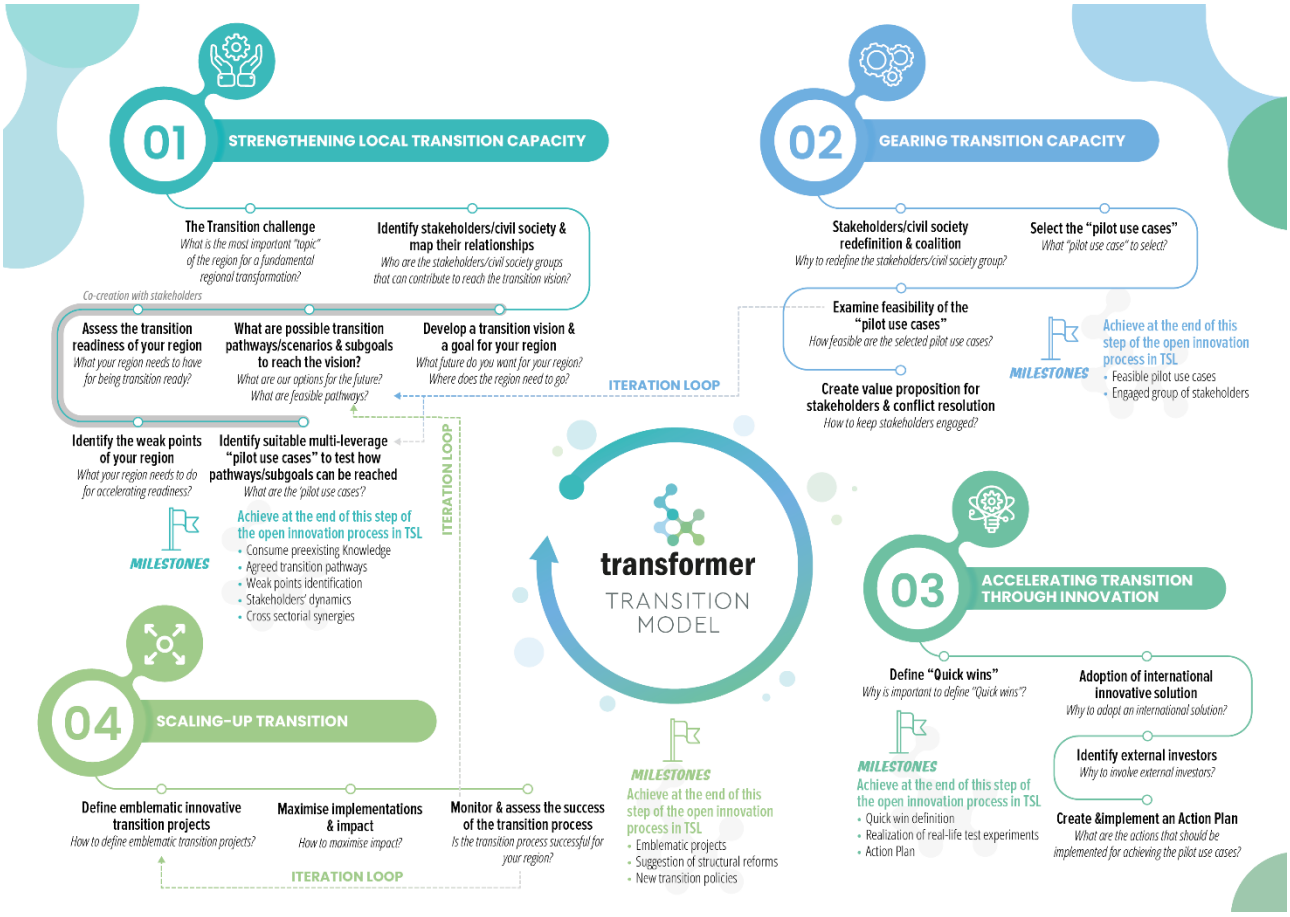

Figure 6: TRANSFORMER transition model

The efficiency and success of the transition process is assessed through the achievement of the defined milestones to be reached at the end of each step in the suggested timeline (milestone achievement monitoring). The milestones and timelines suggested are based in TRANSFORMER TSLs experience within the two years project. They will be further validated and enriched at the end of the project and thus, they can be slightly modified.

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4.1 The transition process towards climate neutrality

The open innovation process towards a climate neutral transition (TRANSFORMER transition model) is described below:

4.1.1 Strengthening local transition capacity

This first step is a preparatory stage that helps each TSL to create a fertile ground for the transition by consuming the capacities of the local ecosystem and by using common knowledge & understanding of the problems to be solved. This stage contains a sequence of paces that a TSL should follow and the milestones that should be achieved at the end of this stage are considered critical for the continuation and the success of the transition process:

1. Defining the challenge in the region.
2. Identifying stakeholders based on the challenge.
3. Collaborating with stakeholders to establish the vision.
4. Engaging stakeholders in discussions to explore potential pathways and scenarios for realizing the vision.
5. Assessing the transition readiness of the region (based on the methodology described in Chapter 3)
6. Identifying the weak points of your region (based on the methodology described in Chapter 3)
7. Identifying suitable multi leverage ''pilot use cases'' to test the achievement of the pathways, vision and objectives.

Transition challenge

Transition challenge of TSLs refer to the main difficulty and obstacle faced by the region during its transition period from fossil-fuel-based to zero-carbon local economies. Sometimes this challenge resulted from the need of the region for economic and social transformation and is already predefined in European, national and/or regional strategic plans. However, often transition strategies don´t exist or although they exist, there are different, more urgent transition needs and challenges that are not addressed in the strategic plans due to political reasons and lobbying. Thus, the TSLs need to define their transition challenge based not only to the existing strategic plans but also considering the real needs of the region.

