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THE CONTRIBUTION OF R&I PROGRAMMES TO TRANSITION:
EVIDENCE ON TRANSFORMATIVE OUTCOMES IN THE AREAS OF THE GREEN TRANSITION AND THE ENERGY TRANSITION

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ABSTRACT

This paper examines the role of Research and Innovation (R&I) programmes in driving systemic transitions, with a focus on the Green and Energy Transitions in the EU and Germany. It analyses two major programmes—the 7th Energy Research Programme (Germany) and Horizon Europe Clusters 5 & 6—through a transformative outcomes framework grounded in sustainability transition theory and the multi-level perspective (MLP). Using a mixed-method evaluation approach, the study assesses how these R&I initiatives foster innovation, support niche development, influence regime change, and drive systemic transformation. Findings highlight meaningful contributions to building and expanding niches, yet limited impact on regime destabilisation and institutionalisation. The paper underscores both the potential and limitations of R&I policies in catalysing sustainability transitions, offering insights for programme design, policy alignment, and evaluation practice.

BACKGROUND & RESEARCH QUESTION

The pressing need for a paradigm shift in response to escalating human-induced environmental change has fuelled the quest for a Green Transition in policy, economy, and society.

In the European Union, the 2019 European Green Deal marked a turning point in the political landscape, adopting key concepts such as net-zero and climate targets alongside sectoral policies. A key element of the Green Deal is its emphasis on digitalisation as a strategic enabler of the green transition, recognising that digital technologies can facilitate energy efficiency, smart infrastructure, and more sustainable resource use. However, critiques about the aspired transformation process within the Green Deal, the Green-Growth paradigm, and limits to growth remain unresolved, raising questions about the desired nature of the Green Transition. Growth-critical concepts highlight the constraints on human impact, adding depth to the understanding of the Green Transition.

In light of these challenges, the role of Research and Innovation (R&I) becomes crucial. Transition-oriented R&I programmes can serve as catalysts for innovative solutions, promoting the development of sustainable technologies and innovative practices to navigate the complexities of the Green Transition. Ultimately, they could play a pivotal role in shaping a more resilient and sustainable future.

To effectively assess and guide these processes, it is essential to employ analytical instruments that can accurately portray the transformation dynamics at play. For analysing transformation processes, tools such as systems mapping, scenario modelling, and policy simulations have been developed to provide insights into how transformation unfolds over time, highlighting interdependencies, potential trade-offs, and emergent properties of change. In the area of R&I policy evaluations, the necessity for a nuanced understanding of innovation pathways becomes evident, as it helps policymakers assess the feasibility and effectiveness of various strategies within the transition process. Systematic, transformation-oriented analytical instruments may inform decision-makers about the most effective leverage points for intervention.

Against this background, this paper examines the role of R&I programmes in facilitating transition processes, focusing on their contributions to both the Green Transition and the Energy Transition. Adopting a transition theory

perspective, the paper provides empirical evidence on how two major R&I initiatives drive systemic change by fostering innovation, supporting technological development, and enabling institutional shifts.

From a policymaker's perspective, the paper offers insights into how R&I programmes can serve as strategic tools for steering transitions, identifying key leverage points for intervention. Additionally, for researchers in R&I policy evaluation and Science, Technology, and Innovation studies, it demonstrates how the contributions of these programmes can be systematically measured, offering a framework for assessing their effectiveness in driving sustainable transformations.

