



Original research article

Shared values, shared acceptance? Towards an acceptance milieu framework illustrated by renewable energy research

Patrick Stuhm^{a,*}, Dirk Scheer^a^a Institute for Technology Assessment and Systems Analysis (ITAS), Germany

ARTICLE INFO

Keywords:

Technology acceptance
Social milieus
Shared values
Energy transition
Socio-technical transformation
Energy governance

ABSTRACT

Understanding recurring patterns of public acceptance has become increasingly important for explaining and governing socio-technical transformations such as the energy transition. Addressing this challenge requires understanding both how technologies are evaluated and how socio-cultural value configurations shape these evaluations. Technology acceptance research explains how technologies are evaluated, whereas social milieu research explains how shared value orientations and social positions give rise to recurring socio-cultural value configurations. However, an analytical framework that systematically integrates both perspectives is lacking. To address this gap, this paper develops the Acceptance Milieu Framework, linking shared value orientations and social positions to acceptance judgements. In doing so, it provides a conceptual and methodological basis for analysing and empirically reconstructing recurring socio-cultural patterns of technology acceptance. To illustrate the analytical utility of the framework, representative survey data on public acceptance of the German energy transition are analysed through two recurring societal conflict fields that serve as illustrative cases. The empirical illustration shows that shared value orientations are systematically associated with different societal priorities and corresponding patterns of acceptance judgements. These findings suggest that public acceptance cannot be understood solely through attitudes towards technologies but must also be understood in relation to the socio-cultural value orientations through which technological change is interpreted. The framework thus establishes a systematic approach to empirically reconstructing Acceptance Milieus and analysing how socio-cultural value configurations shape recurring patterns of technology acceptance.

1. Introduction

Public acceptance of technologies has become widely recognised as a prerequisite for the successful implementation of socio-technical transformations such as the energy transition. While technological innovation and supportive policy frameworks are indispensable for achieving climate neutrality, their implementation ultimately depends on societal support [1–4]. Over the past two decades, public acceptance has therefore become a central topic in energy research, technology assessment, and environmental governance [5–9]. However, despite substantial empirical research, public acceptance remains a complex and often contested concept [10–12]. Citizens do not evaluate technologies solely on the basis of their technical characteristics. Rather, technology evaluations are shaped by a broad range of psychological, social, and contextual factors [13]. Evaluations emerge within broader societal contexts in which technologies are interpreted in relation to competing societal objectives, normative expectations, and conflicting

societal interests [6,11,12,14].

This complexity is particularly evident in the energy transition. Renewable energy technologies are generally supported by broad segments of the population, yet specific implementation projects frequently generate controversy [5,6,8,9]. Moreover, societal debates surrounding the energy transition increasingly extend beyond questions of technological performance [8,9]. These debates revolve around the definition and prioritization of competing societal objectives such as climate protection, energy security, affordability, environmental conservation, regional development, and distributive justice [15]. Citizens differ in the priorities they assign to these objectives, resulting in recurring patterns of support and opposition that cannot be explained solely by technology-specific characteristics [6,12,14,16]. Understanding how these recurring patterns emerge therefore represents one of the central challenges of contemporary technology acceptance research [10,16].

While technology acceptance research has made significant progress in explaining how technologies are evaluated and has increasingly

* Corresponding author at: Institute for Technology Assessment and Systems Analysis (ITAS), Karlstr.11, 76133, Karlsruhe, Germany.

E-mail addresses: Patrick.stuhm@kit.edu (P. Stuhm), Dirk.Scheer@kit.edu (D. Scheer).

<https://doi.org/10.1016/j.erss.2026.104908>

Received 19 December 2025; Received in revised form 29 July 2026; Accepted 30 July 2026

Available online 4 August 2026

2214-6296/© 2026 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

recognised that these evaluations are socially embedded [11,12,14], an important limitation remains. It provides only limited explanations for why recurring patterns of technology acceptance emerge across society. Research has primarily focused on identifying individual, psychological, social, institutional, and contextual determinants of technology acceptance [17–21], whereas the socio-cultural value configurations underlying these evaluations remain under-researched. This raises the question of how shared value orientations give rise to recurring patterns of technology acceptance.

A promising perspective for addressing this question is offered by sociological milieu research. Since the pioneering work of Durkheim, Weber, and Bourdieu, this research tradition has argued that societies are not only differentiated by socio-economic characteristics but also by shared value orientations, lifestyles, and cultural practices [22–26]. Contemporary milieu approaches describe relatively stable socio-cultural configurations whose members share comparable value orientations and interpretative frameworks [27–29]. This perspective suggests that recurring patterns of technology acceptance may reflect shared socio-cultural value configurations. If acceptance judgements are shaped by broader socio-cultural contexts, do shared value orientations systematically generate recurring patterns of technology acceptance across different societal conflict fields? This perspective asks why similar acceptance judgements repeatedly emerge among people sharing comparable value orientations. Put differently: Can shared values explain shared acceptance? More specifically, can recurring patterns of technology acceptance be understood as expressions of shared socio-cultural value configurations?

To address this research question, this paper develops the Acceptance Milieu Framework by systematically integrating technology acceptance research and social milieu research. The argument unfolds in three analytical steps. First, the complementary contributions of technology acceptance research and social milieu research are examined to establish the need for their integration. Second, acceptance judgements are established as the central empirical manifestation of technology acceptance, and the theoretical approaches explaining their formation are reconstructed. Third, both perspectives are systematically integrated through the analytical categories of acceptance subject, action, and object, which provide the conceptual basis for the Acceptance Milieu Framework. The framework is subsequently operationalised and illustrated using representative survey data on public acceptance of the German energy transition. The paper concludes by discussing implications for future empirical research and the governance of socio-technical transformations.

2. Background: acceptance research and social milieu research

The first analytical step addresses the research question by examining technology acceptance research and social milieu research as complementary perspectives for explaining recurring patterns of technology acceptance. Rather than reviewing these traditions independently, this section compares their explanatory contributions to identify the conceptual gap that motivates their integration within the Acceptance Milieu Framework.

2.1. Acceptance research

Acceptance research is a central approach for analysing how individuals and social groups evaluate technologies, policies, and socio-technical transformations [10,30]. It examines positive, negative, and ambivalent attitudes and behavioural responses, thereby capturing both evaluative and action-based dimensions of acceptance [16,30]. Rather than being a clearly defined concept, acceptance is used in varying ways across research contexts, resulting in a wide range of existing definitions [31–33].

As a basic analytical framework, acceptance research distinguishes between acceptance subjects, objects, and the socio-cultural context in

which evaluations are embedded [5]. This allows for the analysis of acceptance across different levels and domains, ranging from individual technologies to broader policy frameworks. In energy research, for example, this perspective has been further differentiated into socio-political, community, and market acceptance [ibid.]. For analytical purposes, this relational structure can be specified along the dimensions of subject, action, and object, thereby focusing on who evaluates, how evaluations are expressed, and what is being evaluated [33].

Empirically, acceptance research typically combines measures of attitudes, perceptions, acceptance judgements, and behavioural responses with socio-demographic and contextual variables, often relying on survey-based and experimental methods. Within this field, a distinction is commonly made between public acceptance and broader forms of social acceptance. Public acceptance is often operationalised as aggregated attitudes and evaluations of individual citizens, whereas social acceptance encompasses multi-level processes involving different actors, objects, and institutional contexts. Public acceptance therefore cannot be treated as a proxy for social acceptance, as it captures aggregated evaluations but does not account for the broader multi-level processes and interactions that characterise social acceptance [10,11].

Overall, acceptance research provides a framework for analysing how opinions and judgements about technologies are formed and expressed across different social contexts. However, although it accounts for psychological, social, institutional, and contextual influences on technology evaluations [10–12], it provides only limited insight into why recurring patterns of acceptance judgements emerge across groups sharing comparable socio-cultural value orientations and structural positions.

2.2. Social milieu research

Social milieu research is a key approach in contemporary empirical sociology for understanding social differentiation beyond economic or class-based distinctions [25,26,29]. Rather than viewing societies primarily through socio-economic categories, milieu research identifies a relatively small number of socio-cultural groups whose members share similar value orientations, lifestyles, and structural positions. By integrating structural and cultural dimensions, it provides a comprehensive perspective on how different social groups perceive, interpret, and respond to societal developments.

Empirically, milieus are identified by linking structural indicators, such as education, occupation, or income, with value orientations, while lifestyles and everyday practices are used to describe and differentiate the resulting socio-cultural configurations [25,26]. These configurations are typically identified using segmentation approaches that combine quantitative analyses with qualitative reconstruction and interpretation [29].

Theoretically, milieu research builds on traditions of social stratification while extending them to cultural and symbolic dimensions. A central influence is Pierre Bourdieu, whose theory of social space highlights how economic, cultural, and social capital shape dispositions, lifestyles, and patterns of perception [24,34]. Complementary approaches emphasise symbolic boundaries, shared classifications, and cognitive schemas through which social groups interpret the world [35,36]. Together, these perspectives demonstrate that social differentiation is not only material but also cultural and interpretive.

Values and milieu segmentation are widely applied across research fields. In political sociology, they help explain why political preferences increasingly reflect cultural orientations alongside socio-demographic characteristics [37,38]. Similar approaches have been applied in educational and consumer research to analyse participation patterns, consumption practices, and lifestyle differences [39]. Overall, social milieu research provides a theoretically grounded and empirically robust framework for analysing how shared value orientations and structural positions shape societal perceptions and evaluations. However, despite its broad application across numerous fields of social

research, it has only rarely been applied to analyse recurring patterns of technology acceptance.