Coalition building

A coalition is a temporary alliance or partnering of groups in order to achieve a common purpose or to engage in joint activity. Coalition building is seen as the process by which parties (individuals, organizations, or nations) come together to form a coalition. Forming coalitions with other groups of similar values, interests, and goals allows members to combine their resources and become more powerful than when they each acted alone[38]. In the TRANSFORMER project, coalition building starts in this first step of the transition process and continues throughout the whole process including the

[38] Spangler, B. (2003, June). Coalition Building. Conflict Information Consortium.

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identification and engagement of the transition-related stakeholders from the quadruple helix stakeholders in the TSLs activities among others. Based on the vision and the pilot use cases, each TSL creates a unique roster of key stakeholders from the public sector, private sector, academia and civil society. For defining the list of stakeholders, it is important to define the geographical area of implementation of the use cases or the geographical area for which impact can be created from use cases implementation or impact can be assessed.

Stakeholders' relationships should be also mapped in this stage. Usually, their current relationships are considered but in TRANSFORMER it is critical to explore also their potential relationships in the context of achieving the transition ("Don't think about what you are doing but also about what you will be able to do for achieving TSL's vision).

The "veto" players need to be identified at this stage. As veto player we may define the stakeholder whose decision has more impact in the achievement or the non-achievement of the goal of a use case. As a game theory term "a veto player is a stakeholder whose utility maximization objective has the most prominent impact on the outcome of a conflict"[39].

Vision

A common definition of a vision has been prepared by TRANSFORMER partners as following: a *vision for Transition Super-Labs is an ideal representation for the future of the region that captures a common understanding of the desirable and transformative direction towards a sustainable society.* Vision development is an essential element of the TSL process. It is crucial for achieving long-term transformation because it provides a clear set of goals, direction and alignment and collaboration among the key stakeholders.

Scenarios and Pathways

A scenario can be defined as a structured framework comprising various feasible pathways aimed at achieving an envisioned vision. It involves considering different possibilities and assessing the potential pathways to determine the most suitable approach. Pathways are specific routes of actions taken to reach the vision with a structured approach. These are defined before the pilot use cases. In the TRANSFORMER project, our primary focus has been on the development of pathways. In the WP4 road mapping activities, we will delve deeper into exploring and discussing the terminology of scenarios.

Pilot use case

Pilot use cases are identified as co-created concrete project ideas to achieve climate neutrality and promote systemic transformation. Pilot use cases are developed and implemented with a focus on a regional transformation.

[39] Darbandsari et al. (2020)

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The milestones of this step include:

- Consume pre-existing Knowledge (M1-M6)
- Stakeholders' dynamics (M3)
- Agreed transition pathways (M6)
- Weak points identification (M6)
- Cross-sectorial synergies (M6)

4.1.2 Gearing transition capacity

In this step the TSLs continue the coalition building activities trying to increase cross-sectorial ecosystem capacity towards innovative sustainable sectors:

Stakeholders/civil society redefinition and coalition

Although the stakeholders to be involved have been identified in the first step of the process, it is considered essential to redefine the group of stakeholders that are relevant with the multi leverage ''pilot use cases''. Relevance of stakeholders could be defined as following: Important to secure feasibility, involved at pilot use case implementation, veto stakeholder, impacted by the implementation, transition facilitator. A stakeholder can participate to more than one pilot use case group.

Select the ''pilot use cases''

TSLs should select the most suitable pilot use cases among the ones identified in the first step. The selection is based on the following criteria as defined and described in D3.2- Definition of Transition Super Lab use cases:

- Contribution to the goal of climate neutrality (according to agreed visions and scenarios)
- Potential for systemic transformation
- Regional character beyond merely local solutions and expected value for the region
- Experimental and innovative approach (may refer to the pilot use cases' content or the development process)
- Potential for co-creation during the development phase (beyond the initial phase of definition and selection)
- Cross-sectorial approach

Examine feasibility of the ''pilot use cases''

As soon as the pilot use cases are selected, their feasibility aspects should be examined. The TSLs should collect the necessary data in order to be able to assess if the pilot use case is worth exploring further. The feasibility study should consider technical aspects including the availability of necessary technology, infrastructure requirements, data availability, compatibility with existing systems, and potential technical challenges or limitations. Along with the technical aspects, the operational feasibility of the pilot use case should be examined, meaning the availability of skilled personnel and the organizational readiness for change. The economic viability of the pilot use case should be also tested at this stage. Through cost-

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benefit analysis, the TSL would be able to assess both the short- and long-term costs and benefits. By examining potential sources of finances, the financial sustainability of the examined pilot use case can be ensured. At this point, the TSLs should also identify legal/regulatory and socio-economic factors (e.g., citizens acceptance & political support) that may impact the pilot use case implementation as well as define the timeframe horizon.

Create value proposition for stakeholders and conflict resolution

As the participation of stakeholders in the TSL activities is voluntary, TSL should ensure the creation of a value proposition for each of them specifying in parallel the role of each stakeholder in the transformation process. Some examples of roles are the following: tools & data for building common understanding creation, capacity for conflict solving, implementer, conditions creator, one stakeholder mobilizing many other stakeholders in a field.

Additionally, in this cross-sectorial transition, TSLs cannot follow the same procedure for stakeholders' engagement and management. The role of the "leader" stakeholder able to "govern" other stakeholders needs to be also defined as a category and it is important to define their role in the transition process success.

The milestones of this step include:

- Feasible pilot use cases (M12)
- Engaged group of stakeholders (M12)

4.1.3 Accelerating transition through innovation

In this step TSLs stakeholders should collaborate in innovative solutions development and demonstration of mature innovative solutions in alleviating barriers. This could be achieved through the definition of "Quick wins'', the adoption of international innovative solution and the identification of external investors.

