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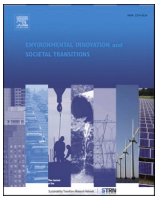
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Sorting out sustainability transitions: Q methodology as a tool for studying and navigating stakeholder perspectives

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ABSTRACT

Sustainability transitions involve genuine uncertainty, competing values, and persistent stakeholder disagreement about problems, solutions, goals and policy interventions. Understanding these contested dynamics requires methodological approaches that can systematically capture subjectivity while maintaining analytical rigor. In this perspective, we argue that Q methodology, a mixed-methods approach that combines qualitative depth with quantitative rigor, is an underutilized yet highly valuable tool for transitions research. Drawing on our experience from Q studies on industrial decarbonization and electrification in Sweden and Norway, as well as a broader reading of transitions-related Q research, we reflect on the method's strengths, limitations, and untapped potential. We highlight how Q methodology enables the identification of distinct stakeholder narratives, reveals areas of alignment and disjointment, and brings into view discursive and normative dimensions of transitions that research drawing on frameworks such as Technological Innovation Systems and the Multi-Level Perspective has often left underexamined. We also discuss important limitations, including challenges related to statement design, participant selection, and the interpretation of factors, and share practical lessons learned from applying the method across different empirical contexts. Beyond research, we suggest that Q could complement established participatory approaches in transition governance, for instance by helping to select participants who span the range of perspectives and by feeding identified narratives back into stakeholder dialogue. We conclude by outlining a research agenda to advance Q methodology in transition studies, including longitudinal designs, cross-country comparisons, mixed-methods integration and methodological refinements.

1. Introduction

Sustainability transitions involve genuine uncertainty, competing values, and persistent stakeholder disagreement. In this perspective, we argue that Q methodology — a mixed-methods approach to studying human subjectivity — is an underutilized yet highly valuable tool for capturing these contested dynamics, both as a research method and as a practical tool for stakeholder

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engagement and transition governance.

As transitions unfold, individuals across firms, academia, policy, and civil society hold divergent views on the nature of the problems to be addressed, which goals to set, what solutions to pursue, and the policy interventions needed to enable change. These disagreements are not merely technical or factual; they are shaped by different values, interests, and knowledge bases, and may reflect deeper normative conflicts about the direction and purpose of societal transformation (Andersson et al., 2026). Transitions also carry emotional costs, as actors must cope with the disruption, loss, and uncertainty that change entails (Bogner et al., 2024). Actors navigate this complexity through cognitive frameworks, or "mental models", that shape how they interpret problems and evaluate solutions (Van Den Broek et al., 2024). These subjective and interpretive dimensions underscore the relevance of analytical approaches that systematically engage with how actors make sense of transition challenges, especially since contestation in transitions manifests across multiple interfaces between emerging and established socio-technical configurations (Madsen et al., 2022).

At the same time, contestation is increasingly seen as a central challenge in, for example, mission-oriented innovation policy, prompting the need for inclusive, reflexive, and responsive approaches that take stakeholder disagreement seriously (Wiarda et al., 2023, 2024). Stirling (2010) has argued more broadly that science tends to push knowledge production toward single "definitive" interpretations that suppress legitimate disagreement. He advocates instead for "plural and conditional" approaches that map a range of reasonable perspectives, explicitly naming Q methodology as one such tool (Stirling et al., 2007; Stirling, 2010). Other approaches to uncover conflicting or competing perspectives include discourse network analysis (Leifeld, 2013), multi-criteria mapping (Coburn and Stirling, 2019), cognitive mapping (Eden, 1988), a wide range of computational clustering techniques (Kassambara, 2017; Svanberg et al., 2025), as well as problem-structuring procedures such as soft systems methodologies etc. (Checkland, 1981; Ackermann and Eden, 2010).