PROGRAMMES UNDER CONSIDERATION AND THEIR EVALUATIONS

This research draws upon two independent evaluation studies that have been conducted for the following two major R&I programmes related to the Green and Energy Transitions:

1. The 7th Energy Research Programme 'Innovations for the Energy Transition' (2018-2023) is pursuing a strategic approach for energy research, focusing on the transfer of technology and innovation. The Federal Ministry for Economic Affairs and Climate Action (BMWK) in Germany funds Collaborative Projects (TRL 3-7), Real-World Labs (TRL 7-9), Micro Projects, and accompanying measures. The programme also strengthens research on cross-system issues and strives for close networking at the international and European levels. Open calls for participation offer continuous opportunities for application. In total, 6,499 sub-projects from companies, universities, research institutions, and other organizations were funded from 2018 until the end of 2023. These sub-projects were based on proposals independently developed by the grant recipients. The total funding volume (federal funds) amounted to €3.317 billion.
2. Horizon Europe Cluster 5 (Climate, Energy, and Mobility) and Cluster 6 (Food, Bioeconomy, Natural Resources, Agriculture, and Environment) are key pillars of the Green Transition, supporting research and innovation to tackle climate change, enhance sustainability, and ensure the responsible use of natural resources. The European Commission funds Research and Innovation Actions (TRL 2-6), Innovation Actions (TRL 6-8), as well as Coordination and Support Actions and Partnerships,

facilitating technological advancements and the implementation of policies. Both clusters operate through specific thematic calls in designated work programmes, fostering collaboration across sectors and disciplines. By June 2023, a total of 1,016 projects have been funded under these clusters, driving innovative solutions for Europe's environmental and energy challenges. With a combined budget of €24.075 billion for 2021-2027, Horizon Europe Clusters 5 and 6 support international cooperation, multi-disciplinary research, and systemic transformations needed for a sustainable future.

Both the 7th Energy Research Programme (ERP) and Horizon Europe Clusters 5 and 6 aim to drive sustainable innovation and systemic transformation through research and development funding. They share a commitment to supporting decarbonisation, fostering technological advancements, and hence facilitating policy implementation for the Green and Energy Transitions. A key difference lies in their scope and scale: the 7th ERP is a national programme focused on Germany's energy transition, emphasising applied research and real-world demonstration projects, whereas Horizon Europe operates at the EU level, covering a broader range of environmental and energy challenges with a stronger emphasis on interdisciplinary research and international collaboration.

The evaluation study "Horizon Europe and the Green Transition: Interim evaluation support study" (European Commission 2024) was part of a back-to-back evaluation for the ex-post evaluation of Horizon 2020 and the interim evaluation of Horizon Europe conducted on behalf of the European Commission, with a thematic focus on Green Transition. The interim evaluation support study was conducted between February 2023 and January 2024. During the inception phase of the study, a specific methodological approach was designed in agreement with the Steering Committee, utilising a combination of various data collection and analysis tools, including bibliometrics, case studies, surveys, and benchmarking.

The evaluation of the 7th ERP commenced in 2021 as a five-year accompanying evaluation. The evaluation employs a mixed-methods approach to develop ongoing analyses, reflections and recommendations as a basis for steering and continuous improvement of the programme („programme learning"), while also contributing to an assessment of its effectiveness and impact. It informed the design of the 8th Energy Research Programme, which was launched as a mission-oriented research programme in 2023, with funding commencing in 2024.

ANALYTICAL FRAMEWORK

Both evaluation studies underlying the present research paper employed an evaluation framework that aimed to assess the contributions of these programmes to ongoing systemic transformations. The evaluations employed an enhanced programme theory approach, based on the Transformative Outcomes Framework (Ghosh et al., 2021), which is embedded in the Multi-Level Perspective (MLP) on System Innovation and helps to grasp systemic transformations better (see Dinges et al., 2022). A programme theory is often built on a conceptual model that explains how change is supposed to happen and what leads to impact. These models can be either explicitly stated or assumed without being clearly outlined. They might be based on theories, real-world experiences, or specific perspectives. In addition to traditional input-output-outcome-impact (I-O-O-I) frameworks, this paper adopts a theoretical approach to analyse the theory of change behind these programmes, drawing on insights from sustainability transition research.