Define ''Quick wins''

The definition of ''Quick wins'' is a critical stage in this step of the transition process as they build momentum with stakeholders providing an immediate, visible improvement or positive outcome that can be achieved relatively easily and quickly (e.g., a feasibility study). The achievement of positive results quickly builds confidence among the parties involved, and it is more likely for them to actively participate and contribute towards the successful implementation of the pilot use case. In cases of long-term use cases, ''Quick wins'' serve as milestones that require minimal effort and resources and can be implemented without extensive planning. However, they highlight progress ensuring long-term commitment and keeping stakeholders engaged through the whole process towards the achievement of the larger goal. Achieving quick wins enhances the credibility of the project, encouraging further investment in necessary resources, such as funding, personnel and infrastructure. or technology, or effort

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towards the transition achievement. Finally, ''Quick wins'' create feedback loops through useful input, and areas for improvement can be identified. Through this iterative strategy, the pilot use cases can be continuously refined increasing the likelihood of long-term success[40].

Adoption of international innovative solution

The adoption of international innovative solutions can accelerate the transition towards climate neutrality as the TSL benefit from global best practices, proven methods, technologies and innovative ideas that may not be readily available within the local context. Moreover, by adopting and adjusting solutions that have been successfully implemented in other countries/regions mitigate the implementation risks. The successful implementation of global solutions to local environments simulates collaboration and knowledge sharing among countries, organizations, and research institutes. This cooperation promotes collaborative problem solving, the transfer of expertise and joint research and development activities. New ideas and solutions could be raised as a result of these joint activities.

Identify external investors

The identification of external investors that can support the implementation of the pilot use cases when the traditional local resources are insufficient is considered critical. Bridging the funding gaps during the implementation enhances the credibility and legitimacy of the process and builds confidence among other stakeholders. Moreover, the external investors bring valuable expertise and knowledge from similar climate-related projects, have the power to drive market transformation ensuring the success and viability of the pilot use cases and open new opportunities for partnerships and collaborations that enhance scalability and replicability aspects.

Create and implement an Action Plan

An action plan is a document that lists various measures necessary to realize the vision set by the TSLs and is directly linked with the pilot use cases. A complete action plan should follow the structure below:

- List all the tasks that need to be accomplished during the implementation of real-life test experiments and prioritise them
- Put a price tag on the implementation
- Agree on stakeholders' responsibilities
- Define a timeline
- Identify a financing plan

[40] Bakker, Stefan, Haq, Gary orcid.org/0000-0002-7724-0606, Peet, Karl et al. (5 more authors) (2019) Low-carbon quick wins: Integrating short-term sustainable transport options in climate policy in low-income countries. Sustainability (Switzerland). 4369. ISSN 2071-1050

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The milestones of this step include:

- Quick win definition (M12)
- Action Plan (M20)
- Realization of real-life test experiments (as soon as the action plan is defined)

4.1.4 Scaling-up transition

In order a transition process to be effective and successful, it is important to secure innovative policy response to maximize implementation and impact of the solutions and achieve full adoption by the citizens.

Define emblematic innovative transition projects

As emblematic innovative transition projects are defined:

- Large scale projects, or
- Projects that have high transformative impact, or
- Projects characterized by their potentiality for scalability and replication

Defining emblematic projects in a transition process is crucial as they stand out as a pioneering example of innovation in the process of transition inspiring and motivating stakeholders and civil society. They serve as concrete illustrations of the transition's vision and goals, aims and targets. Additionally, by implementing emblematic projects, the TSLs can gain valuable knowledge to be used for the refinement and improvement of future actions.

Maximise implementations and impact

The successful implementation of the previous steps of the transition process ensures the scalability of the use case implementation and the maximization of their impact. Some critical steps that can contribute towards this direction is the development of alleviation policies for the weak points as they were identified during the transition readiness assessment, the identification of legal incentives and the suggestion of new legal transition policies and structural changes.

Monitor the efficiency and success of the transition process

This last step includes:

- Perform Evidence-based use case Impact Assessment to ensure the sustainability of transition (as described in Chapter 5)
- Collect data for each step of the transition process in order to quantify various elements that will help us assess at what level the milestones have been achieved (to what extent the structural changes were achieved?)
- Assess the usefulness of the tools used in each transition step in alignment with the roadmap and the toolkit

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The milestones of this step include:

- Emblematic projects (M22)
- Suggestion of structural reforms (M22)
- New transition policies (M22)

5 Evidence-based use case Impact Assessment Methodology

5.1 Quantitative analysis through KPIs for sectorial improvement

A six-step approach that TSLs should follow to achieve a structured and comprehensive impact assessment of the pilot use cases was developed. The focus of this analysis is (1) the improvement of the operational readiness of the pilot actions and (2) the level of fulfilment of the regional needs and priorities through pilot outcomes.

The methodology unravels through the following steps: (1) identification of the expected impact categories, (2) KPIs identification, (3) baseline scenario definition, (4) TO-BE scenario definition, (5) analysis for impact determination, and (6) conclusions and overall impact determination.

The Assessment Framework defines "what" needs to be evaluated, "how" it will be evaluated, ''when" the evaluation activities will take place and "who" will perform the evaluation.