2.3. Conceptual synthesis and research contribution

The comparison of both research traditions demonstrates that they provide complementary perspectives for explaining recurring patterns of technology acceptance. Acceptance research provides detailed insights into attitudes, behavioural responses, and contextual determinants of technology-related evaluations, while milieu research explains how these evaluations are embedded within socially structured configurations of shared values and structural positions. Despite these complementarities, both traditions have largely evolved in parallel and have rarely been systematically integrated. The key limitation is therefore not that acceptance research neglects social context, but that it lacks a systematic account of how evaluative mechanisms are distributed and stabilised across socio-culturally differentiated groups. Conversely, milieu research explains such social structuring but does not specify how technology-related evaluations are formed.

The comparison demonstrates that existing research lacks an analytical framework capable of systematically linking shared value orientations and structural social positions with the formation of acceptance judgements. Addressing this gap requires reconstructing how acceptance judgements are theoretically understood and how they can be connected to socio-cultural value configurations. The following chapter therefore examines acceptance judgements as the central empirical manifestation of technology acceptance and reconstructs the theoretical approaches explaining their formation.

3. Exploring acceptance judgement formation: approaches between ‘self and society’

The second analytical step addresses the research question by establishing acceptance judgements as the central empirical manifestation of technology acceptance. Before technology acceptance research and social milieu research can be systematically integrated, it is necessary to reconstruct how acceptance judgements are theoretically understood and how they are formed. Existing theoretical approaches can

be grouped into three complementary perspectives: individual evaluation, social interaction, and socio-cultural context. Fig. 1 summarises this relational understanding of acceptance judgement formation. Together, these perspectives show that acceptance judgements emerge through the interplay between the individual and broader societal contexts, that is, between the “self” and “society”. Reconstructing this continuum establishes the explanatory scope of existing approaches and provides the conceptual basis for their subsequent integration within the Acceptance Milieu Framework.

3.1. Psychological approaches to acceptance judgements

Public acceptance research has developed a wide range of theoretical models explaining how individuals evaluate technologies and form attitudes towards their adoption, particularly in the context of energy systems and infrastructures [19,40]. These include cognitive-behavioural models such as the Theory of Planned Behavior [18] and the Technology Acceptance Model [17], as well as integrative frameworks combining cognitive, affective, and contextual variables [21,40]. In addition, related strands of research draw on normative and value-based approaches, such as the Norm Activation Model [41] and the Value-Belief-Norm theory [42], to account for the role of moral considerations and value orientations.

Cognitive-behavioural models conceptualise evaluation as a reasoned process in which individuals assess expected outcomes, perceived social expectations, and their own ability to act. Within frameworks such as the Theory of Planned Behavior, attitudes, subjective norms, and perceived behavioural control shape behavioural intentions, which in turn influence action [18]. While these models are primarily concerned with explaining behavioural intentions, they also provide important insights into how evaluative orientations towards technologies are formed, which underpin acceptance judgements.

Normative and value-based approaches complement these models by highlighting that acceptance judgements emerge not only through instrumental reasoning but also by internalised norms and broader value orientations. Although not originally developed within acceptance research, frameworks such as the Value-Belief-Norm theory show how values influence beliefs about consequences and responsibilities,

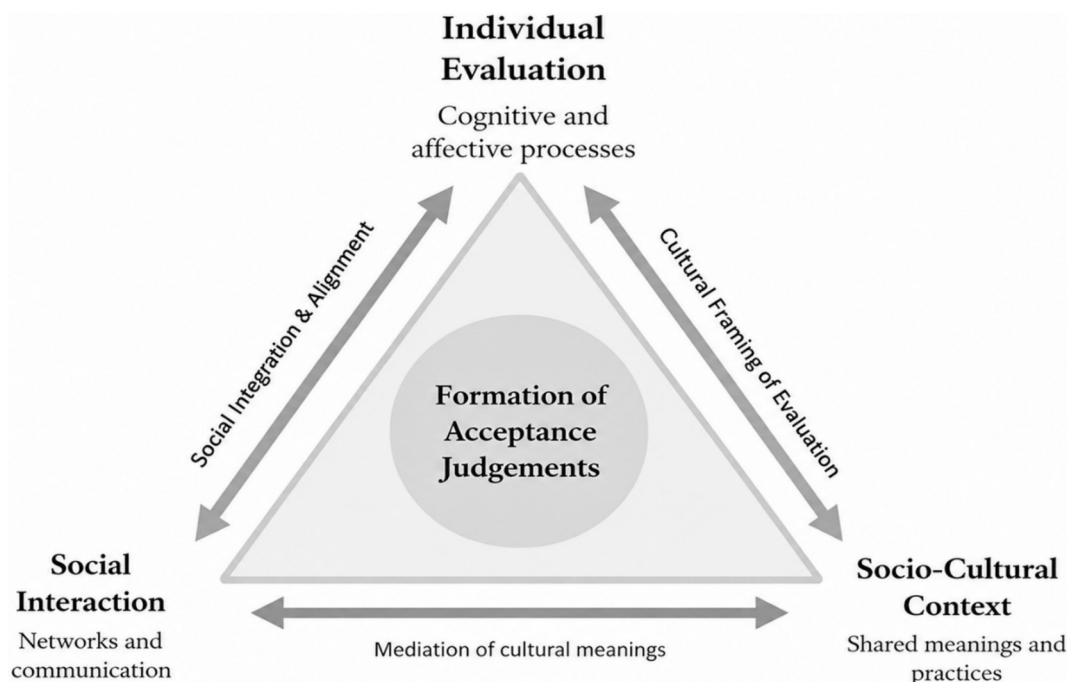


Fig. 1. Relational framework of acceptance judgement formation (own depiction).

thereby activating moral norms that guide evaluation [42]. As a result, acceptance judgements may reflect not only perceived utility but also normative considerations such as fairness, responsibility, or environmental concern.

Integrative models show that evaluation processes are shaped by the interplay of cognitive and normative factors, enriched by affective and contextual influences. Trust in institutions and developers, perceived procedural fairness, and emotional responses such as fear or enthusiasm can significantly influence how energy technologies are evaluated [12,15,21,43]. Within this mainly micro-level perspective, acceptance is typically explained through variables such as perceived risks and benefits, social norms, and affective responses, all of which contribute to how individuals process information and develop evaluative positions [19,40].

3.2. Social interaction and group processes in acceptance judgements

Beyond evaluation processes, acceptance judgements are also shaped through social interaction and group-level dynamics. Diffusion-oriented approaches explain how acceptance judgements spread and align within social systems. According to diffusion theory, individuals revise their evaluations based on communicated experiences, observed behaviour, and perceived adoption patterns within their social environment, leading to convergence of evaluations within social groups [44]. Threshold models further specify this mechanism by showing that individual evaluations depend on how many others have already adopted or supported a given position. Once a critical threshold is reached, shifts in acceptance can occur rapidly, resulting in cascading processes of opinion change within groups [45].

In addition, social norm approaches highlight that acceptance judgements are influenced by perceived expectations within relevant reference groups. Individuals orient their evaluations towards what they believe others approve of or expect, which can lead to conformity and the reinforcement of shared positions. Descriptive norms (what others do) and injunctive norms (what others approve of) both influence how technologies are evaluated, thereby contributing to the alignment of evaluations within social groups [46]. Beyond this, research on social representations emphasises that shared interpretations and collectively constructed meanings play a central role in shaping how technologies are perceived and evaluated within groups [47].

3.3. Socio-cultural perspectives to acceptance judgements

Building on psychological and interaction-based approaches, socio-cultural perspectives explain acceptance judgements as embedded in broader systems of meaning, social practices, and spatial contexts [48,49].

Cultural Theory of Risk conceptualises judgement formation as a process filtered through culturally embedded interpretive worldviews, shaped by underlying value orientations, that define what counts as risk, benefit, and appropriate action. Individuals drawing on different cultural biases, such as hierarchical, individualist, or egalitarian orientations, interpret the same technology differently, as their evaluations are guided by underlying assumptions about social order, responsibility, and control [50–52]. Social Practice Theory shifts the focus from discrete decision-making to routinised practices, explaining acceptance judgements as outcomes of how technologies are integrated into everyday life [48,49].

Science and Technology Studies (STS) further emphasise that acceptance judgements are shaped through public discourse, collective meaning-making, and socio-technical imaginaries. Technologies are interpreted within broader societal narratives about progress, responsibility, and legitimacy, and different social groups may attribute different meanings and expectations to the same technology [53–55]. Acceptance judgements are thus shaped not only by evaluation but also by interpretation within contested discursive contexts.

In addition, place-based approaches demonstrate that acceptance judgements reflect emotional and symbolic attachments to specific locations. Technologies are evaluated in relation to place identity, landscape meanings, and perceived impacts on local environments. Acceptance or resistance may therefore reflect not only assessments of technological characteristics but also perceived disruptions to valued places and social identities [26,56].

These approaches show that within the macro-level, acceptance judgements are shaped by broader socio-cultural contexts that provide shared frameworks of meaning and interpretation. Cultural orientations, social practices, public discourses, and place-based attachments influence how technologies are perceived, evaluated, and experienced, thereby framing what is considered desirable, acceptable, or problematic. Socio-cultural contexts structure individual evaluation processes by providing interpretive orientations, while being reproduced and negotiated through social interaction. As these orientations are shared among individuals with similar cultural backgrounds and ways of life, acceptance judgements may exhibit patterned similarities within such groups.

4. Bridging acceptance research and social milieus research

The third analytical step addresses the research question by systematically integrating technology acceptance research and social milieu research. The previous chapter established acceptance judgements as the central empirical manifestation of technology acceptance and showed that they emerge through the interaction of individual evaluation processes, social interaction, and broader socio-cultural contexts. Acceptance judgements therefore reflect evaluations that are socially embedded and shaped by shared value orientations, structural social positions, and collective frameworks of interpretation. While social milieu research explains how such socio-cultural configurations give rise to recurring patterns of perception and evaluation, what is still missing is a conceptual framework that reconnects these insights with the core analytical categories of technology acceptance research. Following the analytical tradition of acceptance research, this integration is developed through the categories of acceptance subject, acceptance action, and acceptance object, which provide the conceptual interface between both research traditions.

