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Polycentric energy governance: Under what conditions do energy communities scale?

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Abstract

As the polycentric nature of climate governance becomes ever more apparent, understanding the role played by individual initiatives becomes an increasingly urgent research priority. In recent years, community initiatives have blossomed in relation to clean energy, both in their overall number and diversity. Polycentric governance thinking offers a powerful but incomplete account of how and why such initiatives emerge, grow, and replicate in different contexts, that is, how they "scale." This article investigates the conditions under which different clean energy communities scale. Based on a systematic literature review, it identifies 23 separate conditions, which are subsequently categorized into what happens within, between and in the context of individual initiatives. As well as enriching polycentric governance thinking, this article identifies practical ways to inform and facilitate the emergence of new community initiatives.

KEYWORDS
climate change, community energy, polycentric governance, scaling

1 | INTRODUCTION

Approaches to understanding global climate governance have undergone a marked shift in recent decades, placing more emphasis on networked (Kim, 2013) multi-layered (Di Gregorio et al., 2019; Newig & Fritsch, 2009), local, non-state and/or decentralized action (Gillard et al., 2017; Jordan et al., 2018; Jordan & Huitema, 2014a). The emerging system is polycentric in nature (Jordan et al., 2018), meaning that actors follow different logics (state, community, and market) and operate across different scales. Polycentric governance scholarship concentrates on how such actors nested in multiple, partially overlapping jurisdictions negotiate solutions to common pool resource dilemmas (Aligica, 2013; Aligica & Tarko, 2012; Heikkila et al., 2018; Jordan et al., 2018; Nagendra & Ostrom, 2012; Ostrom, 1999, 2005, 2010, 2012).

Although much has been written about the fact that local-scale action opens up pockets of innovation that demonstrate the viability of alternatives—such as nature based solutions, living labs, or energy communities (see for example Frantzeskaki, 2019; Hellstrom-Reimer et al., 2012; Seyfang et al., 2013)—the academic debate has only recently turned to the question of the wider systemic impact of such initiatives. Indeed, while we understand the emergence and operation of local initiatives much better, a perplexing issue remains: how far has successful local action based on self-organization become embedded enough to create lasting impacts? In order to understand that issue we need to better understand the issue of scaling in a polycentric governance system, and to explore under what conditions it occurs.

While we know about matching the scale of problems with potential governance interventions (Gupta, 2007; Gupta, 2008; Newig & Moss, 2017), the specificities of how community-based initiatives in polycentric systems are scaled remains a relatively open field of enquiry. Scaling can be understood on the one hand as the expansion of an initiative in spatial, geographic, and quantitative terms, resulting in more and/or bigger initiatives. But it can also be

conceptualized as the process affecting the enabling institutions—where needed—for this spatial transformation to occur. These two have been termed horizontal and vertical up-scaling, respectively (van Doren et al., 2018).

This article focuses on a particular type of initiative—the clean energy community—which has blossomed in recent years, both in number and in diversity (Blasch et al., 2021). Like other initiatives, they are based on voluntary and joint ownership and management of assets, and the sharing of the benefits of these assets (Walker & Devine-Wright, 2008). In general, energy production is an important aspect of the debate surrounding the governance of climate change (IEA, 2020). Many hope that clean energy communities and their initiatives (heretofore energy communities) will play a key role in decarbonizing the sector by experimenting with new technologies, producing new knowledge and creating new practices that gradually replace the current system. Such communities "often involve the use of innovative and smart technologies and aim to create new value for their members and society that go beyond the joint production of renewable energy" (van der Grijp, 2019). Motivations for participating in such communities may be diverse (see for example Sloot et al., 2019), but together they are expected to play a critical role in decarbonizing the energy sector (Bauwens, 2017; Seto et al., 2016). They also actively involve citizens in the governance of energy systems (Bauwens et al., 2022).

This article addresses four questions. (a) Does polycentric governance offer insights into how scaling works in the context of climate governance? (b) What to-date is known about the scaling of such initiatives in the energy sector? (c) What cumulative insights can be derived from this evidence? And finally, (c) can these insights be used to refine polycentric governance in theory and in practice?

The remainder of this article proceeds as follows. Section 2 reviews existing theories of polycentric governance, focusing on different accounts of scaling. Section 3 describes our approach to documenting the conditions under which energy communities successfully scale through a systematic literature review of the existing literature on energy communities. The findings are presented in Sections 4 and 5, respectively. We conduct our review in light of admitting to this conceptual debate living its early days, and hence included empirical findings discussing a handful of grass-roots, local-scale or urban energy transition initiatives. We consider the limitations of such an approach and for this reason admit to the highly explorative nature of our findings. Section 6 concludes and provides pointers to future research.

2 | THEORY: SCALING IN POLYCENTRIC GOVERNANCE

The growing complexity of climate governance has produced an overall setting characterized by growing experimentation (Sengers et al., 2020), as well as local (Bulkeley et al., 2014), and translocal (Loorbach et al., 2017) action. Multiple types of actors are tied together through multiple policy dimensions, scales, and domains involving a variety of institutions (Heinen et al., 2022). This situation is inherently polycentric in nature.