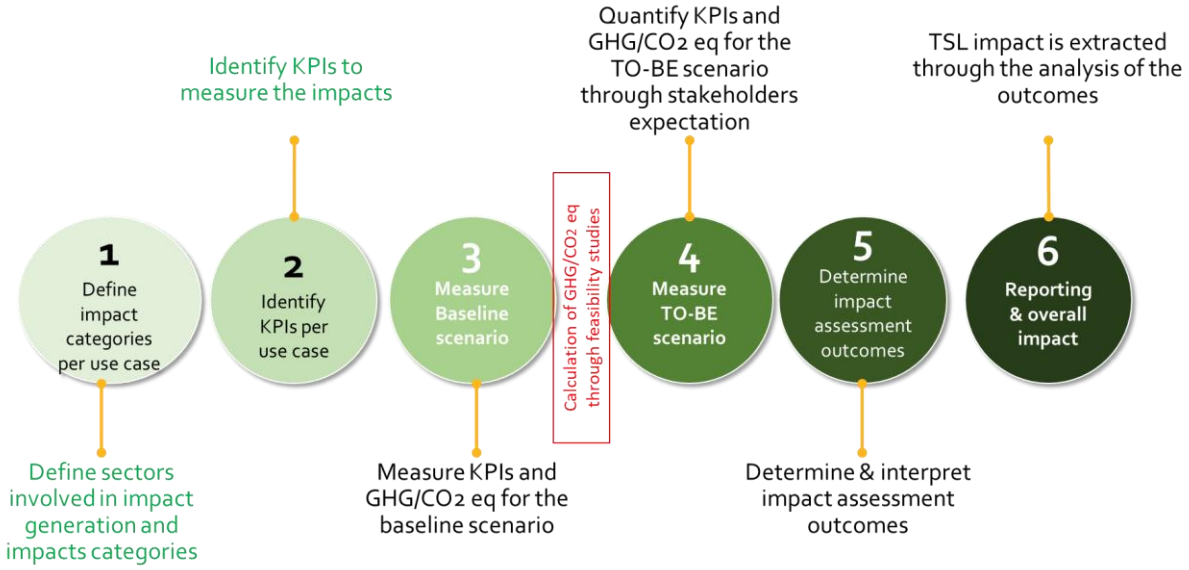

Figure 7: The six-step approach of the evidence-based use case Impact Assessment

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5.2 Step 1- 2. Set the areas, the expected Impact and KPIs

Considering the Key sectors of TRANSFORMER TSLs (Mobility, Circular Economy, Energy, Agriculture & Food Production, and Industry) and the regions vision for climate neutrality, 5 areas of climate neutrality interventions/achievements are defined:

- Sustainable Zero Carbon Energy
- Sustainable Agriculture & Agri-food system
- Net Zero Industrial Transformation
- Moving without emissions
- Circular Economy

Based on the 4 TSLs visions and their pilot use cases a set of impact categories was created for each of the areas of climate neutrality interventions/achievements (use case sectors). Each region's use case is directly related with one or more sector and each TSL should identify this relation at the beginning of the assessment process and proceed with the analysis through KPIs of the main impact categories.

For each use case, each TSL should define sectors involved in impact generation and impact categories (step 1&2):

- Single sector Use case: Expected Impact categories definition for the unique sector involved in use case
- Cross-sectorial Use Case: Impact categories definition for all sectors involved in the use case.
- Compile list of impacts and select the KPIs for impact assessment from the indicative list of KPIs associated to impact categories.

We included both rather common indicators as well as ones that go beyond the standard set to produce new insights or to shine a light on currently underrepresented aspects. For "new" or less common indicators, data availability may be limited or not exist at all. The indicators can be either quantitative or qualitative and can be derived from one or more measures. The indicators can be expressed as a ratio, index, percentage or other value. Data availability is crucial but did not restrict the indicator selection as new data gathering processes may occur during the TSLs implementation. The following list includes specific indicative KPIs that were selected from the extended list of KPIs in the report ''Measuring progress towards climate neutrality, Part I: Assessing structural change through net zero indicators''[41] and will be further validated, modified, enriched or decreased at the end of the project based on TSLs feedback.

[41] Ecologic Institute, IDDRI, (2021) MEASURING PROGRESS TOWARDS CLIMATE NEUTRALITY, PART I: ASSESSING STRUCTURAL CHANGE THROUGH NET ZERO INDICATORS

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Table 1: Indicative Impact Categories & KPIs to measure impact (Ecologic Institute, IDDRI, 2021)

Use cases Sectors	Impact categories	KPIs for measurements
1. SUSTAINABLE ZERO CARBON **ENERGY**	E1: SUPPORTING REGULATORY FRAMEWORKS	– **CO2 eq reduction per invested EUR [t CO2 eq/EUR]** – **Share of EU financial support for zero carbon energy (EU budget and other programmes, e.g., TRANSFORMER) [%]** – **Public money going to fossil-fuels (fossil fuel subsidies) [EUR]**
	E2: INFRASTRUCTURE TO ENABLE A SECURE TRANSITION	– **Infrastructure additions (incl. cross-border capacities) for electricity and gas networks [km; MW]** – **Storage capacities for energy (for electricity, heat, gas) [TJ or m_3]**
	E3: REDUCING TOTAL ENERGY CONSUMPTION & EMISSIONS	– **Share of renewable energies/H2 in gross final energy consumption [%]** – **Share of H2 in gross final energy consumption [%]** – **Carbon intensity of electricity generation [g CO2 eq/kWh]** – **CO2 emissions from energy generation captured and used or stored (with share from produced electricity/heat [t CO2]** – **Share of households' expenditure on electricity and gas and other housing fuels for average and poor households [%]**
2. SUSTAINABLE **AGRICULTURE & AGRI-FOOD SYSTEMS**	E1: FOSTER NEW ECO-AGRICULTURAL PRACTICES AND INNOVATION	– **GHG emissions of agriculture [tCO_2eq per year] and per agricultural output [tCO_2 eq/kg of produced output]**
	E2: REDUCING EMISSIONS AND AGRICULTURE/FOOD WASTE	– **CO_2 emissions from agriculture activities captured and used or stored [t CO_2]** – **Amount of agriculture waste [% of total agriculture production or tons/year]**
3. NET ZERO **INDUSTRIAL** TRANSFORMATION	E1: ENSURE LOW-CARBON INDUSTRY COMPETITIVENESS BY INTEGRATING CLIMATE POLICY	– **Annual investments in zero carbon industrial processes [EUR]** – **GHG emissions per industrial output (including specific basic material production, like cement aluminium etc…) [tCO_2eq/tonne]** – **CO_2 intensity of gross final energy consumption in industry (sub-indicator for energy intensive industry) [tCO_2/kwh]**
	E2: INFRASTRUCTURE TO ENABLE THE INDUSTRIAL TRANSITION	– **Share of industrial sites having access to CO_2 storage [%]** – **Share of industrial sites having access to hydrogen [%]** – **Length or transport capacity of hydrogen and CCS infrastructure network (with sub-indicators per infrastructure) [km or volumes per year]**