- Acceptance *subject*: individuals and collective actors who formulate and express acceptance judgements.
- Acceptance *action*: the behavioural expression or manifestation of acceptance judgements.
- Acceptance *object*: the technology, socio-technical arrangement, or responsible actors that constitute the reference point of acceptance judgements.

Both technology acceptance research and social milieu research rest on assumptions about the nature of the acceptance subject, that is, how people perceive, evaluate, and act in relation to technologies. Examining these assumptions provides the first conceptual building block for integrating both research areas within the Acceptance Milieu Framework.

From the perspective of technology acceptance research, the subject is conceptualised as an evaluative actor whose attitudes, intentions, and behaviours emerge from cognitive, affective, and normative processes [18,21]. While many empirical studies focus on individual evaluations, acceptance research does not conceptualise individuals as socially detached decision-makers. Rather, a substantial body of research demonstrates that acceptance judgements are embedded in social, institutional, and spatial contexts and are influenced by factors such as trust, place attachment, and collective meaning-making [6,9,12,57]. Within this perspective, individuals evaluate technologies through recurring criteria including perceived risks and benefits, costs, environmental impacts, trust, and procedural fairness [5,10,21]. Overall, this perspective primarily conceptualises individuals as evaluative actors whose

judgements are shaped through cognitive, affective, and normative processes.

Social milieu research conceptualises individuals as socially situated actors whose perceptions and evaluations are shaped by shared value orientations and structural social positions. Drawing on Mannheim's sociology of knowledge [58] and Bourdieu's concept of habitus [24], this perspective explains how social structures become embodied as durable dispositions that guide perception, evaluation, and action. Cultural sociology further emphasises that actors interpret the world through socially shared cognitive schemas [59]. Consequently, preferences and evaluations are understood as expressions of broader socio-cultural contexts rather than merely individual characteristics. This perspective becomes empirically visible through milieu typologies that identify relatively stable socio-cultural groups sharing similar value orientations and structural positions. Approaches such as the Sinus Milieu models illustrate that socio-ecological milieus are characterised by strong environmental concern and sustainability orientations, adaptive-pragmatic milieus by a focus on everyday feasibility, performer milieus by efficiency and innovation, and traditional milieus by stability and continuity [60]. These distinctions represent different socio-cultural frameworks through which societal developments and technological change are interpreted and evaluated.

Comparing both research traditions reveals their complementarity. Technology acceptance research explains how individuals form technology-related evaluations, whereas social milieu research explains why similar evaluations tend to recur among groups sharing comparable value orientations and structural positions. The Acceptance Milieu Framework integrates these perspectives by conceptualising the acceptance subject as simultaneously an individual evaluator and a member of a socio-cultural configuration. Acceptance judgements are therefore understood as the outcome of individual evaluation processes that are systematically shaped by shared socio-cultural orientations.

This leads to the first theoretical implication of the framework:

- Acceptance judgements are shaped by socially situated actors whose shared value orientations and structural social positions give rise to recurring patterns of technology evaluation across social milieus.

4.1. The action: from evaluative processes to socially structured practices

A second analytical dimension concerns how acceptance is expressed in action, that is, how evaluations of technologies are translated into observable behaviour. In technology acceptance research, action is typically conceptualised as the outcome of evaluative processes. Models such as the Theory of Planned Behavior explain behaviour as resulting from attitudes, subjective norms, and perceived behavioural control, mediated through behavioural intentions [18]. However, a substantial body of research demonstrates that intentions do not translate directly into behaviour. The well-established intention-behaviour gap shows that behavioural outcomes are additionally shaped by situational constraints, habits, available opportunities, and contextual conditions [61,62]. In the context of energy technologies, positive evaluations therefore do not automatically result in adoption or active engagement. Rather, acceptance may be expressed through different forms of action, including technology adoption, public participation, passive support, or active resistance [5]. Behaviour consequently depends not only on evaluative orientations but also on the conditions under which these orientations are translated into practice [63,64].

Social milieu research complements this perspective by emphasising that action itself is socially structured. Drawing on Bourdieu's concept of habitus [24] and practice-theoretical approaches [48,49], behaviour is understood as embedded in socially shared routines and practices that reflect shared value orientations and structural living conditions. Empirical research demonstrates that behavioural patterns differ systematically across social milieus [60,65]. Research on energy-related

behaviour further shows that the relationship between evaluations and action varies across milieus. For example, Vibrans et al. (2023) demonstrate that both the level of photovoltaic adoption intentions and the influence of their determinants differ significantly between social milieus [66]. Similar evaluations therefore do not necessarily lead to similar behavioural outcomes, as behavioural decisions are mediated by milieu-specific opportunities, constraints, and practices.

Taken together, both research traditions suggest that acceptance judgements and behaviour should be distinguished analytically. Technology acceptance research demonstrates that behavioural outcomes depend on situational and contextual conditions, while social milieu research explains why these conditions differ systematically across socio-cultural groups. Consequently, acceptance judgements may exhibit recurring similarities among people sharing comparable value orientations, whereas their behavioural expressions may vary according to milieu-specific structural conditions and everyday practices.

This leads to the second theoretical implication of the framework:

- The translation of acceptance judgements into action is socially structured and mediated by milieu-specific value orientations, structural conditions, and everyday practices.

4.2. The object: from socio-technical artefacts to attributions of meaning

A third analytical dimension concerns the object of acceptance, that is, what exactly becomes the object of evaluation. Technology acceptance research has increasingly demonstrated that technologies are not evaluated as purely technical artefacts but as socio-technical objects whose meaning depends on the contexts in which they are embedded. Accordingly, analytical attention extends beyond technical characteristics to include the broader conditions under which technologies are developed, implemented, and governed.

In public acceptance research, the object of acceptance is therefore typically conceptualised as a concrete technology, infrastructure project, or policy measure. Individuals evaluate these objects with regard to characteristics such as perceived risks and benefits, usefulness, fairness, ownership structures, environmental impacts, or procedural arrangements [6,21]. In the context of energy technologies, different technological options are associated with distinct profiles of perceived attributes. Nuclear energy, for example, is frequently associated with high risks and centralised control, whereas renewable energy technologies are commonly linked to environmental benefits, decentralisation, and climate protection [5,67]. Acceptance is therefore explained by how these perceived characteristics are evaluated under specific contextual conditions. At the same time, acceptance research increasingly emphasises that technologies are embedded within broader socio-technical contexts. Their evaluation depends not only on technological attributes but also on implementation contexts such as ownership structures, spatial location, procedural fairness, and opportunities for public participation [6,9,57]. Recent research further argues that acceptance is often directed not only towards technologies themselves but also towards the actors and institutions responsible for their development, implementation, and governance. Technologies thus function as reference points through which responsibility, trust, and legitimacy are evaluated [16].

From the perspective of social milieu research, technologies acquire meaning through socio-cultural frameworks characterised by shared value orientations and structural social positions. Consequently, the same technology may be interpreted differently by different social groups, not because its technical characteristics differ, but because it becomes associated with different societal objectives that are prioritised differently across socio-cultural contexts. Technologies therefore function as symbols within broader societal debates concerning sustainability, economic prosperity, energy security, distributive justice, regional development, or technological progress. Empirical milieu research suggests that these interpretations vary systematically across

socio-cultural groups. Milieus characterised by strong environmental orientations are more likely to interpret renewable energy technologies primarily in terms of sustainability and collective benefits, whereas more stability-oriented milieus may emphasise reliability, affordability, or potential disruptions. Similarly, the attribution of responsibility differs across milieus, as different groups draw upon distinct interpretive frameworks when evaluating which actors should be held accountable for technological developments [60].

Taken together, technologies should not be understood as fixed objects of evaluation. Rather, they function as socio-technical reference points through which broader societal objectives, value conflicts, and questions of responsibility become negotiated. Consequently, identical technologies may elicit systematically different acceptance judgements because different socio-cultural groups interpret them through different value-based frameworks. Acceptance judgements therefore emerge not only from technological characteristics themselves but also from the socio-cultural meanings attributed to these technologies.

This leads to the third theoretical implication of the framework:

- Acceptance objects are multidimensional because their meanings emerge from the interaction between their material characteristics, their socio-technical embeddings, and the socio-cultural value frameworks through which they are interpreted.

5. Developing and operationalizing the Acceptance Milieu Framework

The previous chapters established the theoretical foundations of the Acceptance Milieu Framework by integrating technology acceptance research with social milieu research. Building on this conceptual synthesis, the present chapter develops the framework's analytical architecture and discusses its empirical operationalization. The framework

organises the theoretical insights developed so far into four interconnected components that explain how socio-cultural value configurations become reflected in context-specific acceptance judgements.

5.1. Developing the architecture of the Acceptance Milieu Framework

The proposed framework assumes that acceptance judgements emerge from relatively stable socio-cultural configurations. These configurations are conceptualised as acceptance milieus, which combine shared value orientations with comparable structural social positions. Acceptance is therefore understood neither as a purely individual psychological disposition nor as a direct consequence of socio-demographic characteristics, but as the outcome of socially embedded interpretative frameworks through which technologies are perceived and evaluated (see Fig. 2).