Although there is strong and growing interest in understanding conflicts and contestations in transition research, the field has been slow to adopt new methods for analyzing and addressing them. The field remains strongly oriented toward process-oriented qualitative case studies that rely on thematic content analysis. While generating rich empirical insights, this approach is not necessarily well suited to uncovering conflicting and competing perspectives, and it is sometimes questioned for its analytical transparency and replicability (Zolfagharian et al., 2019; Svanberg et al., 2025). The reliance on case-specific qualitative work has also been argued to constrain cumulative knowledge-building and the development of middle-range theories applicable across empirical contexts (Vaskelainen et al., 2025). Together, these developments create a clear demand for approaches that can systematically capture the structure of stakeholder disagreement and contribute to both transition research and practice.

Q methodology offers this type of approach by combining qualitative richness and quantitative rigor. By having purposively sampled participants rank statements on a forced distribution grid, Q identifies shared patterns of subjectivity that are extracted as factors and interpreted as narratives (Brown, 1980; Watts and Stenner, 2005). With a variance-based research design, Q captures the structure of distinct perspectives and their characteristics at a given point in time, rather than tracing how those perspectives unfold or interact over the course of a transition process. Importantly, the term "narrative" is here used in a specific methodological sense to refer to a coherent pattern of statement rankings, which differs from how the term is sometimes used in transitions research.

Q has been applied in a growing number of transitions studies. Empirical domains include the development of biogas (Kriechbaum

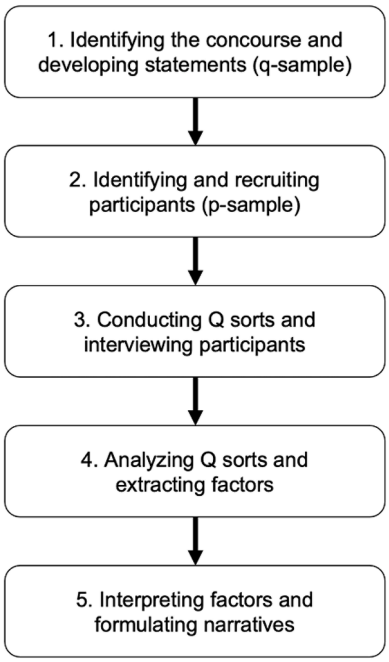


Fig. 1. Five methodological steps in Q research. Adapted from Watts and Stenner (2012).

et al., 2023) and the bioeconomy (Bauer, 2018; Lobensteiner and Losacker, 2026), carbon capture and storage (Setiawan and Cuppen, 2013), geoengineering (Cairns and Stirling, 2014), hydrogen technology (Baxter and Hacking, 2015), photovoltaics (Späth, 2018; Chang et al., 2019), electrification (Phan et al., 2025), industrial decarbonization (Steen et al., 2024; Andersson et al., 2026), circular construction (Wiarda et al., 2023), the collaborative economy (Gruszka, 2017), as well as climate (Mehleb et al., 2021) and energy policy (Kilpeläinen et al., 2019). While the identified studies apply the methodology to investigate a transitions-related phenomenon, only a few explicitly connect the findings to analytical frameworks such as technological innovation systems (Baxter and Hacking, 2015) and policy-mixes (Chang et al., 2019). Some of these studies have been published in EIST (Bauer, 2018; Gruszka, 2017; Mehleb et al., 2021; Andersson et al., 2026), indicating an existing yet modest track record within the journal's tradition.

In this perspective we argue that Q deserves a more prominent place in the transition studies toolbox. Drawing on our experience from three Q studies on industrial decarbonization and electrification in Sweden and Norway (Steen et al., 2024; Phan et al., 2025; Andersson et al., 2026), as well as a broader analysis of transitions-related Q research, we reflect on the method's strengths, limitations, and untapped potential. We also reflect on its value for stakeholder engagement and collective sense-making in transition governance and outline some ideas for future directions using the methodology.