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4. MOVING WITHOUT EMISSIONS	E1: ZERO CARBON FUELS	– Share of low-emission fuels (with sub-indicators for biofuels, synthetic fuels, RES and H2) – Energy consumption of transport (incl. sub-indicators for fuel types) [PJ – Electric charging points (incl. sub-indicators for different charging types) [number] – GHG emissions from transport (incl. sub-indicators for road, rail, water, air if available in regional level) [Mt CO_2eq]
	E2: INCENTIVISING THE MODAL SHIFT	– Modal split of passenger transport (according to type) [%] – Expenditure per capita on transport [EUR]
	E3: TRANSPORT PLANNING AND DIGITALISATION	– Passenger transport volume (incl. sub-indicators for mode and purpose) [passenger-km] – Infrastructure updates and additions (incl. roads, rail, bike-lines etc.) [km and invested EUR per capita – Average distance travelled per year [km] – Commuting travel time [average time of commute in minutes per day] – Congestion and delays [hours spend in road congestion annually]
5. CYCLING ECONOMY	E1: ENHANCING INVESTMENT INTO RESEARCH, DEVELOPMENT AND DEMONSTRATION	– Legal framework for cycling economy activities – Funding for cycling economy activities (EU budget, other programmes) [Total EUR]

5.3 Steps 3-4. Baseline and TO-BE scenarios

The assessment of the baseline vs TO-BE scenario defines the impact of TRANSFORMER TSLs interventions to the transition process towards the climate neutrality. During the assessment, two processes are implemented for measuring the transition impact KPIs:

- baseline scenario: Data measurement **involved in KPIs calculation** **BEFORE** the implementation of TRANSFORMER TSLs interventions
- TO-BE scenario: Values of KPIs measuring impact through **stakeholders' estimation (EXPECTATION)**

5.3.1 Baseline measurements and TO-BE scenario quantification

The KPIs the TSLs selected in the previous step must be quantified for the baseline scenario. TSL describe their baseline scenario per impact (KPI), focusing on the measurements of the current situation while in TO-BE scenario the focus is on "what is expected through the implementation of the transition intervention''.

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The TSL records the baseline values to set the base for comparison with the TO-BE situation – i.e. the after the TRANSFORMER implementation reality. Therefore, it is imperative to ensure that the measurements used to quantify the KPIs for the AS-IS and TO-BE scenarios are the same for each KPI and the quantifications accrue from the same process.

Each TSL provides measurements that quantify the selected KPIs in each pilot use case before the TRANSFORMER project, covering a specified time period. The baseline scenario aims at recording the current operational reality before the implementation of the transition intervention, while the TO-BE scenario does so for the expected reality after the implementation of the TSL pilot use cases. The quantification of the KPIs in the TO-BE scenario (target values) will be performed by the stakeholders based on their expectations.

The overall goal is to measure two, directly comparable situations so as to improve the operational readiness of the pilot use cases and examine the level of fulfilment of the regional needs and priorities through the pilot outcomes.

5.3.2 CO2 calculation methodology

Based on the KPIs selected and quantified, each TSL will calculate the CO_2 emissions in the baseline and TO-BE scenario (expected estimation), and thus it will have an overview of the expected CO_2 reduction per use case. Then, each TSL will examine if the expected CO_2 reduction will be achieved when the pilot use case is implemented. This step, meaning the calculation of the CO_2 saving from the implementation of the pilot use case, can be performed as a part of the pilot use case feasibility study. However, TSL could engage different methods such as modelling or simulation techniques. By applying the CO_2 calculation methodology, the TSLs will have an evidence-based assessment of the pilot use case impact that will provide valuable insights to decide if a pilot use case is worth implementing (in terms of both CO_2 reduction and levelized cost of carbon abatement)[42].

5.4 Steps 5-6. Determine impact assessment outcomes & Reporting overall impact

The outcomes of the impact assessment are recorded and analysed in step 6. The determination of the impact assessment outcomes is based on a) the KPIs selected for each use case of the TSL (steps 1-2) and their expectations/measurements (steps 3-4) and b) on the CO2 calculation of the pilot use case. Therefore, at the end of impact assessment, each TSL will be able to answer the following questions in order to assess if a use case is worth to be implemented:

[42] Friedmann, Y S. J., Fan, Z., Byrum, Z., Ochu, E., Bhardwaj, A., and Sheerazi, H. (2020) Levelized Cost of Carbon Abatement: An Improved Cost-assessment Methodology for a Net-zero Emissions World

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- Are the expected values of the KPIs and the expected CO2 reduction achieved?
- How much does 1kg CO2eq reduction cost (levelized cost of carbon abatement in € per year)?

In case of common KPIs' among the TSLs use cases, cross pilot assessment results could be further examined and discussed (through KPIs weights and Multicriteria analysis).

The assessment of each pilot use case will be monitored for each TSL through a unique TSL Traceability Matrix. For the purposes of TRANSFORMER, a template will be developed for each TSL in order to map and trace the TSL requirements for each pilot use case and to record the assessment results. The goal is to ensure that all the requirements initially set by the TSL are covered in a pilot use case, so that the use case could be a best practice for other regions that would like to accelerate their transition towards climate neutrality.

6 Conclusions

The aim of the current deliverable was to delve into the transition assessment of the TSLs through the framework developed. The TRANSFORMER project's framework for assessing Transition Super-Labs presents a comprehensive approach to accelerating the shift towards climate neutrality in regions. The framework emphasizes the importance of a methodological approach that cover the aspects of transition readiness, effectiveness and success of the transition process and evidence-based use case impact assessment. These methodologies are integral to understanding the current state of a region's transition readiness and the effectiveness of its transition process.

The transition readiness assessment of a region is built upon a systemic approach to cross-sectorial transition ecosystem that defines the required elements and sub-elements that a region should have in order to be characterised as transition ready. Through benchmarking and qualitative assessment techniques, the region is able to discover its weak points in order to direct the actions of stakeholders towards a speedy achievement of climate neutrality.