The concept of polycentricity was originally coined by Polanyi in describing social systems with a multitude of decision-making centers and autonomous powers, operating under an overarching set of rules (Aligica & Tarko, 2012; Polanyi, 1951). Parallel to that, Ostrom et al. (1961) began to explore the institutional complexity of governing metropolitan areas. Building on this conception, a several decade long body of research took off, primarily dealing with common pool resource dilemmas (Aligica & Tarko, 2012; Jordan et al., 2018; Ostrom, 1999, 2005, 2010, 2012). Studies cover water governance (Schröder, 2018), fisheries (Carlisle & Gruby, 2018) and forests (Nagendra & Ostrom, 2012) among others. In effect it speaks to the agency of actors and how they initiate cooperation and construct institutions in the process for the sustainable management of common pool resources. Ostrom (1999, 2005, 2010) outlines several attributes, which have been coined design principles, and which potentially could inform the conscious design of local-scale institutions suitable for governing common pool resources. Among these is the need for nested enterprises, which is very much in line with polycentric thinking (Ostrom, 2005).

Building on the principle of nested enterprises, recent years have witnessed the production of a body of literature assessing a variety of subjects through a polycentric lens. These include irrigation reforms in Kenya (Baldwin et al., 2018), the governance of the Great Barrier Reef (Morrison, 2017), global (environmental) governance at large (Heikkila et al., 2018; Kim, 2020) as well as understanding power and conflict in polycentric governance systems (Lubell et al., 2020; Morrison et al., 2019). These studies explore the potentialities of viewing the governance of environmental resources through a polycentric lens. This falls in line with the call of Aligica and Tarko (2012) to explore the potentials of polycentric thinking not only empirically but also theoretically. Accordingly, Jordan et al. (2018) helpfully summarize several core propositions as they relate to climate governance. In effect we consider this entire body of literature as constituting polycentric governance thinking.

Ostrom (2010) pointed to the potential applicability of polycentric governance to tackle a global challenge such as climate change, and thus the relevance of community action for addressing it. For many this was a counterintuitive argument because polycentric governance thinking had primarily been associated with small scale, localized issues, whereas climate change is widely seen as a global challenge that needs to be resolved by other (global) actors, driven by very different logics, and equipped with very different capabilities (Young, 2002). Even if Ostrom (2010) made a ferocious attempt to suggest that community initiatives could in the end provide the start and the basis for global action, the nuts and bolts of the process in which such initiatives can be expected to emerge essentially remained black boxed, that is, part unexplained, and part hopeful assumptions.

In light of this it is worth re-examining why polycentric governance thinking suggests that a more diverse and multilevel approach, building on cumulative positive externalities of local, bottom-up initiatives, should work (Ibid.). As Jordan et al. (2015, 2018) outline, the

development of a theory including testable propositions was not something that the Ostroms managed to fully address in their lifetimes (Aligica & Tarko, 2012). Building on this work Aligica and Tarko (2012) have made an elaborate conceptual contribution on the "logical structure of polycentricity" (2012, p.257). Their effort to develop more specific propositions carries the potential to make the Ostroms' thoughts more explicit. The above-mentioned conceptual exploration in the context of polycentric climate governance done by Jordan et al. (2018) include local action, mutual adjustment of governing units, experimentation, trust, and overarching rules as propositions. The propositions are in line with the micro-level focus of Ostrom (2010) on individuals and the attributes leading to cooperation, alongside the need for an empirical grounding of what this means in the field of climate governance.

Turning to energy communities, Bauwens (2016, 2017) examines the diverse motivations for initiating them, and the enhanced resilience of energy systems resulting from them. Ultimately his studies highlight the lacking clarity of what governance arrangements are the most appropriate for mitigating GHG emissions.

So how can polycentric governance explain scaling from the inside-out, that is, building from community initiative to global-scale impact? Thus far, there have been limited attempts at explaining how one can build a polycentric arrangement (Thiel et al., 2019), or namely how the concept of governance can be conceived of in its true nature: a directional and process-oriented series of actions resulting in the solution of problems or creation of opportunities for societies. Attempts at assessing the performance of polycentric systems have focused on interactions through cooperation, conflict (resolution), and competition (Koontz et al., 2019). Nonetheless the directionality and the implied temporal aspects remain a gap in polycentric governance literature. This points towards implications for academia and practice alike in applying a polycentric lens to assess the performance of a polycentric climate governance system. Utilizing polycentricity as a descriptive lens can help identify the polycentric qualities of the status quo (Jordan et al., 2018). A polycentric system nevertheless implies that there is a structural arrangement at play, with governance activities taking place, ultimately pointing towards orchestrated relationships between cause and effect.

In this vein, Aligica (2013) outlines that decision making power is generally assumed to be decentralized and to be "automatically" scaled to higher levels as required – inherently producing a polycentric quality, while also creating an architecture of overarching rules. Nonetheless as Harvey (2013) outlines

> "relations between independent and autonomously functioning communities have to be established and regulated somehow. […] But we are left in the dark as to how such higher-order rules might be constituted, by whom, and how they might be open to democratic control." (p. 83).

In this sense, governance arrangements on multiple scales are taken as a given, the probing of how they emerge is preliminary.

TABLE 1 Characteristics of good performance in polycentric governance

Characteristics of good performance	Definition
Agents organize among themselves at the local scale	Actors and members of initiatives organize among themselves congruent with local conditions. This includes collective choice arrangements, allowing for participants to modify rules where needed and in effect build trust.
Governing units collaborate	By exploring domain boundaries and levels, units identify synergies and collaborate in a spontaneous manner beneficial to all units involved, while nesting within existing governance levels where resources closely relate to larger socio-ecological systems.
An attitude of learning is in place	Governance experiments can take place at multiple scales and in multiple domains, which implies that they are regarded as natural experiments. This includes having monitoring and evaluation frameworks in place for the use of participants.
Overarching rules and boundaries target the functioning initiatives	Informal and formal rules tie initiatives together in a manner which enhances their functioning. These should be recognized at the governmental level.
An architecture for fair and efficient conflict resolution is in place	Rule violations carry graduated sanctions (e.g., start low but rise for repeated violation); if conflict arises it can be resolved fast and at low cost.