2. Q in brief

The Q methodology is a research approach designed to study patterns of human subjectivity and perception in a structured and replicable way, thereby revealing how people value, prioritize, and frame complex issues (Stephenson, 1953; Brown, 1980; Watts and Stenner, 2005). The method was originally developed within social psychology (Stephenson, 1953) and then expanded through political science where (Brown, 1980) demonstrated Q's merits for mapping competing ideological perspectives. It was subsequently adopted in health research (Risdon et al., 2003; Cross, 2005; van Hooft et al., 2015), environmental management (Barry and Proops, 1999; Webler et al., 2001; Ellis et al., 2007) and numerous other disciplines (Watts and Stenner, 2012; Dieteren et al., 2023).

A Q study typically involves five steps (see Fig. 1 adapted from Watts and Stenner (2012)). First, the researcher(s) identify the concourse, the full range of discourse surrounding a topic, drawing on a combination of literature reviews, policy documents, media analysis, exploratory interviews etc. From this full concourse, a representative subset of statements (the q-sample) that span different positions and arguments about the topic is developed. Second, a purposive sample of participants (the p-sample) is recruited to capture a diversity of perspectives rather than a statistically representative population. Third, participants are presented with the statements and rank them on a forced-distribution grid, typically ranging from "most disagree" to "most agree" or from "least important" to "most important". The resultant Q sort is typically followed by a post-sorting interview in which participants explain the reasoning behind their rankings. Fourth, the Q sorts are analyzed statistically using factor analysis. This step is inverted relative to conventional R-technique factor analysis. Whereas R groups variables based on similarity across people, Q groups people based on similarity in response patterns across variables. Fifth, the extracted factors are interpreted qualitatively, drawing on both the statistical output and the interview data to articulate a narrative associated with each factor. In brief, these represent distinct ways of understanding the topic at hand.

The sorting and factor analysis provide structure, transparency, and replicability, while the interpretive step retains the richness and contextual depth associated with qualitative work. Because Q aims to map the range of perspectives on a topic rather than to measure their prevalence in a population, it works with small, purposive samples, typically 15 to 40 participants.

3. What Q brings to transition research

Reflecting on the growing body of Q-based transition studies, including our own, we believe that Q makes three main contributions to transition research: (1) it reveals structures of agreement and disagreement; (2) it enables transparent and comparative research designs; and (3) it brings subjective and normative dimensions of transitions into view (Table 1). First, Q allows researchers to identify and unpack internal diversity within seemingly unified positions. Indeed, what appears as monolithic "opposition" or "support" often contains distinct perspectives with different rationales. Späth's (2018) study of local resistance to large-scale solar parks reveals

Table 1
Summary of contributions, exemplary studies, limitations, and complementary methods.

Contribution of Q	Description	Exemplary studies	Limitations	Complementary methods
(1) Revealing structures of agreement and disagreement	Q unpacks diversity within seemingly unified positions, identifies alignment through consensus statements, and brings out marginalized perspectives.	Späth (2018); Gruszka (2017); Bauer (2018); Mehleb et al. (2021); Andersson et al. (2026)	Small purposive samples; says nothing about how widespread narratives are	Large-sample surveys (Baker et al., 2010); discourse network analysis (Leifeld, 2013)
(2) Enables transparent and comparative research designs	The standardized Q procedure allows comparison across countries, governance levels, niches and regimes.	Steen et al. (2024); Davies and Hodge (2012) (repeated Q, adjacent field)	Captures perspectives at one point in time; interpretation remains researcher-dependent	Process-oriented case studies; repeated Q studies
(3) Bringing subjective and normative dimensions into view	Q generates concepts of contestation, e.g. varieties of disagreement, disjointment, and meta-challenges.	Phan et al. (2025); Andersson et al. (2026); Wiarda et al. (2023)	Captures stated positions, not behavior; statement set reflects researchers' assumptions	Multi-criteria mapping (Coburn and Stirling, 2019); cognitive mapping (Eden, 1988)

principled objections grounded in landscape values alongside more pragmatic positions favoring alternative siting. Gruszka (2017) finds a similar pattern for attitudes toward the collaborative economy, where supporters and critics share a transformative orientation but diverge on whether the phenomenon delivers on its promise.