The assessment of the effectiveness and success of the transition process is built on a combined approach of the OIC and NESTA innovation approaches integrating elements from the traditional planning methodologies as used in mobility. Through 4 steps including strengthening local transition capacity, gearing transition capacity, accelerating transition through innovation and scaling-up transition, the process underscores the importance of stakeholder dynamics, agreed transition pathways, and pilot use cases in achieving climate neutrality. All these steps are vital in developing a structured approach towards the envisioned vision of the region and achieving systemic transformation through emblematic projects, action plans and maximisation of impact. The assessment is performed through milestones achievement monitoring.

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Finally, the evidence-based use case Impact Assessment Methodology is based on the quantification of KPIs in the current region's situation (baseline scenario) and the stakeholders' expectations (TO-BE scenario). The CO_2 calculation methodology will further contribute in the TSLs decision making process providing an evidence-based report about how much a use case is worthy to be implemented.

TSL Assessment Reports, one per TSL, is suggested to be developed by the end of the project. Each report will integrate information from all the stages of the methodological approach including the results of the Transition Readiness Assessment, the Assessment of the Transition Process and the impact assessment. These reports will provide valuable insights to Tasks 5.2 '' Impact Evaluation of TSLs pilots in regions'' and 5.3 '' Tools and structures assessment'' and will be the basis for the D5.2: Best practices and recommendations for Super-Labs operation towards the region transition.

The availability of the data generated or/and collected by TSLs throughout the whole assessment process is a critical factor that will enhance the validity and reliability of the results, leading to evidence-based decision for more effective climate interventions.

The TRANSFORMER project's framework for assessing Transition Super-Labs provides a robust and comprehensive approach to accelerating the shift towards climate neutrality. It integrates various elements, and highlights the importance of collaboration, strategic planning, and practical implementation in achieving a sustainable future. Next steps will focus on validating and refining the current framework based on feedback and lessons learnt to be collected during its implementation from TRANSFORMER TSLs. This iterative process will ensure that the framework remains effective and relevant in guiding regions towards climate neutrality. The final refined version of the Assessment Framework will be delivered by the end of the project (M24).

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Annexes

Table 2: Qualitative Assessment of readiness

Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
Governance & Fusion	***Inter-departmental coordination***	*What is the level of inter-departmental coordination for implementing climate actions? (Region authority or functional region area may be considered)*	Climate Change actions are implemented by the National authorities. Lack of connection with regional level.	Multiple departments are involved in actions implementation but there are important gaps and inefficiencies.	The cooperation of related organizations has started (i.e., intergovernmental partnerships, innovation hubs were organized emphasizing in local innovation capacity, etc). However, no practical result yet for innovative solutions in the region.	Clear interdepartmental strategy towards implementation of innovative policy exists but its implementation in practice (i.e., achieving generalisation of pilots of solutions emerging by companies) is limited.	A dedicated Department or authority is responsible for coordinating the actors in speedy adoption and assessment of innovative solutions. Innovation Scale up is already happening in the region.
	Cross-sectorial planning	*What is the level of cross-sectorial Planning?*	Sector based planning. Non-extended collaboration! There are no horizontal processes applied in planning	Working groups of each sector are involved in planning developing fragmented cross-sectorial initiatives. Inadequate framework of cross-sectorial planning and lack of effective communication between sectors.	A dedicated local unit for climate change is responsible for the coordination of the planning activities among the various sectors. The unit has neither the power nor the legal mandate to influence the formulation of	Participation of regional government (as well as representation from different sectors, civil society and academia) in the National commissions for climate change to enhance the cross-sectorial	Comprehensive and holistic cross-sectorial planning approach for addressing climate change challenges. Full Public involvement in cross-sectorial planning. Linked with available finance & Political support.

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Element	Sub-element	Questions	Scale				
			1	2	3	4	5
					federal national strategies on mitigation and adaptation to climate change	aspect of climate-change-related interventions.	
	Public Investments & subsidies	*At what level the region has the competence for fund raising for innovation (PP schemes, …) What is the level of public investments for smart innovative policy making?*	Initiatives are low. NO funding available for innovative policymaking. Region capacity is low in raise funding opportunities.	Region is participating in networks and initiatives for exploiting smart city including mobility dedicated funds with no results until now.	Regional funding is used for implementing small scale innovative initiatives. Region welcomes Private investment in emerging mobility solutions.	Region is active in Raising EU and national funds (participating in EU projects, smart cities mission) for test-bending innovative solutions	Region has secured funding for wide development of integrated ICT & ITS enabled solutions. A wide infrastructure for smart solutions is under development.
	Processes to identify conflict resolution	*At what level the stakeholder's analysis is mature?*	All stakeholders are identified (e.g., key stakeholders, veto players) and their interests, strengths, weaknesses	Mapping stakeholders' relationships to recognise potential conflicts	Mapping the power and the interest of stakeholders (Power/interest matrix: key stakeholders, Keep informed, keep satisfied, minimal effort stakeholders) [43]	Development of conflict resolution strategy for supporting effective stakeholders' management (avoiding, competing, collaborating,	Application of the chosen resolution strategy and measuring the success of conflict management; Minimization of possible conflicts.

[43] Johnson, G. and Scholes, K. (1999) Exploring Corporate Strategy: Text and Cases (5th edn). London: Prentice Hall Europe

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
			and needs are recorded.			accommodating, compromise) [44]	
	Political support	*What is the level of political support in climate transition?*	Climate transition is no priority in the political agendas.	Delayed alignment with the EU requirements related to the achievement of climate neutrality. Development of the required plans (e.g., Just Transition Plan). However, these plans are poorly implemented.	Strategic plans are implemented slowly due to legal restrictions and insufficient funding.	Governmental Mechanisms for quickly alleviating legal and bureaucracy barriers.	A political system that totally supports the regions effort towards climate neutrality through various aspects including legislation, funding, institutional change etc.
Openness & Greenness	***Openness***	*What is the level of (inter)national synergies with neutral partners (research institutions, universities) and other regions and organisations for knowledge transfer (e.g.,*	There are no (inter)national synergies with neutral partners.	There are national synergies with neutral partners	There are national and limited international synergies with neutral partners but no heterogeneity in skills and high expertise exists.	There are national and international synergies with neutral partners characterised by heterogeneity in skills and high expertise. However, there is no freedom to participate and collaborate in	Region is part of international collaborations and synergies characterised by heterogeneity in skills and high expertise.