Note: Source: Authors, based on Jordan et al. (2018), Ostrom et al. (1961), and Ostrom (2010).

In answering these issues, we have reviewed key publications discussing the climate regime as an instance of polycentric governance. In Table 1 below, salient frameworks are combined to indicate what characterizes good performance in a polycentric system.

In describing polycentric systems, theoretical accounts so far suggest that when facing common pool resource dilemmas, at the local-scale actors interact and build various institutions for the resolution of these dilemmas (Aligica & Tarko, 2012; Ostrom, 1999, 2005, 2012). As we argue below, the upscaling of the resulting institutional arrangements (energy communities functioning at scale) and polycentric forms of governance are predicated on the presence of a number of enabling conditions. As can be seen from the above formulation, the existing pointers for what characteristics could trigger scaling are still relatively abstract and certainly require empirical testing, grounding and refinement. Our review of the energy community literature aims to contribute to addressing this gap.

The policy diffusion literature arguably utilizes a number of similar concepts. Much of it builds on early work done by Rogers (1962) on the diffusion of innovations. Accordingly, diffusion can be understood as "the process through which these inventions circulate and possibly enter into common use, via processes of learning, transfer, and adoption" (Jordan & Huitema, 2014b). Such a process can be differentiated based on the lens through which one studies them, entailing a differentiation between internal and external approaches to studying the uptake of policies (albeit ones discussing nation state activities) (Ibid). Our analysis is narrower however, with an explicit focus on the growth and replication of initiatives themselves in line with van Doren et al. (2018) conceptualization of horizontal upscaling, rather than on the policy processes involved in supporting their emergence.

Building on the Ostromian conception of community-based institutional logic and moving towards a wider understandings of polycentric governance has important analytical implications. For instance, the self-organization of agents is specific to what happens within an initiative, while the collaboration of governing units and frameworks for learning describe interaction between initiatives. Propositions focusing on overarching rules and boundary setting as well as conflict resolution shed light on the relevance of certain contextual elements. This distinction offers a good opportunity for sorting through the enabling conditions. As can be seen from the review of the existing literature below, several process and change oriented tools exist, but have not been brought sufficiently close to the surface.

3 | METHODOLOGY

Energy communities—particularly in Europe—have been present for decades, but recently have undergone substantial transformation and growth (REscoop, 2015). Accordingly, the remainder of this article