Conversely, Q may identify alignment in contested spaces. Consensus statements (i.e., ranked similarly across all factors) point to areas where participants agree amidst divergent perspectives, and correlations between factors indicate how closely the narratives align overall. For example, Andersson et al. (2026) find a somewhat surprising level of agreement regarding the positive effects of industrial decarbonization on Swedish exports. Q can also reveal marginalized or non-dominant perspectives that other methods might overlook. Bauer (2018) identifies a bioeconomy grassroots narrative that emphasizes localism and social equity alongside dominant techno-optimist and green-growth framings. Mehleb et al. (2021) show that "yellow vest" resistance to carbon taxes expressed justice concerns that were internally differentiated based on class, state capacity and corporate responsibility, rather than simple anti-environmentalism.

These examples demonstrate Q's capacity to uncover structures of agreement and disagreement underpinning transition dynamics. This is particularly important when the key challenge is not incomplete information or disagreement about facts, but competing interpretive frameworks of problems and solutions, and normative disagreement about what matters and why (Stirling, 2010; Frishammar et al., 2019; Andersson et al., 2026; Lobensteiner and Losacker, 2026). Unlike assessment tools that assume well-defined outcome spaces or survey methods that impose predefined categories, Q lets stakeholder perspectives emerge from the data. Such results may also inform policy processes, although research uptake in policy is rarely straightforward. In the decarbonization of energy-intensive industry, for instance, mapping where stakeholders agree and disagree can indicate where interventions could build on alignment and where deliberative effort is needed to address conflicts (Steen et al., 2024).

Second, the structured sorting procedure and factor analysis provide a level of transparency and replicability that addresses common criticisms of qualitative case studies as difficult to compare and cumulate (Svanberg et al., 2025). At the same time, the qualitative interpretation of factors, supported by post-sorting interviews, retains the contextual richness needed to understand transition dynamics. The standardized nature of Q also lends itself well to comparative designs. While factor interpretation always involves some level of researcher judgment, applying the same procedure across contexts enables systematic cross-case comparison with consistent interpretive choices. Steen et al. (2024) exploit this by comparing stakeholder perceptions of decarbonization challenges for energy-intensive process industries in Sweden and Norway, revealing both shared concerns and nationally distinct patterns of disagreement. The same logic extends to multi-level comparisons that, for example, contrast how actors at niche and regime level frame the same transition challenge. Such comparative designs are rare in transition studies, and Q offers a practical pathway for producing them.

Third, research drawing on frameworks such as Technological Innovation Systems (TIS) and the Multi-Level Perspective (MLP) has tended to rely on methods that treat subjective, discursive, and value-laden dimensions of transitions as objective or analytically separable. Q complements other discursive approaches in bringing these dimensions into view. Phan et al. (2025) demonstrate how Q reveals "meta-challenges" to electrification in Sweden that capture not just functional weaknesses but also contestation over values and governance logics. Andersson et al. (2026) distinguish varieties of disagreement, such as factual versus normative, and across problems, solutions, and interventions, introducing the concept of "disjointment" to describe persistent divergences rooted in conflicting values. Wiarda et al. (2023) similarly use Q to operationalize contested problem-solution spaces in circular construction, linking stakeholder narratives directly to analytical concepts. Taken together, these studies suggest that Q can help develop concepts of contestation that are analytically rather than statistically generalizable, even though the prevalence and intensity of contestation are highly context-dependent. Such concepts are, however, only a first step toward middle-range theories, which also specify relationships between concepts (Merton, 1968; Geels, 2007). A second step is to build links between these concepts and contextual factors such as national conditions, actor types, or transition phases. While this requires complementary research methods, Q may provide a conceptual foundation that paves the way for the cumulative knowledge the field has called for (Vaskelainen et al., 2025).