[44] Thomas, K. (1992) Conflict and negotiation processes in organizations. In: Dunnette, M. and Hough, L. (eds) Handbook of Industrial and Organizational Psychology. Palo Alto, CA: DaviesBlack® Publishing, pp. 651–717

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
		POLIS, Eurocities, EIT)?				region's processes.	
	Digitalisation	*What is the level of availability of infrastructure & services offered in the region?*	Old infrastructures and lack of infra & services. Technology penetration is low.	Old infrastructures and lack of infra & services. Electronic services have been introduced allowing for integrated use of services.	Infrastructure need modernization. Emerging new services are operating in the region but physical & digital Infrastructure for their operation is not sufficient.	The region has modern infrastructure and services. There still lack of framework for their integration & lack of capacity for transition to advanced innovation taken up. Digital infrastructure needs further improvement.	In the region the infrastructure & services are advanced & well integrated. Digital management of different services will follow soon. Private and Public actors' capacity & collaboration is sufficient for transitioning towards innovation scale up.
	Science & Education	*Can the region be characterized as a region with Research & innovation activities on climate neutrality?*	There are no research institutions (unis, research centres) available.	Small research institutions in the region (e.g., universities/departments with low/medium reputation), but no research on climate neutrality is performed.	Unis and research institutions in the region (e.g., universities and institutions with high national reputation) that perform scientific work on climate policy. The results of the work aren't communicated to the region's policy makers for	Unis and research institutions in the region (e.g., universities and institutions with high national reputation) that provide independent scientific advice on climate policy. Centre for start-ups/spin-offs foundations.	Dedicated Institutes with high reputation on scientific advice on climate policy. Centre for start-up companies, research centres, technology parks that collaborate towards the achievement of climate neutrality.

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
					aligning the regional climate policy.		
		What is the region's population educational level and digital competence?	Low educational level of citizens (International standard classification of education (ISCED = 0-2)), aging population and low internet access capacity	Young people well educated and capable in electronic means. However important part of the population has no digital services accessibility	Medium Educational level of citizens (International standard classification of education (ISCED = 3-4). Citizens are sufficiently competent in digital services	Population in full transition towards digital competencies and good level of digital competence is already achieved	High Educational level of citizens (International standard classification of education (ISCED = 5-8)) and society fully adapted to shared and electronic economy model
	Use of renewable energy resources	*What is the share of renewable energies in gross final energy consumption*	Lower than the low limit in 2021 ranking[45] (Less than 12%)	Higher than the low limit but lower than EU average (12-21%)	Equal or slightly over the EU average (22 -31%)	Quite over the EU average but lower than EU expectation by 2030 (32- 42.5%)	Over the EU expectation by 2030 (More than 42.5%)

[45] Eurostat, (2021)

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
Transparency & Cross-sectorial Collaboration	***Transparency and inclusiveness of processes***	*What is the level of smartness, inclusiveness and transparency of the region's Government processes (e-tools, e-Governance practices, data transparency, mechanisms for citizen participation)?*	The government processes are not digitalized yet (no e-governance). No mechanisms for citizen participation exist.	Digitalization government processes and mechanisms for citizen participation are under development or limited available (e-Documents, open meetings).	Data centric governance (citizen or user can proactively explore the new possibilities inherent in strategically collecting and leveraging data)	Managed (Fully Digital) (The organization has fully committed to a data-centric approach to improving government, and the preferred approach to innovation is based on open data principles). Mechanisms for citizen participation are applied by case.	Optimizing governance (smart/innovative) (Digital innovation using open data and mechanisms for citizen participation are embedded deeply across the entire government, with buy in and leadership from the top policymakers)
		Is region's data open source, safe and easily accessible?	Data is not open and easily accessible	Data is open but not easily accessible	Data are open and easily accessible	Data is open, easily accessible and safe	Data is open, easily accessible and safe and there is legal framework for ensuring data privacy
	Stakeholders' engagement & Cross-sectorial initiatives & synergies	*Does the region follow stakeholder's engagement practices for co-creation and co-design of*	No engagement available	Multi stakeholder platform available but no regular operation nor emphasis in innovative emerging solutions support.	Upon specific issues the stakeholders were (are) mobilized and solution was found to problems.	6-month meetings among industry & public administration for solutions definitions and measures assessment	Stakeholders' engagement platforms and partnerships available and in operation in the region

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
		innovative solutions?					
		Is the region open to deploy and test new business models? Is the triple helix for innovation applied for smart solutions?	No existing synergies & no previous experience as pilot region in national or EU smart mobility program	Rare synergies between companies for innovations. Local very small implementation of collaborative business models	Participation in EU funds and/or contribution as pilot region. Occasional synergies between companies' innovations (no formal cooperation schemes)	Clusters between the companies in urban mobility of the city preparing & demonstrating collaborative business models and smart solutions	Synergies with big innovators. Participation in EU funds and/or contribution as pilot region. Research results are generalized & extended, and innovation acceleration activities are implemented.
Regulations & Economy	***Supportive regulatory framework***	*Does the region follow a regulatory framework for achieving climate neutrality?*	Lack of supportive regulatory framework on climate neutrality.	Existence of NECPs and regional plans but no alignment between national and regional goals.	A long-term regional climate strategy not older than five years with adequate level of detail and alignment with national goals. Cohesion between short-term actions and long-term climate goals	Full formal regional climate policy learning cycle (target setting, strategic planning, policy formulation, progress monitoring).	Proliferation of framework climate laws with integrated policy cycle.