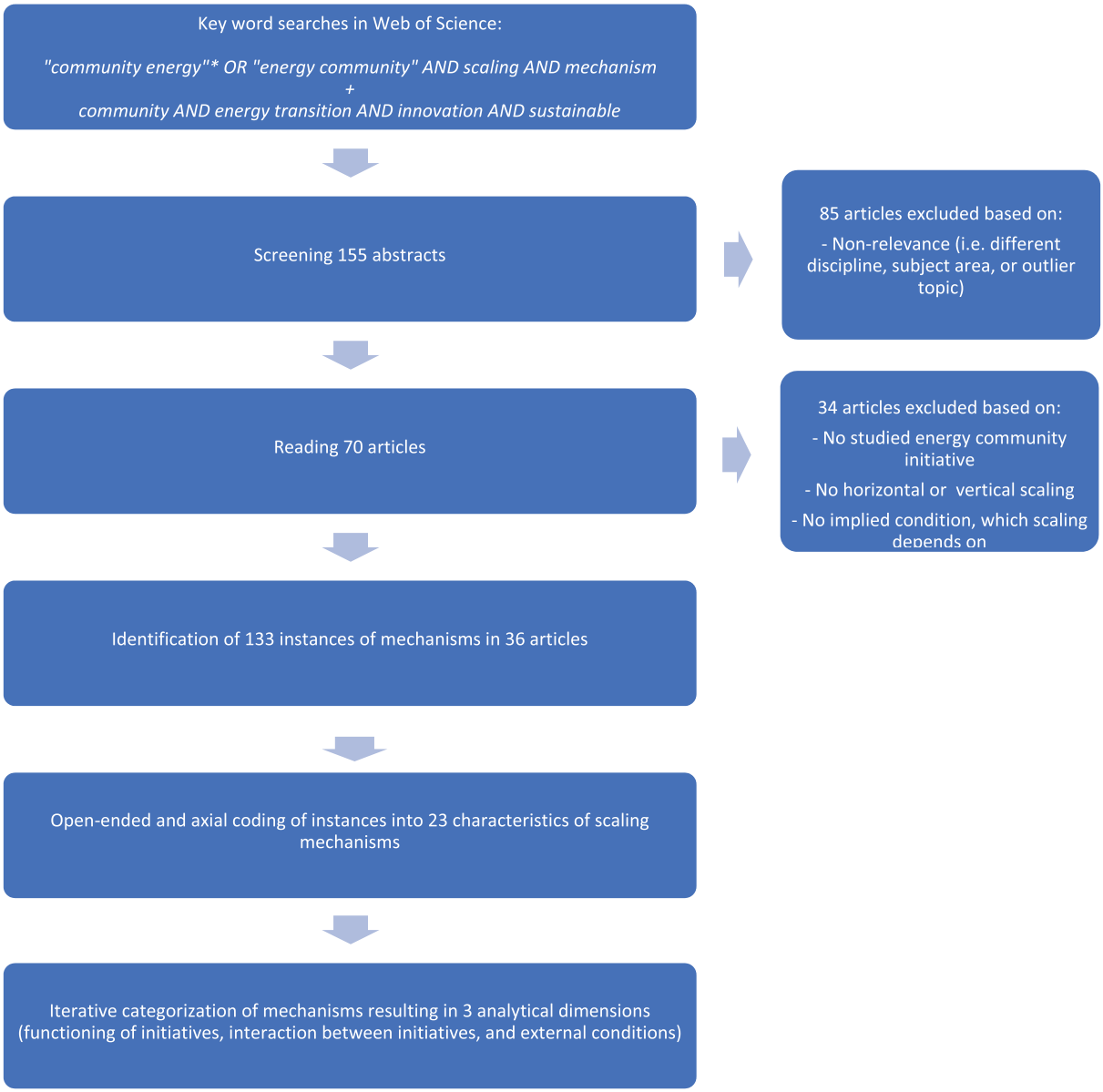

FIGURE 1 Systematic literature review process [Color figure can be viewed at wileyonlinelibrary.com]

surveys the existing literature which may have triggered the scaling of such initiatives. Such a conceptualization is common to mechanismic thinking (Gerring, 2008), as typified by the context-mechanism-outcome (CMO) model of Pawson and Tilley (1997). It points to how outcomes can be explained by studying mechanisms within given contexts. In this light, a mechanism is dependent on conditions, which lead to a certain process resulting in a given outcome, all of which is contextually embedded. In this sense, a condition is a pre-requisite for scaling processes to occur (see also Geels and Schot (2007)).

To identify these conditions we undertook systematic review of the existing literature. To this end a targeted search in the Web of Science was conducted with the search string "community energy"* OR "energy community" AND scaling AND mechanism. This resulted in only eight articles. Consequently, a broader string was used to capture broader developments in practice and research alike. This string included the terms community AND energy transition AND innovation AND sustainable development. We ran multiple combinations of search strings by including further concepts such as diffusion and learning. These searches resulted in very narrow (<20) results. For this reason, we decided to ensure that the conceptual focus of our first string was amended with a set of articles reflecting broad developments in the field. The steps of our systematic review are outlined in Figure 1.

Overall, the two strings (spanning results up until the end of 2020) resulted in 155 articles. This list was further enriched with a handful of seminal pieces, such as van Doren et al., discussion of the scaling of low carbon urban initiatives (2018), and Sovacool and Van de Graaf's (2018) study of the polycentric performance of energy and climate governance networks. These articles were then analyzed for fit by assessing:

1. Whether they discuss energy communities or energy-linked initiatives,
2. Whether the studied initiatives were successful – either in terms of upscaling in horizontal or vertical terms, and
3. Whether conditions on which scaling depends are implied.

The review was done initially by screening abstracts for subject relevance followed by screening the full text of relevant articles based on the aforementioned selection criteria. The remaining 70 articles were read in full extent resulting in 36 articles pointing towards 133 conditions being at work. These examples have been clustered in the process of analysis through open-ended coding (i.e., the construction of emergent conceptual categories) and axial coding (i.e., the connection and clustering of these categories), resulting in 23 conditions under which scaling may occur.

4 | RESULTS: THE CONDITIONS UNDER WHICH SCALING OCCURS

Somewhat surprisingly, given the dearth of explicit attention to conditions and mechanisms in the existing literatures, our systematic review identified a high number of salient conditions. While in the majority of cases these conditions can be linked to the aforementioned measures of good performance, ultimately validating the propositions (Tables 2, 3, and 4), in a handful of cases, they provide recommendations on how to refine polycentric governance thinking (Table 5).

As can be seen from Figure 2, the conditions have been categorized in an inductive manner along three dimensions, which point towards their broad qualities. These are on the line of what happens at the level of initiatives directly (i.e., how actors interact, leverage their agency and construct initiatives); of how initiatives interact with each other (i.e., how they build networks and transfer experiences and knowledge); and of how external conditions can best be shaped to support the emergence and functioning of initiatives (i.e., what contextual conditions are necessary).

The implications of these three dimensions are discussed in detail in Section 5. At this point it is relevant to briefly reflect on their implications of the results. Considering the dimensions emerged from axial coding (a process, which integrates conceptual categories and sub categories through clustering), these categories uncover a deeper structural quality of the conditions needed for scaling in the energy community space. This means that the dimension at which these conditions can be found varies considerably in quality (e.g., actor interactions in a community versus contextual conditions), however it also means that similarities can be found in the nature of these conditions. In the following, these conditions are outlined briefly in line with these three dimensions.

4.1 | What happens within an energy community?

First, as is outlined in Table 2, eight conditions point towards what happens within a community initiative. This entails a diverse set of activities, primarily pointing towards how actors interact and what role their agency takes on in the process.

As can be seen, a number of these conditions echo Ostrom's (2010) design principles and Jordan et al. (2018) propositions primarily pointing towards what is necessary for designing functioning initiatives. These include effective and clear communication channels between actors (van Doren et al., 2018) arguably an example of agents organizing among themselves. This can also be seen as precursors for the creation of simple rules and procedures (Gui & MacGill, 2018), which links to a number of elements of well performing polycentric systems – namely on the self-organization of agents, overarching rules and fair conflict resolution. In several cases, strong leadership (be that by individuals or a group) proved to drive the success of an initiative (Reeves et al., 2014), indicating once again the agency of actors in organizing among themselves.