4. Limitations and lessons learned

While Q methodology offers significant advantages for transition research, it also comes with limitations. In this section, we reflect on challenges encountered in our own studies and draw on observations from others employing the methodology.

The first challenge arises when formulating and delimiting a research question. Q can systematically assess perceptions related to narrow topics, for example, in cases where both problems and solutions are well-defined, but governance or responsibilities are contested (Chang et al., 2019). It can also address complex settings where the problem-solution space is broad, such as our study of decarbonization challenges and solutions for the energy-intensive process industries (Steen et al., 2024; Andersson et al., 2026). In our experience, however, transition studies should generally aim for a middle ground. Designing a Q study involves defining the problem or solution, setting clear case boundaries, including relevant perspectives, and developing a manageable set of statements. These choices are challenging and inherently non-neutral. They rest on researchers' own assumptions about which problems and solutions are worth considering in the first place (Feola, 2020), calling for a critical and reflexive approach to how Q is implemented (Sneegas, 2020).

This connects to the second challenge we would highlight, which concerns the q-sample. Constructing a comprehensive and balanced set of statements that adequately represents a full concourse is demanding and inherently involves researcher judgment. Some perspectives may therefore be inadvertently underrepresented. In Steen et al. (2024) and Andersson et al. (2026), we addressed this through iterative approaches combining literature reviews, expert interviews, and pilot testing in line with recommendations from Watts and Stenner (2012). Marginalized or hidden voices and perspectives may nevertheless have been overlooked. Researchers must

therefore be both reflexive and transparent about how the q-sample was constructed and acknowledge its boundaries (Sneegas, 2020), as well as account for this challenge when delimiting the research question as discussed above.

A third challenge concerns the p-sample. Q studies should have 15–40 participants and avoid a larger p-sample than q-sample, since this may yield results with low statistical explanatory power and interpretative issues (Watts and Stenner, 2005). As with other research designs, critical or marginalized voices may decline to participate or be difficult to recruit. In Andersson et al. (2026), for instance, individuals holding particularly critical views of industrial decarbonization did not respond to invitations, limiting the extent to which their views are reflected in the identified narratives. Researchers should therefore acknowledge whom they were unable to include and corresponding implications for results.

A fourth challenge arises in the analysis of data from the completed Q sorts. Factor analysis demands decisions about the number of factors to retain, the handling of bipolar and confounding factors (e.g. Späth (2018)), and the treatment of high inter-factor correlations (e.g. Andersson et al. (2026)). Retaining statistically marginal factors on substantive grounds, because the narratives they represent are interpretively distinct despite providing limited explanation of variance, illustrates a recurring tension between statistical parsimony and empirical richness. Transparency about these choices is essential for the credibility of Q research. It is also worth stressing that Q captures how actors reason and position themselves on a topic, not how they subsequently act. As with attitudes more broadly, a stated position is not a reliable predictor of behavior, and Q narratives should therefore be interpreted as structured accounts of reasoning rather than evidence of behavioral change (Kollmuss and Agyeman, 2002).

A final, more practical challenge concerns data collection. Q interviews are less flexible than “conventional interviews”. Each session typically lasts about one hour, and the sorting procedure requires sustained engagement from participants. Online administration through specialized software, which all three of our studies used, has widened accessibility and enabled participation across geographic distances, but may reduce the depth of interaction compared to face-to-face settings and carries a (software) subscription fee.

Apart from these challenges, our studies have yielded several practical lessons. Combining Q sorts with post-sorting interviews proved essential for rich factor interpretation, as participants' verbal reasoning often revealed nuances that the statistical output alone could not capture. So-called crib-sheets, used to compare how the extracted factors rank key statements (Watts and Stenner, 2012), helped ensure interpretive discipline. Pre-sorting, where participants first categorize statements into broad groups before detailed ranking, was valuable for orienting participants and reducing the cognitive burden of the sorting task. In addition, designing comparable q-samples for cross-country studies, where institutional and policy contexts differ substantially, required careful balancing of context-specificity and comparability (Steen et al., 2024).