To capture this relationship analytically, the framework distinguishes four interconnected components that together explain how socio-cultural orientations are translated into technology-specific acceptance judgements:

- First, *shared value orientations and structural social positions* constitute the socio-cultural foundation of acceptance milieus. Shared value orientations provide relatively stable normative orientations regarding desirable societal goals and principles, while social position reflects structural conditions such as education, occupation, income, age, and life circumstances. Together, these dimensions shape individuals' general perspectives on technological developments without implying deterministic relationships.
- Second, *technology-related attitudes* that mediate between socio-cultural orientations and context-specific acceptance judgements represent the relatively stable evaluative predispositions associated with acceptance milieus. They comprise perceptions of technological

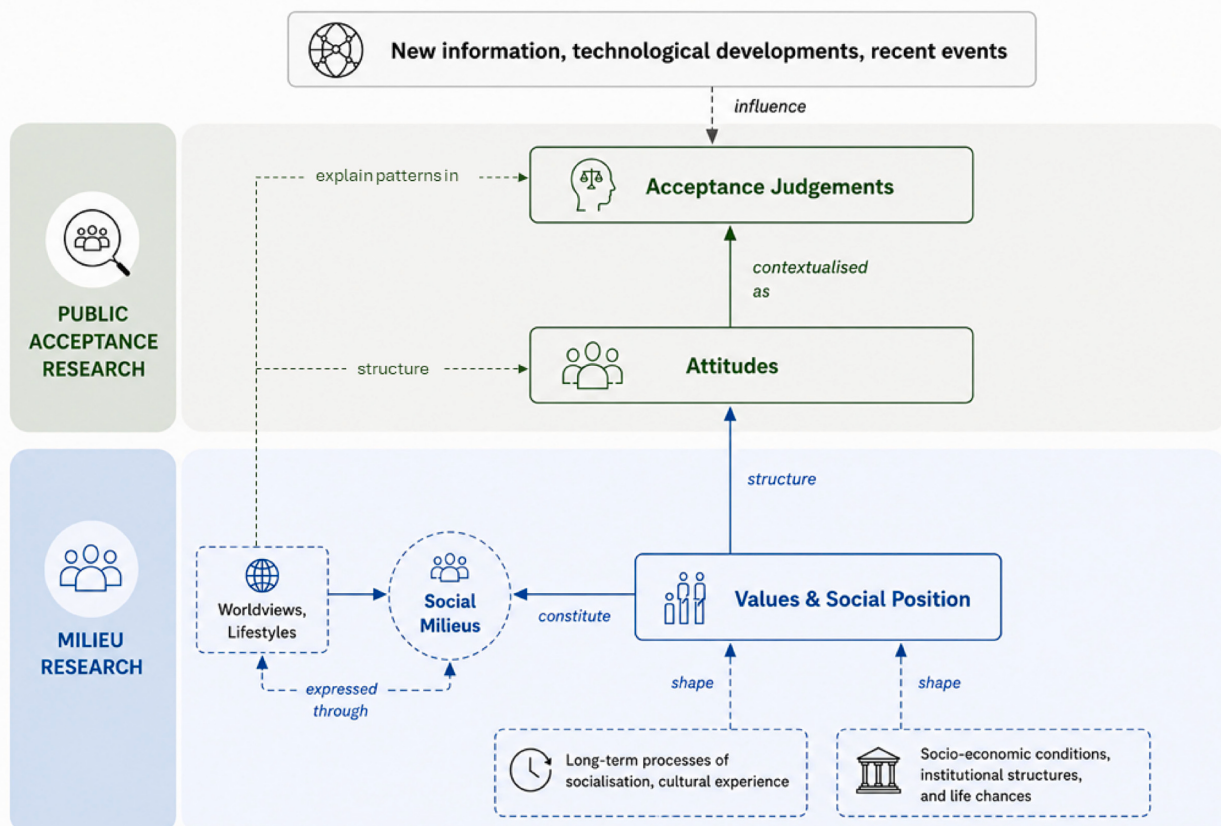


Fig. 2. Analytical framework of acceptance milieu integrating milieu research and public acceptance research.

risks, benefits, fairness, legitimacy, responsibility, and related evaluative dimensions. While attitudes reflect broad orientations towards technological domains, they remain more stable than evaluations of individual technologies or concrete policy decisions.

- Third, *acceptance judgements* represent context-specific evaluations. Unlike attitudes, they arise in response to concrete technological applications, implementation contexts, or societal conflict situations in which meanings are attributed to technologies. Acceptance judgements therefore vary depending on contextual conditions such as technology characteristics, perceived distributive consequences, local implementation, or newly available information, while remaining embedded within broader socio-cultural orientations.
- Finally, *technologies* constitute the object dimension of acceptance. Technologies are inherently multidimensional and relational objects whose evaluation depends both on their technological characteristics and on the societal conflicts in which they are embedded. Consequently, identical value orientations may result in different acceptance judgements depending on the specific technological context and societal conflict field in which a technology is evaluated.

In short, the Acceptance Milieu Framework therefore conceptualises technology acceptance as the product of an interaction between relatively stable socio-cultural configurations and context-specific technological conflict situations. Shared value orientations and comparable structural social positions provide the socio-cultural context within which technology-related attitudes are formed, while acceptance judgements reflect the application of these broader orientations to concrete technological situations. This perspective explains why technologies may be evaluated differently across social groups despite identical technological characteristics, and why identical value orientations may lead to different acceptance judgements depending on the societal conflict in which a technology is embedded.

5.2. Operationalizing the method design of the Acceptance Milieu Framework

The conceptual architecture of the Acceptance Milieu Framework provides the basis for its empirical operationalization. Implementing the framework requires a research design that systematically links shared value orientations, structural social positions, technology-related attitudes, and context-specific acceptance judgements. This emphasis on integration responds to a broader challenge in public acceptance research, where methodological diversity and the absence of common analytical frameworks have limited the comparability of empirical findings across studies [31]. While attitudes capture relatively stable technology-related evaluations, identifying Acceptance Milieus requires relating these evaluations to enduring value orientations and structural social positions.

Values can be measured using established frameworks such as Schwartz's theory of basic human values [68,69], Rokeach's value theory [80], or Inglehart's theory of cultural value change [70,71]. Social position can be operationalised through indicators such as education, occupation, income, or other structural characteristics. Empirically, Acceptance Milieus are identified by analysing how value orientations combine with structural social positions, building on established traditions of social stratification and lifestyle research [24–26,81]. Segmentation techniques such as cluster analysis or latent class analysis provide suitable tools for identifying groups characterised by similar value orientations and structural conditions [72,73,82].

Acceptance Milieus cannot be fully reconstructed through quantitative segmentation alone. As socio-cultural configurations, they also require qualitative approaches capable of reconstructing shared orientations, evaluative logics, and patterns of meaning [83]. Accordingly, quantitative segmentation should be complemented by qualitative methods such as in-depth interviews and focus groups. These methods fulfil three complementary functions. First, they enable the

reconstruction of the interpretative frameworks through which technologies are understood and evaluated, thereby revealing the underlying meaning structures that cannot be observed through quantitative indicators alone. Second, they support the interpretation and profiling of statistically identified clusters by explaining their internal coherence. Third, they contribute to the empirical validation of milieu classifications by assessing whether statistically derived groups correspond to meaningful socio-cultural configurations [74,75].

Building on this mixed-methods logic, the framework can be operationalised through a multi-step research design. First, socio-cultural clusters are identified based on value orientations and structural indicators. Second, qualitative analyses reconstruct group-specific orientations and interpret the internal coherence of these clusters. Third, technology-related attitudes are measured using established constructs such as perceived risks, perceived benefits, trust, legitimacy, and fairness [19,21]. Fourth, acceptance judgements are analysed to examine how these evaluative predispositions are translated into concrete support or opposition under different technological and societal conflict conditions. Finally, the resulting Acceptance Milieus are characterised through their distinctive value orientations, worldviews, and lifestyles.

Both technology-related attitudes and acceptance judgements can be measured using survey instruments, while experimental approaches such as vignette studies or discrete choice experiments allow contextual characteristics of technologies and conflict situations to be varied systematically [76,77]. Acceptance judgements therefore constitute empirical outcomes of Acceptance Milieus rather than their defining characteristics. This integrated research design enables the analysis of how shared socio-cultural orientations are translated into recurring patterns of technology acceptance while remaining sensitive to contextual variation. Rather than treating acceptance as an isolated outcome, it situates acceptance judgements within their broader socio-cultural context. Acceptance Milieus may either be derived empirically as new clusters or analysed as reinterpretations of existing segmentation models such as the Sinus Milieus [28]. In both cases, Acceptance Milieus are defined by the systematic linkage between shared value orientations, structural social positions, technology-related attitudes, and context-specific acceptance judgements.

6. Illustrating the energy transition case of the Acceptance Milieu Framework

Having outlined the conceptual architecture and methodological operationalization of the Acceptance Milieu Framework, the next step is to illustrate its empirical applicability. Rather than presenting a comprehensive empirical reconstruction and/or new configuration of Acceptance Milieus, this section provides a proof of concept for the analytical utility of the Acceptance Milieu Framework by illustrating how shared value orientations are reflected in systematically different acceptance judgements across recurring societal conflict fields. The Acceptance Milieu Framework assumes that recurring patterns of acceptance judgements originate in shared value orientations, whereas social position provides the structural dimension through which these value-based configurations become empirically identifiable as Acceptance Milieus. Illustrating the value dimension therefore provides an initial empirical illustration of the framework's value-based mechanism while laying the foundation for future studies that reconstruct Acceptance Milieus in their full conceptual scope.

6.1. Value-based conflict fields in the energy transition

The Acceptance Milieu Framework assumes that public acceptance of energy technologies is shaped not only by technological characteristics and their socio-technical embedding but also by the value orientations through which citizens interpret their societal implications. Rather than evaluating technologies in isolation, individuals assess how technological developments affect societal objectives they consider

important, such as climate protection, energy security, affordability, environmental conservation, or fairness while these considerations link back to core values. Consequently, identical technologies may receive substantially different evaluations because citizens assign different priorities to these competing objectives while we find explanations for these differing priorities in distributed value patterns.