Visioning and the definition of clear goals (Seyfang et al., 2013; van Der Schoor & Scholtens, 2015) as well as the manner in which community members could mobilize resources (Seyfang & Haxeltine, 2012) contributed to the success of initiatives. Once again these conditions link to the agency of actors towards self-organizing.

TABLE 2 Conditions in which scaling occurs: Empirical examples within initiatives

Condition (# of articles mentioning)	Description	Example
Actors communicate among themselves (5)	Effective communication channels and skills among actors involved in a community initiative is necessary for the functioning of the community.	Good communications skills and their application by project coordinator running low-carbon urban initiatives (among them energy consumption-linked ones) in Copenhagen contributed to the initiatives' success (van Doren, 2018).
Simple rules and procedures (2)	The efficient functioning of a community initiative and the engagement of participants is allowed for by simple rules and procedures.	A clear and strong set of rules has been an essential element in multiple types of energy communities (centralized or distributed) in ensuring their operations in Australia (Gui & MacGill, 2018).
Ease of engaging citizens in initiative (4)	Arrangements (e.g., business models, community rules, etc.) focus on the ease of engagement of the citizen/consumer.	Simplicity and emphasis of the customer journey has been a key principle for prosumer business models of energy communities in the United Kingdom (Brown et al., 2019).
Space to experiment (3)	Community members have the space to experiment within their initiative.	Experimental ownership arrangements have proven to add further benefits to the members of an energy community in the Hague (Pesch et al., 2019).
Common vision and set of goals (7)	Communities negotiate a common set of goals and a visions to ensure success in their collaboration.	A shared vision and goal in the context of Dutch community initiatives (van der Schoor & Scholtens, 2015) and United Kingdom energy communities (Seyfang et al., 2013) has proven essential to their functioning.
Community members have the capacity to mobilize resources (9)	The capacity of community members to mobilize resources impacts the success of an initiative.	The Transition Town movement mobilized resources in a strategic manner conducive to its growth (Seyfang & Haxeltine, 2012).
Leadership roles within initiative (3)	There is a/are strong leadership figure(s)/group(s) present in an initiative.	Strong leadership figures were essential for successful functioning of initiatives in the United Kingdom (Reeves et al., 2014).
Sense of co-ownership (2)	Sense of co-ownership of community initiatives enhances motivations to join.	The desire for co-ownership at little effort and expense has been a driver for participation in a Swiss energy community (Koch & Christ, 2018).

Next to this, maintaining space for experimenting with the governance architecture of initiatives outside of the status quo (Pesch et al., 2019), indicates an overall attitude towards learning. Easy processes for the engagement of further citizens in the immediate surroundings of the initiatives (Brown et al., 2019) also signals that agents can organize among themselves. Finally, the establishment of a sense of co-ownership within the community among members (Koch & Christ, 2018) links to well-defined and efficient frameworks for conflict resolution.

4.2 | What happens between energy communities?

Moving on, in terms of how initiatives interact and establish networks, a number of conditions emerge. As can be seen in Table 3, this primarily involves how initiatives engage in external activities, what role intermediaries play in this process, how learning takes place, how networks of initiatives come about and how knowledge is transferred.

These conditions serve as empirical evidence to several the points outlined by E. Ostrom (2010), Ostrom et al. (1961), and Jordan et al. (2018). Initiatives had opportunities to interact externally, which means for example engaging the wider community around the initiative (Seyfang et al., 2013). Next to enhancing the standing of an initiative itself, this also led to the establishment of networks of initiatives, which reach from local to global in scale (van Der Schoor & Scholtens, 2015). These networks not only serve as channels for the transfer of knowledge, best practices and learnings, but also as a type of coalescing force, which enhances the standing of initiatives in a compound manner (Hargreaves et al., 2013; Warbroek et al., 2018). In this process intermediaries, who serve as links between initiatives can enhance each of these outcomes, primarily in terms of providing economies of scale for the creation of further initiatives, enhancing their operations, and ultimately transferring knowledge between them (van Doren et al., 2018). The presence of intermediaries indicates a certain degree of institutionalization, which in effect hints at the existence of overarching rules. In short, all these conditions indicate that governing units collaborate to a certain degree.

4.3 | Under what conditions are energy communities successful?

The third set of conditions include empirical evidence of contextual conditions, which have contributed to the growth of initiatives. These conditions point towards supportive (financial and policy) frameworks and are presented in Table 4.

TABLE 3 Conditions in which scaling occurs: Empirical examples between initiatives

Condition (# of articles mentioning)	Description	Example
Initiatives interact externally (7)	Interactions of initiatives and their wider embedding enhances their functioning.	The engagement of wider community of energy communities in the United Kingdom was a success factor (Seyfang et al., 2013).
Presence of intermediaries (6)	Intermediaries aggregate experiences and knowledge and translate these towards decision makers as well as between initiatives.	Intermediaries have played an active role in connecting initiatives for aggregate success (Hargreaves et al., 2013).
Initiatives learn from each other (1)	Capacity building of communities results from learning between initiatives.	Interaction between communities and resulting capacity building has been instrumental among many local low-carbon energy initiatives (Warbroek et al., 2018).
Establishing networks (6)	Establishing networks of initiatives helps in sharing experiences and learning.	Successful energy communities maintain strong and continuous relations on the local and global scale (van der Schoor & Scholtens, 2015).
Transferring knowledge and best-practices (3)	Transferring knowledge and best-practices among initiatives allows for compound learning.	Learnings from energy retrofitting buildings have been transferred through policy networks to allow for broader applicability and use (van Doren et al., 2018).