The field of sustainability transition research defines transformative change as a fundamental shift in how socio-technical systems operate (Markard et al., 2012). This perspective is based on the MLP theory, which explains change as an interaction between three levels (Geels, 2011):

1. Stable Regimes – existing systems and structures that dominate the status quo.
2. Niche Innovations – new ideas, technologies, or practices that challenge the existing system.
3. Landscape Pressures – external forces (e.g., climate change, economic shifts, policy changes) that push for transformation.

The way these three levels interact determines how transitions unfold, leading to different transition pathways (Geels & Schot, 2007). Managing sustainability transitions is challenging because these changes are complex and evolutionary—no single group of actors can fully control them (Kivimaa et al., 2019). Instead, successful transformation requires carefully designed processes that 1) protect and support the growth and expansion of new, sustainable alternatives (niche innovations), and 2) break down or phase out existing, unsustainable systems (incumbent regimes).

These transformative processes comprise 12 key Transformative Outcomes (Ghosh et al., 2021), which provide a structured approach to understanding and guiding change through policies. In evaluation studies, outcomes refer to the measurable effects, results, or changes that occur as a result of a

policy, programme, or intervention. Outcomes (intended and unintended) are typically assessed in relation to predefined goals and objectives, using indicators to track progress. Unlike conventional outcomes, the concept of Transformative Outcomes focuses on systemic and structural change rather than just measuring success against predetermined objectives. The key distinction is that Transformative Outcomes are not static results but ongoing, process-oriented mechanisms that contribute to transformative change over time. They play a crucial role in driving transformation, which is why it is important to focus on understanding how specific programmes contribute to these processes.

The twelve Transformative Outcomes are grouped into the following three overarching processes of transformative change: Processes 1 and 2 are related to supporting the growth and expansion of new, sustainable alternatives 1) building and nurturing niches; 2) expanding and mainstreaming niches; Process 3) is related to break down or phase out existing, unsustainable regimes:

Building and nurturing niches: This process focuses on developing and supporting emerging innovations through 1) Shielding - active protection of the niche (e.g. through R&I subsidies for development), 2) Learning - encouraging experimentation and knowledge exchange among niche actors that challenges beliefs and assumptions of (incumbent) actors, 3) Networking – strengthening connections between (niche) actors to support innovation, 4) Navigating Expectations – developing and sharing visions of change to inspire action.

Scaling and mainstreaming niches: This process focuses on mechanisms for scaling and broadening the reach of successful innovations and experiments beyond their niche, thereby increasing their scale and scope. It consists of 1) Upscaling – increasing the adoption of new practices/technologies by involving more users, 2) Replicating all or parts of the innovations in new contexts, 3) Circulating ideas and resources through learning, and transferring ideas from one niche to another through ensuring funding, skills and infrastructure support and 4) Institutionalising – modifying policies, norms, and regulations through shared narratives, definitions, standards and interpretations.

Opening up and unlocking regimes: This process focuses on embracing new perspectives, deconstructing rules that characterise a dominant regime, and creating space for alternatives to emerge and grow. It consists of 1) De-aligning and destabilising mechanisms that facilitate the decline or transformation of existing dominant socio-technical regimes, those entrenched systems of practices, institutions, rules, and technologies that maintain the status quo, 2) Unlearning and deep learning – mechanisms helping regime actors to

questioning existing mindsets and values in comparison to new rules and routines, associated with solving sustainability challenges, 3) strengthening regime-niche interactions – creating stronger links between niche actors and regime actors, and 4) changing perceptions of landscape pressures – challenging collective perceptions about wider socio-political developments.

To understand whether real, lasting change is happening, we developed project beneficiary questionnaires in both evaluation studies that help track progress in two important ways:

First, to assess the current state of transformation processes, respondents were asked to evaluate the current state of transformation processes within their area of expertise as experts in the field. This section of the questionnaire, conducted only as part of the Energy Research Programme evaluation, aimed to capture the broader picture:

- To what extent are transformative processes already underway?
- Is the country actively driving sustainable change, or are existing systems remaining unchanged?
- Do researchers perceive tangible shifts toward systemic transformation, or does the status quo persist?