This perspective builds on extensive research in environmental psychology demonstrating that basic values constitute relatively stable motivational orientations shaping environmental beliefs, policy preferences, and evaluations of environmental change [42,63,68]. In the context of energy transitions, values influence which consequences of technological developments citizens perceive as desirable or problematic and therefore provide an important foundation for technology-related evaluations [78]. Recent research increasingly conceptualises energy transitions not as collections of individual technologies but as complex socio-technical transformations involving multiple and often competing societal objectives [79,84–86]. Public evaluations therefore reflect broader judgements about how energy transitions balance goals such as climate protection, affordability, energy security, environmental conservation, distributive justice, and energy justice [87].

While previous research has shown that citizens prioritise different societal objectives when evaluating energy transitions, it provides only limited insight into why these priorities recur systematically across different groups. The Acceptance Milieu Framework addresses this question by proposing that recurring patterns of technology acceptance originate in shared socio-cultural value orientations. Acceptance Milieus therefore differ not because they evaluate different technologies but because they interpret the same technologies through different value-based perspectives. Accordingly, the empirical illustration focuses on recurring societal conflict fields rather than on individual technologies. Conflict fields make underlying value priorities directly observable because they require citizens to balance competing societal objectives.

For illustrating purposes, we will rely on two important conflict fields most relevant in the energy transition. Across the literature on energy transitions and technology acceptance, two conflict fields emerge particularly consistently. The first concerns the balance between climate protection, energy security, and affordability, reflecting tensions between environmental, economic, and security-related objectives. The second concerns the balance between renewable energy expansion and landscape protection, reflecting tensions between decarbonisation goals and place-based evaluations of environmental change. Together, these conflict fields provide a suitable proof of concept for illustrating how different value orientations give rise to systematically different acceptance judgements. To examine this proposition empirically, the following illustrative application operationalises the central components of the Acceptance Milieu Framework using data from a representative CATI telephone survey on public acceptance of the German energy transition. The survey was conducted in early 2023 among 1155 respondents aged 16 years and older living in Germany. A dual-frame random sampling design combining landline and mobile telephone numbers was employed, and survey weights were applied to ensure socio-demographic representativeness. Table 1 summarises the conceptual components, their empirical indicators, and their operationalization.

6.2. Conflict Field 1: climate protection versus energy security and affordability

The first empirical illustration examines the conflict field between climate protection, energy security, and affordability – one of the most prominent tensions characterising contemporary energy transitions. While all three objectives are widely regarded as desirable, they cannot fully be pursued simultaneously. Decisions that prioritise one objective may require compromises with respect to the others, making this conflict field particularly suitable for examining how citizens balance competing societal priorities. According to the Acceptance Milieu

Table 1

Operationalization of the Acceptance Milieu Framework for the illustrative empirical application.

Framework component	Survey measure	Operationalisation
Basic value orientations	Schwartz Human Values Scale (21 items)	Ten centred value dimensions calculated following the European Social Survey (ESS) scoring procedure
Acceptance judgement: Societal conflict field I (Climate protection–Energy security–Affordability)	“Which of the following goals are most important for implementing the energy transition?”	Binary indicators of respondents' selected societal priorities
Acceptance judgement: Societal conflict field II (Renewable energy expansion–Landscape protection)	“I feel disturbed by the visual changes to the landscape caused by energy technologies such as wind turbines or biogas plants.”	Five-point Likert agreement scale
General acceptance judgement	“Even if I personally experience disadvantages, I have nothing against implementing the energy transition.”	Five-point Likert agreement scale

Framework, these priorities are not randomly distributed across society but reflect different underlying value orientations. Individuals sharing similar value configurations are therefore expected to assign similar importance to competing societal objectives and, consequently, to develop similar patterns of technology acceptance.

The empirical illustration proceeds in two steps. First, it examines which societal objectives respondents prioritise and whether these priorities are associated with systematically different Schwartz value profiles. Second, it analyses whether these different priority groups also exhibit systematically different acceptance judgements regarding the energy transition. Together, these analyses illustrate the value-based mechanism of the Acceptance Milieu Framework: that shared value orientations are reflected in recurring patterns of technology acceptance.

Respondents were asked to indicate which societal goals they considered most important for implementing the German energy transition. Multiple responses were permitted, meaning that the percentages reported in Fig. 3 do not sum to 100%. As depicted, affordability was the most frequently selected societal objective (49.2%), followed by energy security (45.5%) and climate neutrality (36.2%). Energy independence (28.0%), equal access (22.9%) and job creation (11.5%) were selected less frequently. These descriptive results demonstrate that respondents prioritise different societal objectives and provide the empirical basis for the subsequent analyses. Given both their theoretical relevance and their empirical prominence, the following analyses focus on the three most salient objectives: climate neutrality, energy security and affordability.

To examine whether these competing societal priorities are associated with different underlying value orientations, respondents selecting each of the three objectives were compared with respondents who did not select the respective objective. Because multiple responses were permitted, these comparisons are not mutually exclusive but instead capture the value profiles associated with prioritizing each societal objective. The resulting Schwartz value profiles are presented in Table 2.

The comparisons reveal a clear and theoretically consistent pattern. Respondents prioritizing climate neutrality exhibited comparatively stronger Universalism values and comparatively weaker Security and Tradition values. In contrast, respondents selecting affordability or energy security displayed lower Universalism but stronger Security and Tradition values. These differences were most pronounced for climate neutrality, which was associated with moderate positive differences in

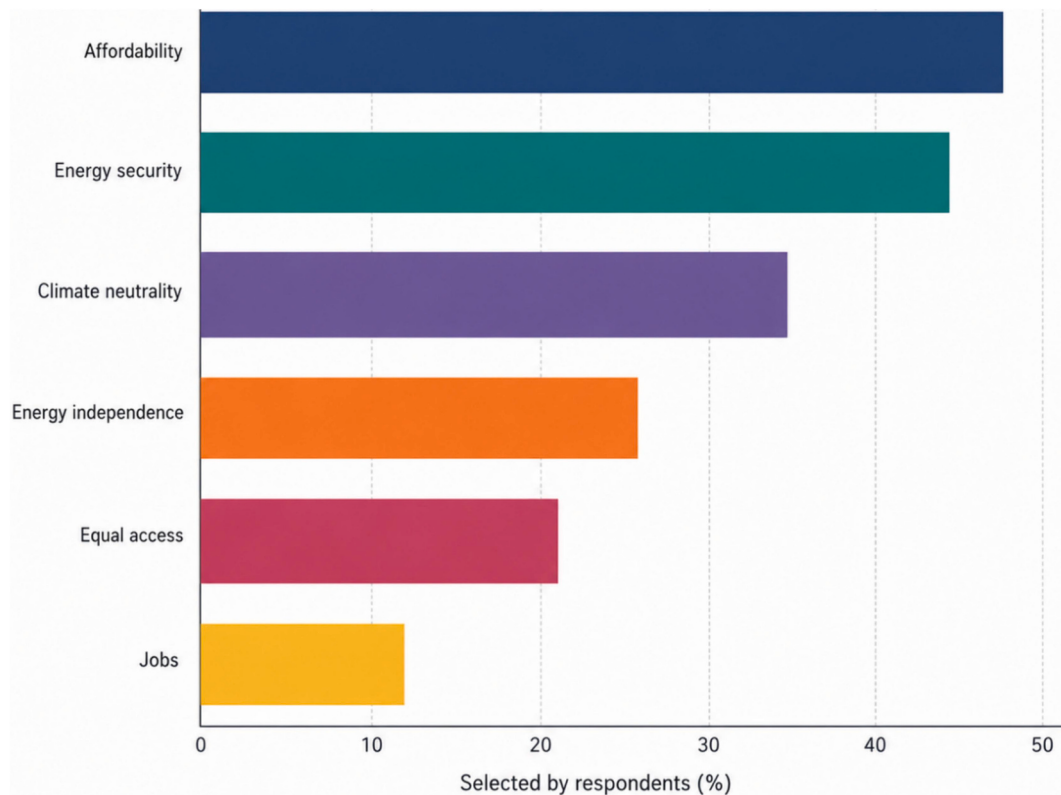


Fig. 3. Percentage of respondents selecting each societal goal as one of the most important goals of the energy transition (multiple responses possible).

Table 2
Schwartz value profiles associated with competing societal priorities.

Priority	Universalism	<i>d</i>	Security	<i>d</i>	Tradition	<i>d</i>	<i>n</i>
Climate Neutrality	1.14	0.34	0.07	−0.41	−0.37	−0.37	544
Energy Security	0.90	−0.28	0.37	0.12	0.20	0.20	683
Affordability	0.91	−0.26	0.41	0.22	0.22	0.22	739

Universalism ($d = 0.34$) and moderate negative differences in Security ($d = -0.41$) and Tradition ($d = -0.37$). By comparison, respondents prioritizing affordability or energy security showed comparatively smaller but directionally opposite effects.

Overall, these findings illustrate the first part of the value-based mechanism proposed by the Acceptance Milieu Framework. Individuals prioritizing different societal objectives are characterised by systematically different value profiles, suggesting that competing evaluations of the energy transition are associated with different underlying motivational structures. The next step examines whether these different value-based priority profiles are also translated into systematically different acceptance judgements.

Rather than using a general measure of support for the energy transition, acceptance was operationalised as respondents' willingness to support the energy transition even if it resulted in personal disadvantages. This measure was selected because it exhibited substantially greater variation than the general acceptance item and therefore

Table 3
Acceptance of the energy transition despite personal disadvantages across competing societal priorities.