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
	Social and technical regimes	*At what degree socio technical transition happens in the region?*[46]	Strong commitment to existing regimes. Innovation is mostly incremental and dependent on Techno-economic, Social and cognitive and Institutional and political lock-in mechanisms.	Niche innovations are being developed. Experimentation on techno-economic performance, socio-cultural acceptance and political feasibility of radical Innovations. Creation of transformative coalitions of actors who are willing to develop and protect the innovation	Niche innovations begin to stabilise. Establishment of flow of resources for ongoing innovation activities	Economic competition between new and existing regimes; Windows of opportunity for niche innovations do not (sufficiently) materialise.	New socio-technical system replaces the old one and becomes institutionalised in regulatory programmes. Regular and sufficiently detailed progress monitoring of structural changes towards climate neutrality
	Regulatory framework for use of renewable energy resources	*Has the region a regulatory framework for use of renewable energy resources?*	No regulatory framework for RES	Although there is a regulatory framework, there are legal obstacles & fragmented RES initiatives	Support mechanisms for renewables (e.g., carbon tax, tax incentives, Net Metering etc)	Regulatory framework for use of renewable energy resources embedded in supportive regulatory framework. No	Existence of regulatory framework and monitoring system.

[46] Geels, (2020)

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
						monitoring system for environmental and social impact of RES initiatives.	
	Region's economic development and socio-economic well-being	*What is the level of region's economic development?* (Economic performance: GDP per capita, employment rate, income levels, business climate. Socio-economic well-being: poverty rate, quality of life)	Economic performance and socio-economic well-being under the national average.	Below national average economic performance and socio-economic well-being near to average.	Economic performance and socio-economic well-being near the national average.	Above national average economic performance and socio-economic well-being near to average.	Economic performance and socio-economic well-being above the national average.

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
Infrastructure, Technology & Tools	***Data availability and security***	*How mature and smart is the data collection for understanding the current situation of different sectors? (Smart infrastructure, ITS, survey)?*	No data collection or rare surveys	Traditional methods of collecting data (e.g., survey)	Smart infrastructure for data collection	Observatories of data	Region as a living lab-Data space
	Region Innovation Capacity	*To what extend is the current regions's policy making data and evidence driven?*	No data available & open data framework do not exist	Open data framework accepted	Stakeholders' cooperation (PPP for data and knowledge exchange)	Observatories with cloud-based data storage Advanced data analysis techniques	Living Labs and/or digital twins available Advanced data analysis techniques Simulation techniques for testing new innovations

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
		Does the region have skilled workforce on innovative solutions?	Lack of knowledge & expertise	Specific People in public sector with know-how	Team of experts that can be mobilized for guiding innovation taken up. The region applies innovative policies "based on analogy results" from other regions and knowledge gained through networks.	Region has access to specialized organizations and tools for guiding decision making on solutions to be adopted, assessing the solutions impact and developing dedicated policies to strengthening innovation	Capacity is sufficient in the region ecosystem (i.e., operation of capacity building platform with the stakeholders) and competence is available (i.e. competence centre) for innovative policy & solutions taken up.
	Sectorial Innovation	*How wealthy is the region in terms of number of big innovators and high-tech start-up companies?*	No high-tech companies and start-ups	The region has few high-tech companies and no start-ups (e.g., 100 tech companies & <10 start-ups)	The region has high-tech companies and start-ups (e.g., 100 tech companies & 100 start-ups)	The region has high-tech companies and start-ups (e.g., 400 tech companies & 200 start-ups)	The region is hub for technology and innovation (Big innovators & Start-ups) (e.g., 2.2k tech companies & 1.6k start-ups)
Civil society & Stakeholders	***Society's perception***	*To what extent are citizens adopting new services and green solutions?*	People are not aware of what is climate neutrality is and how green solutions could speed up its achievement.	People are aware of green solutions. However, many of them cannot afford their adoption due to financial constraints.	Society starts adopting new services and green solutions thanks to incentives provided by the region.	Community-Led Initiatives for achieving climate neutrality.	Behavioural change is achieved.

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
	Raising society's awareness for environment	*What ways does the region use to raise environmental awareness?*	No educational initiatives for raising society's awareness for environment.	There are few educational initiatives but fragmented and without scientific evidence.	Some educational initiatives but sector based. Society can't perceive the overall impact of climate change.	Organised campaigns for raising environmental awareness supported by scientific research and evidence.	Existence of mechanism for continuing educating and training citizens on climate policy (such as Citizen Assemblies). Capacity-building and training programmes are implemented.
	Knowledge dissemination to public	*At what level the knowledge is disseminated to public?*	Policy makers participate in the decision-making process and knowledge isn't communicated to public.	The results of the decision-making process are communicated to public. No consultation or participation process is foreseen.	Public consultation process but not active participation in decision making.	Participation in decision-making. However, public interests are considered of low priority.	Diffusion to the public of a shared vision and sustainable goals towards the achievement of climate neutrality in the beginning of decision-making process. Use of Appropriate language and common understanding.
	Support of existing veto players	*To what extent the region is aware of the veto players in climate*	The region doesn't know who are the ''veto'' players.	Identification of veto players through stakeholders' analysis. However, they aren't considered during the	''Veto'' players participate in the decision-making avoiding the creation of	Interests of ''Veto'' players are set as high priority in the decision-making	Creating value proposition for ''veto'' players. Equally participate in the decision-

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Element	***Sub-element***	*Questions*	*Scale*				
			1	*2*	*3*	*4*	*5*
		neutrality action?		decision-making processes.	conflict with them (avoiding approach)[47].	process (competing or accommodating approach)[48].	making process. Wins-wins for all stakeholders (cooperative approach)[49].

[47] Thomas, (1992)
[48] Thomas, (1992)
[49] Thomas, (1992)

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