Considering initiatives and the networks they establish are all embedded in contextual conditions, the contours of an overall governance architecture of energy communities also materialize. These conditions fit Ostrom's (2010) rationale on broader contextual conditions, the CMO model of Pawson and Tilley (1997), as well as Jordan et al. (2018) rationale on overarching rules. Among the conditions speaking to this dimension are the following.

Support for local innovation can materialize through any type of localized protective measure, such as through the creation of living labs (Hellstrom-Reimer et al., 2012). Closely linked, explicit policies focused on innovation—be that through organizational or technological means—(i.e., through connecting public authorities, communities and the appropriate private-sector actors (Frank et al., 2018)) can also create a supportive context for scaling. Alongside these conditions, setting a context for entrepreneur focused experimentation (Huang et al., 2018) also ties back to a general attitude towards learning being in place. Next to this, the establishment of supportive financial frameworks (Seyfang et al., 2013) as well as the reliability of technology and policy both point towards the flip sides of the same coin: namely protective and supportive measures needed for the creation of local-scale innovation with the potential for aggregate impact—both of which are manifestations of overarching rules and boundaries. Ultimately, monitoring and evaluation frameworks have allowed for aggregating the development of learning capacities (Sovacool & van de Graaf, 2018), providing the needed frameworks for compiling information on the multitude of local initiatives.

5 | DISCUSSION: CONTRIBUTIONS TO POLYCENTRIC GOVERNANCE THINKING AND PRACTICE

The conditions in which scaling occurs can best be categorized along three dimensions: what happens within initiatives; what happens between initiatives; and what contexts enable scaling. This clustering is displayed in Figure 2. First of all, at the level of an individual initiative the conditions may point to how actors interact, and how they leverage their agency for building local- or micro-scale institutions, which can also be understood as pockets of governance innovation. Here propositions assessing self-organization at the local scale, the role of overarching rules and the architecture of fair and efficient conflict resolutions carry importance. Moving outwards, initiatives interact with each other, building networks, but also creating space for other intermediary actors. This dimension underlines the importance of the key concept of mutual adjustment (Jordan et al., 2018) in polycentric governance. It points towards how actors interact, how and why they collaborate, and the way knowledge transfer and learning take place. This process of knowledge exchange has created a new type of actor in the energy community field, namely the intermediary (Hargreaves et al., 2013), which carries implications for the "spontaneous" nature of collaborations put forward in the past (Jordan et al., 2018). These actors take a growingly active role in organizing the networks of community initiatives and hence serve as aggregators of experiences, knowledge and learning on the one hand; while they also have the opportunity and power to shape the development of this space directly on the other hand.

In terms of external conditions, evidence for an architecture of hard regulatory rules is less evident, but soft tools forming overarching frameworks, which support innovation are clearly present. It is important to highlight that the empirical testing of these contextual

TABLE 4 Conditions in which scaling occurs: Empirical examples from the context of initiatives

Condition (# of articles mentioning)	Description	Example
Monitoring and evaluation frameworks pointing towards learning (3)	Monitoring and evaluation frameworks allows for building and refining supportive contexts through continuous learning.	Information and monitoring mechanisms have been key in several energy-related initiatives (Denmark, Brazil, Bangladesh, and China) (Sovacool, 2011).
Context for entrepreneur-led experimentation (1)	Frameworks targeting the creation of initiatives involving sustainable technologies allow for entrepreneur-led experimentation.	Resident-led social experimentation combined with entrepreneur-led technological experimentation positively impacted the urban energy transition (Huang et al., 2018).
Support for local innovation (18)	Decision makers at the local scale support innovation by considering and utilizing contextual conditions to the advantage of initiatives.	Living lab approach stimulated the creation of a low-carbon community (Hellstrom-Reimer, 2012).
Supportive financial frameworks (27)	Decision makers create financial frameworks, which support the emergence of initiatives.	Financial incentive structures (subsidies, grants, Feed in Tariffs, etc.) are necessary in the context of energy communities (Seyfang et al., 2013).
Innovation focused policy (6)	The introduction of policy, which supports innovation at large (i.e., national-level through the connection of relevant industry actors) allows for enhanced cooperation between relevant stakeholders.	The creation of public-private cooperation activities have had a positive effect on local-scale renewable energy systems (Frank et al., 2018).
Reliability of technology and policies (4)	There is trust in the reliability of technologies and supporting policy frameworks.	The success of energy-linked initiatives has been conditioned by the reliability of both technology and supporting frameworks (van Doren et al., 2018).

conditions may very well indicate that they are necessary for the other conditions to hold as well (i.e., on how initiatives function and interact). Organizing conditions through the lens of these three dimensions allows for a more nuanced analytical characterization, which can inform local-scale innovation while also feed into the amalgam governance architecture of polycentric systems in the climate governance regime (Sovacool, 2011).

Second, searching for conditions of scaling and in effect applying mechanismic thinking to polycentric governance—while consciously acknowledging the complexity of these governance systems—can potentially allow for scholars to go beyond describing polycentric systems, and explain governance in polycentric settings. The conditions identified above can enable the polycentric climate governance system to become more effective. This may be equally relevant for community members, intermediaries, and policy actors at various scales. By identifying empirical evidence of what has taken place through these three dimensions, community members receive pointers on their initiatives in a fashion very similar to that put forward by Ostrom (2010), intermediaries can gain a better understanding of their active role in connecting these initiatives and ensure learnings and knowledge are transferred in a manner constructive to the establishment of more and bigger initiatives, and policy makers can create the supportive contexts from local to (inter)national scales.