By gathering insights on the Transformative Outcomes as seen by experts in the field, this evaluation helped to assess whether and how fundamental changes are taking place, providing a clearer understanding of the progress and challenges in sustainability transitions.

Second, are the funded projects truly driving meaningful transformation? While many projects succeed in meeting their immediate objectives, we aimed to assess whether they also contribute to more profound, lasting change. Specifically, are they helping to shift the underlying systems and structures necessary for a sustainability transformation, as outlined by the 12 Transformative Outcomes? From the researchers' perspective, to what extent are these projects influencing the broader change processes, and how well do their impacts align with the outcomes that are known to catalyse systemic transformation?

By applying this survey concept, we provided a structured framework for how R&I programmes and their projects contributed to actively shaping systemic transformation. Table 1 shows how the Transformative Outcome survey operationalised each Transformative Outcome through multiple survey items.

Transformative Outcome	Survey operationalisation
Building and nurturing niches	
Shielding	*Establishing and promoting new fields of innovation* 1. Development of new, ground-breaking solutions 2. Establishing new fields of knowledge 3. Supporting pioneers 4. Protecting new fields of innovation from dominant interest 5. Protecting new fields of innovation from market influence
Learning	*Learning and exchange of experiences* 6. Learning about subject specific problems 7. Exchange of experience on innovative solutions 8. Reflection on new solutions and their application 9. Promotion of professional competences 10. Open communication of failures *Promoting awareness of problems and new ways of solving them* 11. Awareness of new ways of solving problems 12. Questioning conventional ways of solving problems 13. Critical questioning of established basic assumptions 14. Breaking down established ways of working
Networking	*Networking between and within young innovation fields* 15. Networking between new innovation actors 16. Networking between young innovation fields 17. Synergies between young innovation fields 18. Cooperation between pioneers
Navigating expectations	*Managing expectations and promoting shared visions* 19. Strengthening innovative solutions as legitimate alternatives for the future 20. Establishing and promoting new fields of innovation contributing to a green transition 21. Common understanding of the future direction of innovation fields 22. Anticipation of future trends and shocks 23. Reduced uncertainty about context conditions for innovations
Expanding and mainstreaming niches	
Upscaling	*Expansion of new fields of innovation* 24. Broad acceptance of novel approaches by various stakeholder groups 25. Large-scale use of innovations 26. Accelerated implementation of innovations 27. Recognition of new “rules of the game” associated with innovations
Replicating	*Replication of innovative solutions in new contexts* 28. Application of innovations in other places or regions 29. Transfer of innovations into other application areas 30. Re-interpretation and adaptation of solutions in other contexts 31. Transfer of innovation into other contexts

Circulating	*Dissemination and diffusion of innovative solutions* 32. Widespread dissemination of new, innovative ideas 33. Open communication of novel solutions 34. Transfer of knowledge beyond the boundaries of one's field of knowledge 35. Intensive discussion of innovations from other contexts
Institutionalising	*Institutionalisation of new strategies and norms* 36. Institutionalisation / mainstreaming of new solutions 37. Establishment of new, common definitions or norms 38. Establishment of new legal and regulatory foundations 39. Establishment of new rules of conduct
Opening up and unlocking regimes	
De-aligning and destabilising	*Breaking up outdated structures and strategies* 40. Open-mindedness of established actors for new ideas 41. Opening the system to new strategies 42. Breaking up outdated processes 43. Shaking up the established system through radical innovations
Unlearning and deep learning	*Abandoning outdated habits and rules* 44. Willingness of established actors to engage in new ways of solving problems 45. Questioning the usefulness of prevailing solutions 46. Acceptance of risks that innovations entail 47. Unlearning outdated rules and habits
Strengthening regime-niche interactions	*Exchange between "old" and "new" areas of knowledge* 48. Networking between pioneers and established players 49. Exchange between "old" and "new" areas of knowledge 50. Opportunities for pioneers to enter the dominant system 51. Opening up traditional patterns of cooperation to new actors
Changing perceptions of landscape pressures	*Systemic changes in terms of flexible response to changing framework conditions* 52. Recognition of the need for action due to new developments 53. Critical (re)interpretation of framework conditions 54. Rapid reaction to changing framework conditions 55. Flexible reactions to trends and shocks