Group	Acceptance (M)	SD	<i>n</i>	Cohen's <i>d</i>
Climate Neutrality	4.22	0.94	541	0.68
Energy Security	3.54	1.28	680	−0.27
Affordability	3.40	1.25	736	−0.53

provided greater discriminatory power. Table 3 summarises the corresponding group comparisons. Respondents prioritizing climate neutrality reported the highest willingness to accept personal disadvantages associated with the energy transition ($M = 4.22$), whereas respondents prioritizing energy security ($M = 3.54$) and affordability ($M = 3.40$) expressed considerably lower levels of acceptance. Standardized mean differences further demonstrate these contrasts. The strongest difference emerged for climate neutrality ($d = 0.68$), indicating substantially greater acceptance compared with respondents who did not prioritise this objective. Conversely, respondents selecting affordability ($d = -0.53$) or energy security ($d = -0.27$) were less willing to accept personal disadvantages resulting from the energy transition. These findings suggest that the societal priorities identified above are not only associated with different value profiles but also with different levels of willingness to accept personal costs arising from the energy transition.

The results illustrate the complete logic of the Acceptance Milieu Framework for the first conflict field. Different societal priorities are associated with different value profiles, and these priorities are, in turn, reflected in different acceptance evaluations. In other words, these findings indicate that competing societal priorities are associated with distinct value profiles and corresponding differences in acceptance judgements. Together, these findings illustrate the central value-based mechanism proposed by the Acceptance Milieu Framework. Although the analyses do not establish causal relationships, they provide an empirical illustration consistent with the analytical logic of the

Acceptance Milieu Framework.

6.3. Conflict Field 2: renewable energy expansion versus landscape protection

The second empirical illustration examines the conflict field between renewable energy expansion and landscape protection. The conflict field addresses evaluations of local consequences associated with renewable energy deployment. One of the most prominent sources of public controversy concerns the perceived visual impacts of renewable energy technologies on landscapes, particularly in relation to wind energy and bioenergy installations. According to the Acceptance Milieu Framework, such evaluations likewise reflect underlying value orientations. The present analysis therefore examines whether concerns about landscape change are associated with systematically different Schwartz value profiles.

Following the operationalization introduced in Table 1, respondents were asked whether they felt disturbed by the visual changes to the landscape caused by renewable energy technologies such as wind turbines or biogas plants. To facilitate a clear comparison, respondents who disagreed (“strongly disagree” or “rather disagree”) were classified as expressing no landscape concern, whereas respondents who agreed (“rather agree” or “strongly agree”) were classified as expressing landscape concern. Respondents selecting the midpoint of the response scale were excluded from this comparison in order to contrast two clearly distinguishable groups. To examine whether these contrasting evaluations are associated with different underlying value orientations, the Schwartz value profiles of both groups were compared. As in the previous conflict field, all ten centred Schwartz value dimensions were analysed. However, only Universalism, Security, and Tradition exhibited meaningful standardized differences between the two groups, whereas the remaining value dimensions showed only negligible effect sizes. For reasons of clarity, Table 4 reports only these three value dimensions.

The comparison reveals a clear and theoretically consistent pattern. Respondents expressing landscape concern displayed stronger Tradition values than respondents reporting no landscape concern (Cohen's $d = 0.41$), representing the largest standardized difference across the analysed values. In contrast, respondents reporting no landscape concern exhibited comparatively stronger Universalism values ($d = -0.23$). Security was also positively associated with landscape concern, although the observed difference was considerably smaller ($d = 0.19$).

Together, these findings illustrate a second manifestation of the value-based mechanism proposed by the Acceptance Milieu Framework. While the same basic value dimensions remain relevant across both conflict fields, their relative importance changes depending on the societal conflict under consideration. Whereas Universalism constitutes the strongest differentiating value in the conflict between climate protection, energy security, and affordability, Tradition emerges as the most pronounced distinguishing value when the conflict concerns perceived landscape impacts of renewable energy technologies. Security remains positively associated with both conflict fields but exhibits comparatively smaller differences in the second case.

Rather than suggesting that different conflict fields are governed by entirely different value systems, these findings indicate that common value orientations become differently salient depending on the societal conflict under consideration. This pattern is consistent with the value-

based mechanism proposed by the Acceptance Milieu Framework, according to which context-specific acceptance judgements emerge through the interaction between relatively stable socio-cultural value orientations and specific conflict constellations. Together, the two empirical illustrations demonstrate how the framework can be translated into an empirical research strategy while preserving its emphasis on context-dependent acceptance judgements.

7. Discussion and conclusion: contributions, implications, limitations

The central contribution of this paper is twofold: first, the conceptual development of the Acceptance Milieu Framework as an analytical perspective for explaining recurring patterns of technology acceptance through shared socio-cultural value configurations. The framework's development relies on key insights from both exploring acceptance judgement formation as approaches between ‘self and society’, and bridging acceptance research and social milieu research referencing key analytical components of acceptance. Second, the empirical illustration further demonstrates that the framework can be operationalised and applied to recurring conflict fields in the energy transition. Operationalisation has been done by using established value measures and survey-based acceptance indicators, thereby providing an initial proof of concept for the proposed framework. By integrating technology acceptance research with social milieu research, the framework introduces a meso-level perspective that explains why similar acceptance judgements emerge among socially structured groups.

7.1. Theoretical contribution and methodological implications

This paper set out to address a central limitation of contemporary technology acceptance research. Although existing approaches increasingly acknowledge that technology evaluations are socially embedded, they provide only limited insight into why recurring patterns of technology acceptance emerge across society. At the same time, social milieu research offers sophisticated concepts for analysing socio-cultural differentiation but has rarely been systematically connected to technology acceptance research.

The Acceptance Milieu Framework proposed in this paper integrates these two research traditions by conceptualising technology acceptance as emerging from the interaction between shared value orientations, structural social positions, technology-related attitudes, and context-dependent acceptance judgements. Rather than replacing established acceptance models, the framework extends them by introducing a meso-level analytical perspective that links individual evaluation processes to broader socio-cultural configurations. In doing so, it shifts the analytical focus from isolated acceptance judgements towards recurring patterns of acceptance. Instead of asking only why individuals differ in their evaluations of technologies, the framework asks why similar evaluations repeatedly emerge among people who share comparable value orientations and structural social positions. Acceptance is therefore conceptualised not merely as an individual psychological phenomenon but as a socially structured process embedded within broader socio-cultural contexts.

Importantly, the proposed framework does not introduce social milieu simply as an additional explanatory variable. Rather, it conceptualises socio-cultural configurations as the context within which technology-related attitudes and acceptance judgements are formed and stabilised. This perspective complements existing acceptance research by providing a conceptual basis for understanding why combinations of attitudes, value orientations, and evaluative logics repeatedly occur among particular social groups rather than being distributed randomly across individuals. In this way, the framework links individual evaluation processes with broader patterns of socio-cultural differentiation.

The framework also contributes methodologically by proposing a systematic strategy for operationalizing Acceptance Milieus. Unlike

Table 4

Acceptance of the energy transition despite personal disadvantages across competing societal priorities.

Value	No landscape concern	Landscape concern	Cohen's d
Universalism	1.03	0.87	−0.23
Security	0.26	0.44	0.19
Tradition	−0.11	0.28	0.41

conventional segmentation approaches based exclusively on socio-demographic characteristics or behavioural indicators, Acceptance Milieus are conceptualised as socio-cultural configurations integrating structural social positions, shared value orientations, technology-related attitudes, and context-specific acceptance judgements. This conceptualisation implies that their empirical reconstruction cannot rely on a single methodological approach. Quantitative segmentation techniques provide an important basis for identifying potential group structures, but they require qualitative reconstruction to capture the shared interpretative frameworks, evaluative logics, and patterns of meaning that characterise socio-cultural configurations. Acceptance Milieus should therefore be understood as analytically reconstructed socio-cultural formations rather than purely statistical clusters.

The empirical illustration presented in this paper shows how the proposed framework can be translated into an operational research design. Rather than providing a complete empirical reconstruction of Acceptance Milieus, the analyses illustrate the framework's value-based mechanism by demonstrating that shared value orientations are associated with systematically different evaluations of recurring societal conflict fields. More importantly, the illustration highlights the analytical value of integrating technology acceptance research with social milieu research. While technology acceptance research identifies the factors through which technologies are evaluated, social milieu research provides a perspective on how shared value orientations and structural social positions are organised into recurring socio-cultural configurations. The Acceptance Milieu Framework combines these complementary perspectives by linking shared socio-cultural value configurations to recurring patterns of technology acceptance. In doing so, it offers a coherent analytical framework for examining how recurring acceptance judgements can be understood within their broader socio-cultural context.

7.2. Acceptance milieu implications for energy research and energy governance

The proposed framework has particular relevance for energy research because contemporary energy transitions are characterised by recurring societal conflicts that cannot be understood solely through technological characteristics or individual attitudes. Conflicts surrounding renewable energy deployment, energy affordability, energy security, landscape protection, participation, ownership, and distributive justice involve competing societal objectives that are interpreted differently across socio-cultural groups.

The empirical illustration suggests that these recurring conflicts can be analysed more systematically by examining how different value configurations shape evaluations of competing societal objectives. Rather than treating public acceptance as a homogeneous phenomenon, the Acceptance Milieu Framework provides an analytical perspective for identifying recurring patterns of acceptance across socio-cultural groups. In doing so, it complements existing public acceptance research by linking technology evaluations to broader socio-cultural value configurations and patterns of social differentiation.