5. Using Q to support stakeholder engagement and sense-making

We also believe that Q methodology represents an opportunity for transition management and governance, and that it can serve as a practical tool supporting stakeholder engagement and collective sense-making. To begin with, the sorting exercise itself is inherently participatory. When stakeholders rank a carefully constructed set of statements according to their own priorities, the process encourages systematic reflection on trade-offs and assumptions that often remain implicit in conventional consultation formats. In our studies, participants frequently reported that the sorting experience was intellectually demanding but clarifying, forcing them to confront the relative importance of issues they had not previously juxtaposed. In this sense, Q connects to the growing recognition that transitions involve not only cognitive but also emotional dimensions (Bogner et al., 2024). The deliberate, reflexive nature of the sorting process may help participants articulate concerns, including anxieties about disruption, loss, and fairness that might otherwise go unarticulated in less structured settings.

The narratives produced by a Q study can also serve as a mirror for stakeholder groups. Presenting the results back to participants, showing them which perspectives exist, where they align, and where they persistently diverge, can enable collective sense-making and structure more productive deliberation. Rather than asking stakeholders to reach consensus from scratch, Q-based deliberation starts from an empirically grounded understanding of agreement and disagreement, allowing participants to focus where it matters most. A rare example of this approach is Cuppen et al. (2010), who used Q to select participants for a stakeholder dialogue on biomass energy options in the Netherlands, ensuring the perspectives in the room spanned the concourse rather than reproducing established constellations of actors. Cuppen (2012) later used the same perspectives to structure the dialogue itself, organizing discussion around the narratives Q had identified. This process reportedly helped participants move from defending fixed positions toward recognizing the legitimacy of other perspectives, though it also required considerable facilitation effort to translate statistically supported narratives into a format stakeholders could productively engage with. We are not aware of any additional applications of Q as an engagement tool in transitions contexts, suggesting this remains a largely unexplored possibility.

Using Q in this way aligns with Wiarda et al. (2024)'s responsible mission governance framework, which highlights contestation as a key governance challenge, and with Andersson et al. (2026), who emphasize disjointment as a primary issue. Q is not a substitute for such approaches but can complement established approaches to designing participatory processes in two ways. First, as the biomass case shows, Q can help determine who needs to be present for the range of legitimate positions to be represented. Second, feeding the identified narratives back into workshops or dialogues lets participants encounter their own position both as shared with others and as one narrative among several, articulated by people in the room rather than by an analyst. This may shift deliberation from stating positions to examining why they diverge (Cuppen, 2012). Whether such processes can lead to better policy outcomes, however, remains to be demonstrated.

6. Future directions for Q methodology in transition studies

There are several promising avenues to advance the use of Q in transition studies. To begin with, longitudinal Q studies can trace how stakeholder perspectives evolve as transitions progress, policies shift, or crises emerge (Morea, 2022). Repeating a Q study with the same or a comparable q-sample at different points in time enables analysis of discourse change, for example due to landscape shocks. When combined with extensive research designs that assess narrative prevalence, Q may also reveal how dominant perspectives gain or lose support across stakeholder groups. Despite this potential, longitudinal Q studies have, to our knowledge, not yet been applied in transitions research, even though they have been explored in adjacent fields (Davies and Hodge, 2012). As extensive participation and knowledge construction constitute key features of Q studies (Morea, 2022), researchers may have to find new ways to navigate ethical dimensions of sustained stakeholder involvement and, separately, ensure that engagement processes and longitudinal ambitions are realistically compatible with funding cycles.

Second, comparative and multi-level designs can be expanded. Building on the cross-country comparison by Steen et al. (2024), and investigations with similar aims in adjacent fields (Wolsink and Breukers, 2010; Matinga et al., 2014), future studies could apply Q across a wider range of local, regional, and national contexts, beyond the global North settings that dominate the transitions literature. Cross-sector comparisons could similarly show whether patterns of disagreement are sector-specific or recur across transitions.