In the Green Transition Evaluation, each question was tailored as follows: "To what extent do you expect that your HEU project will contribute to the Green Transition in terms…". In the Energy Research Evaluation, researchers were asked to "assess from your personal perspective the extent to which the following developments for the energy transition in Germany are taking place in your area of expertise." In addition, researchers were asked to what extent their project contributes to processes related to the Energy Transition, except from the process of de-aligning and destabilising, as this process was not part of the theory of change. For questions related to the program's contribution to transition processes, only the headlines (e.g., Establishing and promoting new fields of innovation) have been asked.

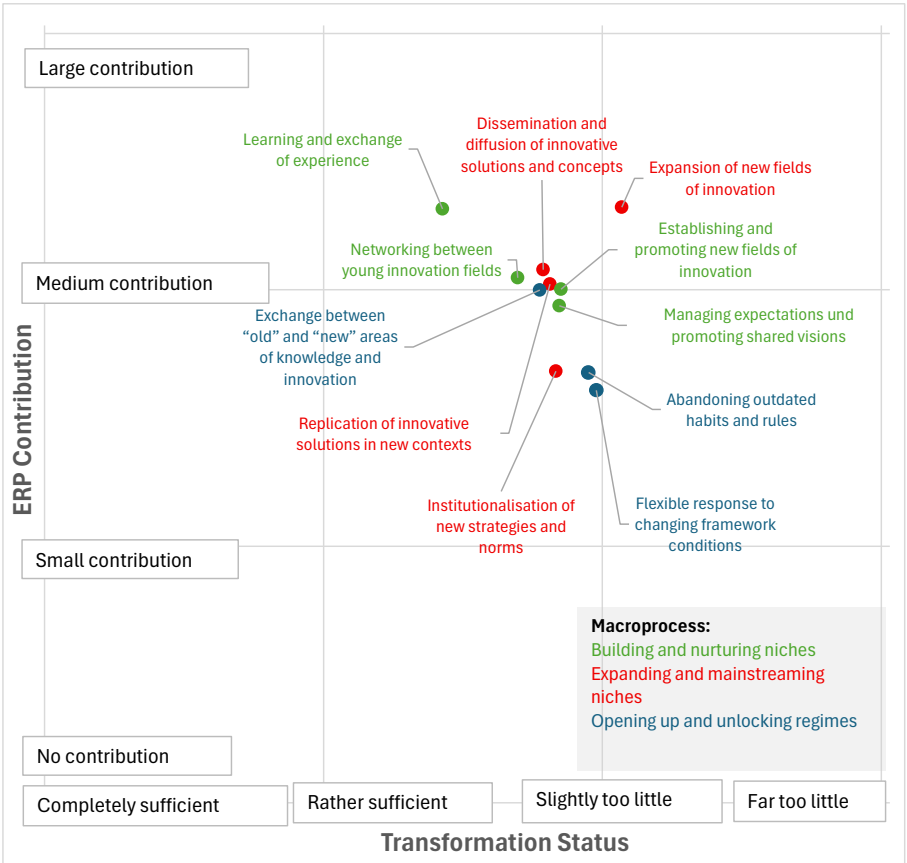
Source: Own compilation based on the surveys in the Green Transition evaluation and the Energy Research Programme evaluation.

SELECTED RESULTS

In the German case (7th ERP), the survey aimed to investigate how transformation processes are perceived by actors in the energy system and to what extend the programme contributes to these developments.

Figure 1 illustrates the relationship between the State of Transformation of the energy system (x-axis) and the Contributions of the 7th ERP to the Transformation (y-axis). The x-axis represents the degree of progress in the transformation process, moving from left (completely sufficient) to right (far too little). The y-axis measures the contribution of the 7th ERP to each Transformative Outcome operationalised in the survey.