From a governance perspective, the framework suggests that public responses to socio-technical transformations cannot be understood independently of the socio-cultural contexts in which technologies are evaluated. Governance instruments, including communication strategies, participatory procedures, ownership models, economic incentives, and regulatory measures, should therefore not be regarded as universally effective interventions. Rather, their effectiveness depends, at least in part, on the value orientations through which different social groups interpret technological change. Consequently, the same policy instrument may be interpreted differently across Acceptance Milieus. Communication strategies emphasising economic efficiency may resonate with some groups while remaining less persuasive for others prioritizing environmental responsibility or procedural fairness. Likewise, participatory approaches, community ownership models, or

distributive policies may acquire different meanings depending on the socio-cultural configurations through which legitimacy, responsibility, and societal desirability are assessed. Rather than advocating group-specific governance strategies, the Acceptance Milieu Framework offers an analytical perspective for identifying potential mismatches between governance instruments and the socio-cultural contexts in which technologies are interpreted. In this way, Acceptance Milieus provide a conceptual tool for developing more reflexive, context-sensitive, and anticipatory approaches to governing socio-technical transformations.

7.3. Conclusions: limitations and future research

Several limitations should be acknowledged. First, the empirical analyses presented in this paper are illustrative rather than confirmatory. They are intended to demonstrate the operationalisability of the proposed framework and to illustrate its value-based mechanism rather than to provide a comprehensive empirical reconstruction of Acceptance Milieus.

Second, the empirical illustration focuses primarily on the value dimension of the framework. Although the theoretical model conceptualises Acceptance Milieus as socio-cultural configurations integrating shared value orientations with structural social positions, technology-related attitudes, and context-specific acceptance judgements, the present analyses do not yet reconstruct these components simultaneously. A comprehensive empirical application will therefore require integrating value orientations, structural social positions, technology-related attitudes, and acceptance judgements within a mixed-methods segmentation approach.

Third, the empirical illustration is limited to the German energy transition. Whether comparable Acceptance Milieus emerge in other socio-technical transformation contexts or national settings remains an open empirical question. Future research should therefore focus on the empirical reconstruction and validation of Acceptance Milieus using mixed-methods research designs that combine quantitative segmentation with qualitative reconstruction. Such studies could examine whether Acceptance Milieus remain stable across technologies, societal conflict fields, and institutional contexts, and assess the extent to which the framework provides additional analytical insight alongside established technology acceptance models.

CRediT authorship contribution statement

Patrick Stuhm: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Dirk Scheer:** Writing – review & editing, Supervision, Methodology, Formal analysis.

Declaration of Generative AI and AI-assisted technologies in the writing process

The authors used generative AI tools for language editing and stylistic refinement of the manuscript. All conceptual content, analysis, and interpretations are the authors' own, and the authors take full responsibility for the content of the article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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.

Acknowledgements

This article was developed within the framework of a doctoral research project. No external funding was received for the conduct of this research.

Data availability

Data will be made available on request.

References

- [1] Ethics Commission on Secure Energy Supply, Germany's Energy Transition – A Collective Project for the Future, Federal Government of Germany, Berlin, 2011.
- [2] F.W. Geels, Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, *Res. Policy* 31 (8–9) (2002) 1257–1274, [https://doi.org/10.1016/S0048-7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8).
- [3] J. Markard, R. Raven, B. Truffer, Sustainability transitions: an emerging field of research and its prospects, *Res. Policy* 41 (6) (2012) 955–967, <https://doi.org/10.1016/j.respol.2012.02.013>.
- [4] IPCC, Climate change 2022: mitigation of climate change, in: Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, 2022.
- [5] R. Wüstenhagen, M. Wolsink, M.J. Bürer, Social acceptance of renewable energy innovation: an introduction to the concept, *Energy Policy* 35 (5) (2007) 2683–2691, <https://doi.org/10.1016/j.enpol.2006.12.001>.
- [6] P. Devine-Wright, Public engagement with large-scale renewable energy technologies: breaking the cycle of NIMBYism, *Wiley Interdiscip. Rev. Clim. Chang.* 2 (1) (2011) 19–26, <https://doi.org/10.1002/wcc.89>.
- [7] B.K. Sovacool, P.L. Ratan, Conceptualizing the acceptance of wind and solar electricity, *Renew. Sust. Energ. Rev.* 16 (7) (2012) 5268–5279, <https://doi.org/10.1016/j.rser.2012.04.048>.
- [8] S. Batel, Research on the social acceptance of renewable energy technologies: past, present and future, *Energy Res. Soc. Sci.* 68 (2020) 101544, <https://doi.org/10.1016/j.erss.2020.101544>.
- [9] M. Wolsink, Wind power implementation: the nature of public attitudes: equity and fairness instead of “backyard motives”, *Renew. Sust. Energ. Rev.* 11 (6) (2007) 1188–1207, <https://doi.org/10.1016/j.rser.2005.10.005>.
- [10] P. Upham, C. Ultra, A. Boso, Towards a cross-paradigmatic framework of the social acceptance of energy systems, *Energy Res. Soc. Sci.* 8 (2015) 100–112, <https://doi.org/10.1016/j.erss.2015.05.003>.
- [11] M. Wolsink, Social acceptance revisited: gaps, questionable trends, and an auspicious perspective, *Energy Res. Soc. Sci.* 46 (2018) 287–295, <https://doi.org/10.1016/j.erss.2018.07.034>.
- [12] S. Batel, P. Devine-Wright, T. Tangeland, Social acceptance of low carbon energy and associated infrastructures: a critical discussion, *Energy Policy* 58 (2013) 1–5, <https://doi.org/10.1016/j.enpol.2013.03.018>.
- [13] N. Gupta, A. Fischer, L. Frewer, Socio-psychological determinants of public acceptance of technologies: a review, *Public Underst. Sci.* (Bristol, England) 21 (2012) 5. 782–95. Verfügbar unter: <https://doi.org/10.1177/0963662510392485>.
- [14] M. Wolsink, The research agenda on social acceptance of distributed generation in smart grids: renewable as common pool resources, *Renew. Sust. Energ. Rev.* 16 (1) (2012) 822–835, <https://doi.org/10.1016/j.rser.2011.09.006>.
- [15] T. Krüger, Energiekonflikte und Demokratiekrise. Eine radikal-demokratische Perspektive auf das Ringen um Gemeinwohlziele der Energiewende, *Z. Polit.* 31 (2021) 539–563, <https://doi.org/10.1007/s41358-021-00289-w>.
- [16] D. Scheer, M. Sonnberger, Addressing “the ones behind”: public responses to technologies and the role of responsibility, *Energy Res. Soc. Sci.* 136 (2026) 104709, <https://doi.org/10.1016/j.erss.2026.104709>.
- [17] F.D. Davis, Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Q.* 13 (3) (1989) 319–340, <https://doi.org/10.2307/249008>.
- [18] I. Ajzen, The theory of planned behavior, *Organ. Behav. Hum. Decis. Process.* 50 (2) (1991) 179–211, [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- [19] M. Siegrist, The influence of trust and perceptions of risks and benefits on the acceptance of gene technology, *Risk Anal.* 20 (2) (2000) 195–204, <https://doi.org/10.1111/0272-4332.20202>.
- [20] M. Fishbein, I. Ajzen, *Predicting and Changing Behavior: The Reasoned Action Approach*, Psychology Press, New York, 2010.
- [21] N.M.A. Huijts, E.J.E. Molin, L. Steg, Psychological factors influencing sustainable energy technology acceptance, *Renew. Sust. Energ. Rev.* 16 (1) (2012) 525–531, <https://doi.org/10.1016/j.rser.2011.08.018>.
- [22] É. Durkheim, *De la division du travail social*, Félix Alcan, Paris, 1893.
- [23] M. Weber, *Wirtschaft und Gesellschaft*, Mohr, Tübingen, 1922.
- [24] P. Bourdieu, *Distinction: A Social Critique of the Judgement of Taste*, Harvard University Press, Cambridge, MA, 1984.
- [25] S. Hradil, *Soziale Ungleichheit in Deutschland*, Leske + Budrich, Opladen, 2001.
- [26] G. Otte, Developments in lifestyle research: a review, *Soziale Welt* 56 (1) (2005) 1–19.
- [27] M. Vester, P. von Oertzen, H. Geiling, T. Hermann, D. Müller, *Soziale Milieus im gesellschaftlichen Strukturwandel*, Suhrkamp, Frankfurt am Main, 2001.
- [28] B. Barth, u. a. (Eds.), *Praxis der Sinus-Milieus®: Gegenwart und Zukunft eines modernen Gesellschafts- und Zielgruppenmodells*, Springer Fachmedien, Wiesbaden, 2023, <https://doi.org/10.1007/978-3-658-42380-3>. Verfügbar unter: O. Groh-Samberg, T. Schröder, A. Speer, Social milieus and social integration: from theoretical considerations to an empirical model, *Köln Z. Soziol. Sozialpsychol.* 75 (Suppl. 1) (2023) 305–329, <https://doi.org/10.1007/s11577-023-00898-9>.
- [30] P. Schweizer-Ries, I. Rau, J. Zoellner, Understanding acceptance of technologies for sustainable development: a psychological perspective, *GAIA* 20 (1) (2011) 19–25.
- [31] R. Moesker, et al., Conceptualising public acceptance of energy technologies: a systematic review, *Energy Res. Soc. Sci.* 109 (2024) 103392, <https://doi.org/10.1016/j.erss.2023.103392>.
- [32] M.S. Schäfer, D. Keppler, Models of public acceptance and resistance to energy technologies, *Energy Policy* 59 (2013) 102–112, <https://doi.org/10.1016/j.enpol.2013.03.030>.
- [33] D. Lucke, Akzeptanz: Legitimität in der “Abstimmungsgesellschaft”, Leske + Budrich, Opladen, 1995.
- [34] P. Bourdieu, The forms of capital, in: J.G. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education*, Greenwood Press, New York, 1986, pp. 241–258.
- [35] P. DiMaggio, Culture and cognition, *Annu. Rev. Sociol.* 23 (1997) 263–287, <https://doi.org/10.1146/annurev.soc.23.1.263>.
- [36] M. Lamont, V. Molnár, The study of boundaries in the social sciences, *Annu. Rev. Sociol.* 28 (2002) 167–195, <https://doi.org/10.1146/annurev.soc.28.110601.141107>.
- [37] J. Roose, *Werte und politische Konflikte*, Springer VS, Wiesbaden, 2021.
- [38] C. Wuthmann, Cultural divides and voting behaviour, *Eur. Sociol. Rev.* 38 (4) (2022) 567–583, <https://doi.org/10.1093/esr/jcab056>.
- [39] H. Barz, R. Tippelt, *Lebenslage und Bildung*, Juventa, Weinheim, 2003.
- [40] V. Venkatesh, M.G. Morris, G.B. Davis, F.D. Davis, User acceptance of information technology: toward a unified view, *MIS Q.* 27 (3) (2003) 425–478, <https://doi.org/10.2307/30036540>.
- [41] S.H. Schwartz, Normative influences on altruism, *Adv. Exp. Soc. Psychol.* 10 (1977) 221–279, [https://doi.org/10.1016/S0065-2601\(08\)60358-5](https://doi.org/10.1016/S0065-2601(08)60358-5).
- [42] P.C. Stern, T. Dietz, T. Abel, G.A. Guagnano, L. Kalof, A value-belief-norm theory of support for social movements, *Hum. Ecol. Rev.* 6 (2) (1999) 81–97.
- [43] S. Fast, Social acceptance of renewable energy: trends, concepts, and geographies, *Geogr. Compass* 7 (12) (2013) 853–866, <https://doi.org/10.1111/gec3.12086>.
- [44] E.M. Rogers, *Diffusion of Innovations*, 4th edn, Free Press, New York, 1995.
- [45] M. Granovetter, Threshold models of collective behavior, *Am. J. Sociol.* 83 (6) (1978) 1420–1443, <https://doi.org/10.1086/226707>.
- [46] R.B. Cialdini, R.R. Reno, C.A. Kallgren, A focus theory of normative conduct, *J. Pers. Soc. Psychol.* 58 (6) (1990) 1015–1026.
- [47] S. Moscovici, The phenomenon of social representations, in: R. Farr, S. Moscovici (Eds.), *Social Representations*, Cambridge University Press, Cambridge, 1984.
- [48] A. Reckwitz, Toward a theory of social practices, *Eur. J. Soc. Theory* 5 (2) (2002) 243–263, <https://doi.org/10.1177/1368431022225432>.
- [49] E. Shove, M. Pantzar, M. Watson, *The Dynamics of Social Practice*, Sage, London, 2012.
- [50] M. Douglas, A. Wildavsky, *Risk and Culture*, University of California Press, Berkeley, 1982.
- [51] M. Douglas, *Risk and Blame*, Routledge, London, 1996.
- [52] M. Thompson, R. Ellis, A. Wildavsky, *Cultural Theory*, Westview Press, Boulder, 1990.
- [53] T.J. Pinch, W.E. Bijker, The social construction of facts and artefacts: or how the sociology of science and the sociology of technology might benefit each other, *Soc. Stud. Sci.* 14 (3) (1984) 399–441, <https://doi.org/10.1177/030631284014003004>.
- [54] S. Jasanoff, S.-H. Kim (Eds.), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, University of Chicago Press, Chicago, 2015.
- [55] A. Stirling, “Opening up” and “closing down”: power, participation, and pluralism in the social appraisal of technology, *Soc. Technol. Hum. Values* 33 (2) (2008) 262–294, <https://doi.org/10.1177/0162243907311265>.
- [56] P. Devine-Wright, Rethinking NIMBYism: the role of place attachment and place identity in explaining place-protective action, *J. Community Appl. Soc. Psychol.* 19 (6) (2009) 426–441, <https://doi.org/10.1002/casp.1004>.
- [57] M. Aitken, Wind power and community benefits: challenges and opportunities, *Energy Policy* 38 (10) (2010) 6066–6075, <https://doi.org/10.1016/j.enpol.2010.05.062>.
- [58] K. Mannheim, *Ideology and Utopia*, Routledge, London, 1936.
- [59] A. Swidler, Culture in action: symbols and strategies, *Am. Sociol. Rev.* 51 (2) (1986) 273–286.
- [60] S. Borgstedt, C. Schleer, *Milieuspezifische Einstellungen zu Natur, Umwelt und Klima*, 2019.
- [61] P. Sheeran, Intention–behavior relations: a conceptual and empirical review, *Eur. Rev. Soc. Psychol.* 12 (1) (2002) 1–36, <https://doi.org/10.1080/14792772143000003>.
- [62] T.L. Webb, P. Sheeran, Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence, *Psychol. Bull.* 132 (2) (2006) 249–268, <https://doi.org/10.1037/0033-2909.132.2.249>.
- [63] L. Steg, C. Vlek, Encouraging pro-environmental behaviour: an integrative review and research agenda, *J. Environ. Psychol.* 29 (3) (2009) 309–317, <https://doi.org/10.1016/j.jenvp.2008.10.004>.
- [64] P.C. Stern, Toward a coherent theory of environmentally significant behavior, *J. Soc. Issues* 56 (3) (2000) 407–424, <https://doi.org/10.1111/0022-4537.00175>.