Third, mixed-method integration offers considerable potential. As noted above and already suggested by Stephenson (1953), Q can be productively combined with large-sample surveys to assess the population-level prevalence of identified narratives. This remains to be done in transition research, but lessons can be gained from other fields (Baker et al., 2010; Mason et al., 2018; McHugh et al., 2026). Q could potentially also be combined with discourse network analysis, network analysis, mental model mapping, or computational text analysis to situate stakeholder narratives within their broader discursive and relational context, though we have not found examples of such combinations.

Lastly, a number of methodological refinements deserve attention. Some of these would benefit Q methodology as a whole, such as developing best practices for online Q administration and exploring rotational alternatives to Varimax. Others, including the handling of low-variance and correlated factors, may carry particular weight in transitions research specifically. Our own studies produced factors with high intercorrelations and substantial cross-loading (Andersson et al., 2026; Phan et al., 2025), plausibly reflecting that stakeholders in transitions contexts often share a broad systemic diagnosis while disagreeing about direction and priority. This is a pattern which is likely to recur across transition settings more broadly. In addition, as the community of Q practitioners in the field grows, shared methodological standards and reporting guidelines would support quality and comparability. This is particularly important given the heterogeneous approaches in the broader Q literature.

These directions point to several research questions where Q can make an important contribution alongside other methods, many of them related to the themes of politics, governance, geography and justice in Köhler et al. (2019). For example:

1. Do stakeholder disagreements shift from empirical to normative as a transition moves from formative to diffusion phases, and do they deepen or fade after landscape shocks?
2. In transformative policy missions, which disagreements can be addressed through more information, and which require negotiation of values?
3. Are patterns of alignment and disjointment around the same transition challenge specific to a country or governance level, or do they recur across them?
4. Do niche and regime actors differ mainly in how they diagnose problems or in which solutions they favor, and which narratives are absent from policy arenas?
5. How do justice concerns relate to differing understandings of problems and solutions, and which trade-off assessments surface in different narratives?

7. Conclusion

To conclude, we believe that Q methodology deserves a more prominent place in the sustainability transitions toolbox. We have argued that Q makes three main contributions to transition research. First, Q reveals structures of agreement and disagreement, including internal diversity within seemingly unified positions. Second, Q's standardized procedure enables transparent and comparative research designs across countries, governance levels, and time periods. Third, Q brings into view subjective and normative dimensions of transitions that research drawing on TIS and MLP has often bracketed, and can thereby provide a conceptual foundation for middle-range theorizing. We also recognize Q's potential as a practice-oriented tool for stakeholder engagement. The sorting exercise encourages reflexive deliberation, the resulting narratives provide an empirically grounded map of the disagreement landscape, and the identification of both alignment and disjointment can inform more targeted and legitimate policy processes. Q thus responds to multiple converging calls in the field: for methodological diversity (Zolfagharian et al., 2019), cumulative and comparative knowledge-building (Vaskelainen et al., 2025), plural and conditional approaches to policy advice (Stirling, 2010), and governance frameworks that take contestation seriously (Wiarda et al., 2024). We therefore invite the transitions community to engage with Q both as a way of widening the methodological base of transition research and as a bridge between research and practice.

Declaration of generative AI and AI-assisted technologies

AI tools (Claude: Sonnet 4.5, 4.6 and Opus 4.7, 4.8) were used throughout the writing process, including drafting text, reorganizing

arguments, and improving clarity. All outputs were carefully evaluated, edited, and validated by the authors, who take full responsibility for the published content.

CRediT authorship contribution statement

Hans Hellsmark: Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization. **Johnn Andersson:** Writing – review & editing, Funding acquisition, Conceptualization. **Nhu Anh Phan:** Writing – review & editing. **Markus Steen:** Writing – review & editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

No data was used for the research described in the article.

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