Figure 1: Contributions of the 7th ERP in relation to the perceived transformation status



Note: Answers to the question: 'Before you answer questions about the energy research programme itself and your project, please assess from your personal perspective the extent to which the following developments for the energy transition in Germany are taking place in your area of expertise.' N= 5,235, average of 3,450 responses. As well as answers to the questions: To what extent does your project in the 7th Energy Research Programme contribute to the following developments in the energy system? To what extent do real-world labs of the 7th Energy Research Programme contribute to the following developments in the energy system? To what extent do accompanying measures of the 7th Energy Research Programme contribute to the following developments in the energy system?' N = 364 projects, average of 2,403 responses.

Source: Online survey 7th ERP (2024)

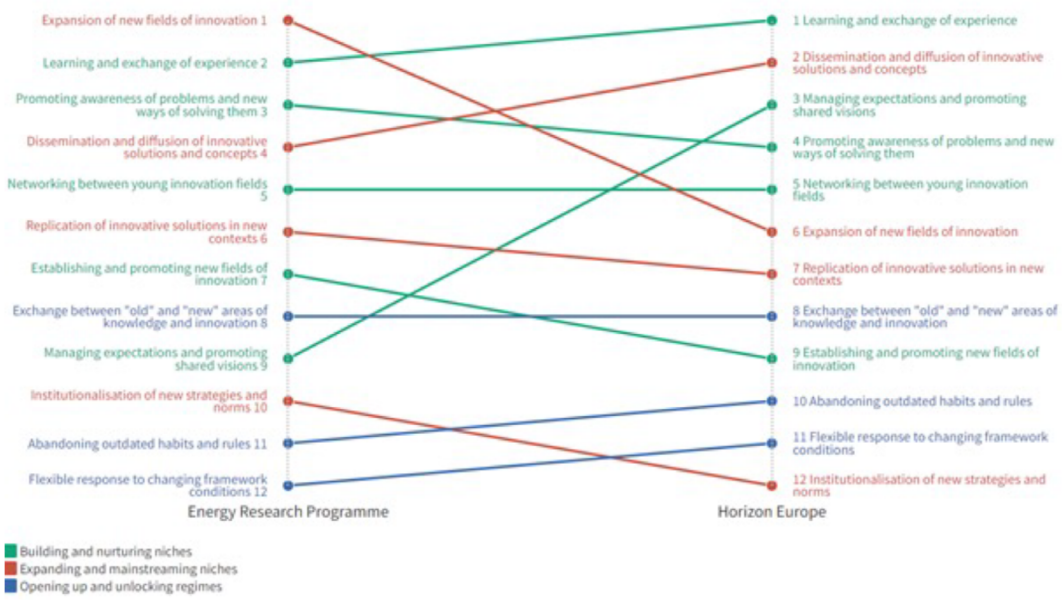
Several outcomes are located in the upper right quadrant, where transformation is perceived as insufficient, but the 7th ERP is making a significant contribution. Transformative outcomes in this area include 'expansion of new fields of innovation' and 'establishment and promotion of new fields of innovation'. These cases demonstrate that the 7th ERP is actively involved in areas where change is still required. The alignment between need and support indicates effective targeting of resources in areas where further transformation is both possible and supported by research activities.

The transformative outcomes 'learning and exchange of experience', as well as 'networking among young innovation fields', are viewed as comparatively well progressed, though not yet fully sufficient, and are attributed high contributions from the 7th ERP. These may be interpreted as areas of successful research engagement, where sustained 7th ERP support has contributed to the maturation of knowledge systems and actor networks.