- [65] F. Reusswig, *Lebensstile und Ökologie*, in: J.S. Dangschat, J. Blasius (Eds.), *Lebensstile in den Städten*, VS Verlag für Sozialwissenschaften, Wiesbaden, 1994, https://doi.org/10.1007/978-3-663-10618-0_6.
- [66] L. Vibrans, et al., Same same, but different: explaining heterogeneity among potential photovoltaic adopters in Germany using milieu segmentation, *Energy Res. Soc. Sci.* 103 (2023) S. 103212. Verfügbar unter: <https://doi.org/10.1016/j.erss.2023.103212>.
- [67] B.K. Sovacool, The cultural barriers to renewable energy, *Energy Policy* 37 (11) (2009) 4500–4513, <https://doi.org/10.1016/j.enpol.2009.06.001>.
- [68] S.H. Schwartz, Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries, *Adv. Exp. Soc. Psychol.* 25 (1992) 1–65.
- [69] S.H. Schwartz, J. Cieciuch, M. Vecchione, E. Davidov, R. Fischer, C. Beierlein, A. Ramos, M. Verkasalo, J.-E. Lönnqvist, K. Demirutku, O. Dirilen-Gumus, M. Konty, Refining the theory of basic individual values, *J. Pers. Soc. Psychol.* 103 (4) (2012) 663–688.
- [70] R. Inglehart, *Modernization and Postmodernization: Cultural, Economic and Political Change in 43 Societies*, Princeton University Press, Princeton, NJ, 1997.
- [71] R. Inglehart, C. Welzel, *Modernization, Cultural Change and Democracy: The Human Development Sequence*, Cambridge University Press, Cambridge, 2005.
- [72] M. Wedel, W.A. Kamakura, *Market Segmentation: Conceptual and Methodological Foundations*, 2nd edn, Kluwer Academic Publishers, Boston, MA, 2000.
- [73] A.L. McCutcheon, *Latent Class Analysis*, Sage, Newbury Park, CA, 1987.
- [74] R. Bohnsack, *Rekonstruktive Sozialforschung: Einführung in qualitative Methoden*, 10th edn, Barbara Budrich, Opladen, 2021.
- [75] U. Kuckartz, *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung*, 4th edn, Beltz Juventa, Weinheim, 2020.
- [76] K. Auspurg, T. Hinz, *Factorial Survey Experiments*, Sage, Thousand Oaks, CA, 2015.
- [77] E. Lancsar, J.J. Louviere, Conducting discrete choice experiments to inform healthcare decision making: a user's guide, *Pharmacoeconomics* 26 (8) (2008) 661–677.
- [78] G. Perlaviciute, L. Steg, Contextual and psychological factors shaping evaluations and acceptability of energy alternatives: integrated review and research agenda, *Renew. Sust. Energ. Rev.* 35 (2014) 361–381.
- [79] C. Demski, C. Butler, K.A. Parkhill, A. Spence, N. Pidgeon, Public values for energy system change, *Glob. Environ. Chang.* 34 (2015) 59–69.
- [80] M. Rokeach, *The Nature of Human Values*, Free Press, New York, 1973.
- [81] M. Vester, P. von Oertzen, H. Geiling, T. Hermann, D. Müller, *Soziale Milieus im gesellschaftlichen Strukturwandel: Zwischen Integration und Ausgrenzung*, Suhrkamp, Frankfurt am Main, 2001.
- [82] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, *Multivariate Data Analysis*, 8th edn, Cengage, Andover, 2019.
- [83] J.W. Creswell, V.L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd edn, Sage, Thousand Oaks, CA, 2018.
- [84] J. Köhler, F.W. Geels, F. Kern, et al., An agenda for sustainability transitions research: State of the art and future directions, *Environ. Innov. Soc. Trans.* 31 (2019) 1–32.
- [85] F.W. Geels, The multi-level perspective on sustainability transitions: responses to seven criticisms, *Environ. Innov. Soc. Trans.* 1 (1) (2011) 24–40.
- [86] B.K. Sovacool, How long will it take? Conceptualizing the temporal dynamics of energy transitions, *Energy Res. Soc. Sci.* 13 (2016) 202–215.
- [87] K. Jenkins, D. McCauley, R. Heffron, H. Stephan, R. Rehner, Energy justice: a conceptual review, *Energy Res. Soc. Sci.* 11 (2016) 174–182.