Third, as a lens polycentric governance has the power to primarily explain what happens at the level of initiatives and in terms of how they interact with each other. This can be credited to Ostrom's extensive work on the governance of common pool resources. However, concepts such as overarching rules (Aligica & Tarko, 2012; Jordan et al., 2018) have to-date not yet been completely unpacked. The questions remain as to what level these rules should be constructed at. Should it be across initiatives at the international scale as is the case with the European federation of citizen energy cooperatives (REScoop)? Is it most appropriate to create national frameworks? Should municipalities be responsible individually? Or should these frameworks be constructed by an amalgam of public and private actors?

The handful of conditions identified in our review point towards principles, which can be considered in constructing such rules. What becomes apparent is that the majority of contextual conditions focus on preserving pockets of innovation from external (market) forces. Polycentric governance to-date has not focused on such aspects in a detailed manner, and potentially other theoretical entry points can help assist the refinement of these concepts. Examples could include more structurally focused theories, such as literature discussing sustainability transitions (Loorbach et al., 2017), and strategic niche management in particular (Schot & Geels, 2008). The ontology of these theories could allow for a potential refinement of the role contextual conditions play in polycentric governance akin to related concept of governance architecture (Biermann, Davies, & van der Grijp, 2009; Biermann, et al., 2009).

Finally, our review has identified a number of conditions which to-date have not been accounted for in elements of good performance in polycentric governance. These conditions shed light on some important blind spots in polycentric governance thinking which are outlined in Table 5.

TABLE 5 Evidence of unaccounted for conditions of scaling in polycentric governance, with empirical examples

Dimension	Condition (# of articles mentioning)	Description	Example from the literature	Linkage to element of good performance in polycentric governance
Functioning of initiatives	Financial frameworks serve members (6)	Community members establish a set of rules to negotiate the distribution of revenues within their community.	The fair distribution of revenues among community members, for the sake of enhancing community benefits has been a key factor in North Frisian energy communities (Süsser & Kannen, 2017).	• Agents organize among themselves at the local scale
	Formalized and professionalized organization (4)	The formal organization of an initiative impacts its success while aligning with the expectations of a wide-range of stakeholders.	Formalization strengthened community energy initiatives (van der Schoor & Scholtens, 2015). Professionalization was also present (Warbroek & Hoppe, 2017).	• Agents organize among themselves at the local scale, • An architecture for fair and efficient conflict resolution in place
Interactions between initiatives	Democratized distribution of knowledge (1)	The democratized distribution of knowledge production positions initiatives in less of a power asymmetry compared to the incumbent actors.	Democratized knowledge production (i.e., in contrast to monopolized knowledge production by energy companies and research institutes) is a condition for grass roots renewable energy initiatives (Kooij et al., 2018).	• Governing units collaborate
External conditions	Local participatory process (5)	Local participatory processes enhance the engagement of citizens with community initiatives.	Local participatory processes have been instrumental in the distribution of community benefits (Süsser & Kannen, 2017).	• Governing units collaborate, • Overarching rules and boundaries contribute to functioning initiatives