A third group of transformative outcomes is located in the lower right quadrant: 'institutionalisation of new strategies and norms', 'abandoning outdated habits and rules', and 'flexible response to changing framework conditions'. These are areas where transformation is perceived as significantly lacking, yet the 7th ERP is considered to make a comparatively limited contribution. The transformative outcomes in this area comprise matters of regime-level or structural change, such as shifts in governance, regulations, or established routines. The 7th ERP's lower contribution here may reflect the inherent limitations of a research program, which may lack direct instruments to influence institutional or political frameworks. Nonetheless, the perceived gap highlights a critical tension: while the 7th ERP may be structurally constrained in these domains, these areas are perceived to be central to advancing the energy transition, suggesting a need to strengthen the interface between research and institutional change, potentially through collaboration with policy actors or the integration of research insights into decision-making processes.

When comparing the 7th ERP with Horizon Europe in terms of its contribution to transformative outcomes, the similarities outweigh the differences between the two R&I programmes. However, there are some striking differences (Figure 2).

Figure 2: Rank Order of Programmes' contribution to transformative outcomes



Source: ERP and Horizon Europe Survey data, own analysis.

Most respondents in the online surveys indicated that their projects contribute particularly well to the macro-processes of 'building and nurturing niches' and 'expanding and mainstreaming niches'. Compared to the 7th ERP, Horizon Europe makes a greater contribution to managing expectations and promoting shared visions. In the European Programmes, no significant differences were found across the different Societal Challenges or Clusters (e.g., energy or mobility), and the anticipated results from Horizon Europe exceed those from H2020.

In the 7th ERP, it is noticeable that the programme's contribution is more focused on the macro-process 'expanding and mainstreaming niches' than on 'building and nurturing niches', compared to Horizon Europe. The activities funded by the 7th ERP have made significant contributions to technology development, the promotion of innovation, and the demonstration and application of new solutions in new contexts. The contributions vary according to the instruments used in the 7th ERP. The scheme R&I projects focused on individual technologies contribute in particular to the macro-process of 'building and nurturing niches'. Real-world labs support the expansion and mainstreaming of niche areas. The accompanying measures (e.g., energy research networks) effectively facilitate learning and the exchange of experiences at the project level, while also raising awareness of new and innovative solutions.

Within the macro-process 'expanding and mainstreaming niches', the results for 'institutionalisation of new strategies and norms', are significantly lower

for both considered programmes (Horizon Europe as well as 7th ERP), calling into question the boundaries of an R&I programme, and the links between R&I, policy making, and deep learning of system actors.

Overall, contributions to the transformative outcomes within the macro-process 'opening up and unlocking regimes' are distinctly lower than those to the other transformative outcomes. There are only low contributions to 'abandoning outdated habits and rules', and limited contributions to a 'flexible response to changing framework conditions'.

Both evaluations also analysed the involvement of stakeholders in programme planning and the funded projects. The analyses for the Energy Research Programme show that stakeholder groups outside the direct target groups (research organisations and industry) are reached to a lesser extent (Dinges et al. 2023). For the European FPs, it becomes evident that although the involvement of regulatory authorities and standardisation bodies has improved, stakeholder involvement is still not sufficient in some areas. Relevant needs for the energy or green transition that go beyond the traditional focus of a research programme receive comparatively little support.

BENEFITS OF ANALYSING TRANSFORMATION PROCESSES IN EVALUATIONS AND REMAINING CHALLENGES

Analysing transformation processes in the evaluation of instruments and programmes provides various benefits, including the ability to assess their contributions to intended outcomes better. Empirically verifying impact mechanisms is critical to understanding whether interventions are achieving their objectives and how these mechanisms function in practice. This evidence-based approach enables evaluators to identify gaps in implementation or unintended consequences, allowing for adjustments to improve overall effectiveness.

Additionally, making changes in prioritisation visibly ensures transparency and adaptability, allowing stakeholders to realign efforts in response to shifting conditions or emerging priorities. By enabling systematic comparisons between instruments, evaluations contribute to the identification of best practices and foster the development of more targeted, effective, and scalable solutions.

Tracking the status of transformative outcomes over time offers critical insights into the dynamics of ongoing transformation processes and helps to navigate the complexities of systemic change more effectively. A key benefit is the ability to record and track changes in perceptions of the energy transition among innovation actors in the field, such as researchers, project managers, and industry stakeholders. Their perceptions serve as crucial, real-time indicators of how deeply change is being internalised and implemented within socio-technical systems. Identifying ongoing transformation processes and needs in different sectors is essential to ensure tailored interventions that address sector-specific challenges and opportunities. External influences, such as political, economic, or social factors, as well as internal dynamics within organisations, should also be systematically considered.

Another benefit includes the development of an empirical survey design, which plays a vital role in capturing transformation processes as well as internal and external influences, providing robust data on how perceptions of energy transition and programme impacts evolve. This allows for an assessment of project-specific characteristics, including the progress achieved, the nature of the projects themselves, and the attributes of the organisations involved.

Despite these benefits, challenges remain. One critical challenge is finding a comprehensive explanation of the concept of transformation. Despite its frequent application in research and policy discussions, the term often lacks a clear, unified definition, which can hinder its practical implementation and evaluation. Relatedly, the design of survey items to capture the nuances of transformation processes presents difficulties, as highlighted by Knöbel et al. (2023). Developing effective survey instruments requires careful balance—while extensive survey sections with numerous items may provide in-depth insights, they also impose significant demands on respondents, potentially leading to lower participation rates and reduced data quality.

A further challenge lies in avoiding oversimplified interpretations of transformation processes. An inadmissible shortcut, for example, is equating R&I programmes fostering transformation solely with niche development processes. Technical change itself drives transformation by persistently generating new niches (Schot and Geels, 2007). These niches serve as critical sources of path-breaking innovations but require temporary protective spaces to develop, as emphasised in foundational works by Schot et al. (1994) and Kemp et al. (1998). The need to balance niche protection with broader systemic change presents a significant challenge for fostering innovation.

Regulatory learning represents another underexplored yet highly important aspect of transformation, particularly in the energy sector. There is limited understanding of the role that research, technology, and innovation can play in advancing regulatory frameworks that facilitate systemic transformation. The interaction between regulatory development and innovation systems demands greater attention to ensure that policies are both enabling and adaptive.

Finally, the importance of interfaces between old and new actors, as well as their influence on behavioural change, remains a complex area of study. Transformation processes often require bridging gaps between established systems and emerging actors, fostering collaboration while addressing resistance to change. Understanding how these interfaces influence behavioural dynamics and long-term systemic transitions is essential for effective transformation but remains insufficiently addressed in current research.

CONCLUSION

Embedding research and innovation programmes within the multi-level perspective of science and technology studies provides a robust framework for developing programme theory. By situating R&I initiatives within the broader context of socio-technical systems, the multi-level perspective allows for a deeper understanding of how transitions unfold across niche, regime, and landscape levels. This approach also helps delineate the boundaries of an R&I programme, offering insights into its limitations and identifying areas where coordination with other policy or sectoral efforts is necessary. Such coordination is crucial to ensuring that programmes effectively contribute to systemic transformation.

The empirical reviews of R&I programmes further underscore the need for continuous refinement of programme theory. These reviews provided valuable indications of areas requiring further development, whether in conceptual design or operational implementation. Moreover, they facilitate the identification of particularly transformation-relevant instruments and topics, enabling policymakers and researchers to focus on interventions with the greatest potential for driving systemic change.

The contributions of individual projects within R&I programmes to broader transformation processes also offer critical insights into transformation needs that warrant targeted policy attention. These contributions can reveal gaps in

existing interventions, highlight emerging challenges, and suggest priorities for future action. However, addressing these needs requires sharpening measurement concepts and developing more precise empirical tools. Advancing methodologies for assessing transformation processes will enhance the ability to evaluate the effectiveness of R&I programmes, ensuring they remain relevant and impactful in addressing complex societal challenges.

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