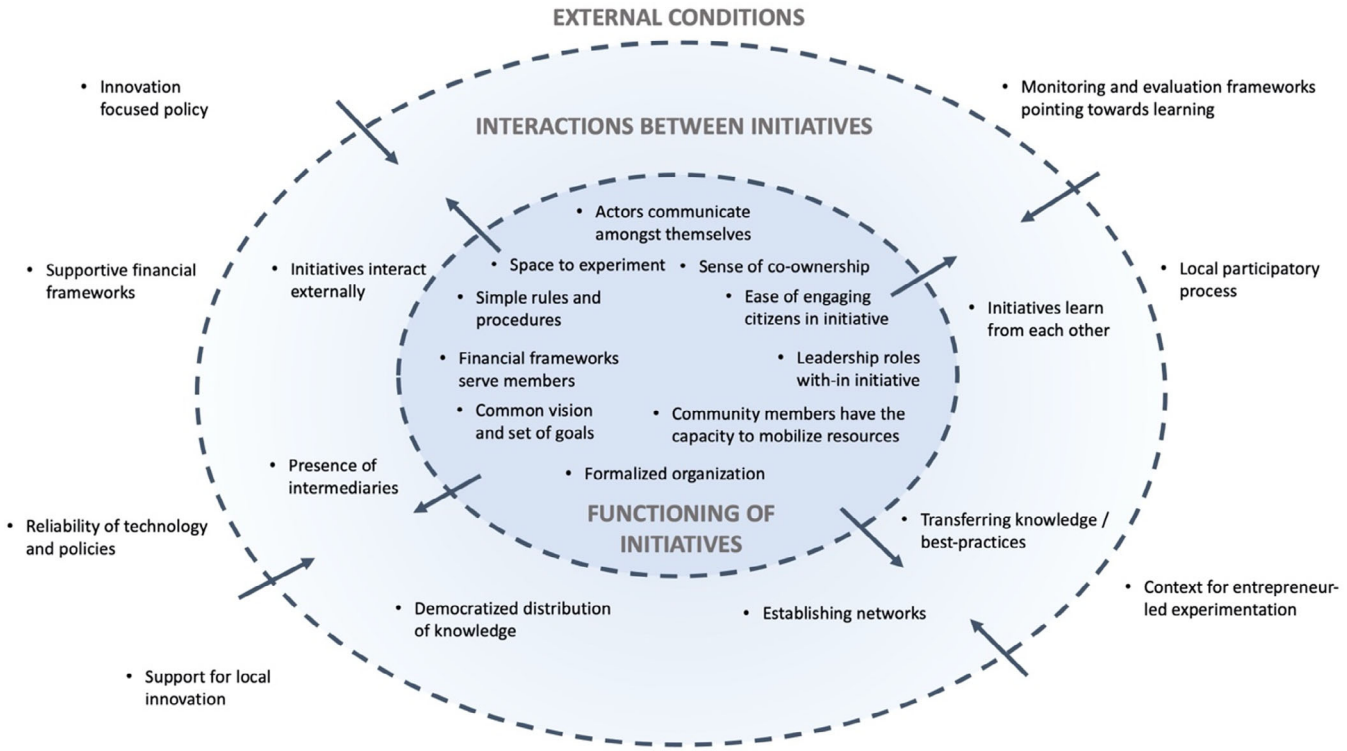

FIGURE 2 The conditions of scaling: A categorization [Color figure can be viewed at wileyonlinelibrary.com]

On the one hand, within initiatives the fair distribution of revenues has facilitated the development of communities (Süsser & Kannen, 2017). This is paralleled with the formalization process of initiatives, which has similarly contributed to the growth of initiatives (van Der Schoor & Scholtens, 2015). These conditions align with polycentric governance propositions on how agents organize among themselves and the type of architecture needed for fairness and efficiency. They also signal that the energy community space has reached a maturity, where in most contexts legal and regulatory frameworks have created formalized structures for initiatives and have created incentives for their professionalization. In the European context, this is underlined by the European Union's Renewable Energy Directive (2018), and the Electricity Market Directive (2019), which set out the frame for renewable energy communities and citizen energy communities, respectively. This formalization enhances the standing and legitimacy of initiatives, however what also emerges from the review of literature is that there is a growing focus on paralleling this formalization with the creation of financially viable business models. The terms prosumerism (Brown et al., 2019), or local energy (Devine-Wright, 2019) highlight this shift, which also entails a turn away from community aspects of energy communities. The neoliberalization of the energy sector has its implications for community-based energy transitions too, as the discourse surrounding energy citizenship carries a dissonance with the actual power and ability of citizens to meaningfully affect the transition, a dynamic that is signaled by the channeling of community-based models towards commercial and business model logic (Bauwens et al., 2022; Lennon et al., 2019). That said, exploring the diversity of potential business models is necessary for scientists and practitioners alike.

On the other hand, at the level of how initiatives interact, the democratized distribution of knowledge has been a key condition for grass roots energy-focused initiatives (Kooij et al., 2018). This highlights that it is not simply the transfer of knowledge that is key but how it happens should also be conceived of – namely with reduced power asymmetries. Such reduced asymmetries tie into the how of collaborations between governance units in a polycentric governance system. In terms of contextual dimensions, the architecture of participatory processes at the local scale have proven fundamental for communities (Süsser & Kannen, 2017), which points to the specificities needed to architect a common set of rules and boundaries. These two conditions can also be seen as a potential backlash or even remedy to tensions arising from financialization and formalization dynamics. Considering evidence suggests first that the reduction of knowledge asymmetries in communities directly enhances their standing in relation to actors of the status quo, as well as second that the architecture of local participatory processes contributes to the effective distribution of benefits in communities; it becomes clear that equipping energy communities with the appropriate tools for their scaling goes past providing financial support in the form of potential subsidies and tax breaks. Leaving space for innovation by protecting these spaces from market forces can allow for citizens to construct micro-scale institutions, which have been proven to be more enduring than private-party led initiatives (Devine-Wright, 2019; Seyfang et al., 2014). By constructing an institutional frame suitable for preserving institutional innovation the "second order task of institutions" can be fulfilled (Aligica, 2013). Such conditions elucidate the specific tools available to decision makers to support the emergence of such institutions.

In terms of the limitations of our analysis, the growing heterogeneity of initiatives makes it difficult to pinpoint single enabling conditions and trace out their causal outcomes. It is most likely that a combination of conditions facilitates scaling. Conducting a qualitative comparative analysis (QCA) of a set of energy communities could be one way to analyze the conditions in a more structured fashion, with a particular emphasis on disentangling necessary from sufficient conditions. Similarly, examining our results from other theoretical stand points could identify further conditions, particularly those along the contextual dimension. For example, the Strategic Niche Management approach (Schot & Geels, 2008) could be used to explore what policy actors do to ensure the appropriate contextual embedding of energy communities, including guarding them from neoliberal pressures.

6 | CONCLUSION

Much of the polycentric governance literature operates at a fairly descriptive level. In this article we have examined if applying mechanismic thinking—and the CMO model (Pawson & Tilley, 1997) in particular—helps to address this. By systematically examining the existing literature, we have identified and categorized conditions which correspond to what has taken place within energy communities, between initiatives, and in their contexts. Our review identified 23 such conditions aligned to three dimensions.

Exploring the precise conditions under which scaling occurs is a way to address important blind spots in the polycentric governance literature. This is true, first of all, for the role of public authorities and state actors in shaping polycentric systems, and second for the question of temporality (i.e., how does a polycentric system change over time?). Next to this, scoping out what conditions are necessary and what conditions are sufficient for the scaling of energy communities can allow individuals interested in creating such initiatives and policy makers to plan better. This is particularly true for policymakers responsible for creating a supportive context for energy communities.

In addition to these conceptual advances, our review has also signaled that the long history of energy communities has entered a new phase characterized by digitalization and the emergence of market-oriented (business) models (Blasch et al., 2021). The transition to a more business-focused logic nonetheless signals a transformation of the aforementioned (energy) citizens into mere producers or consumer (prosumers) of energy (see also Devine-Wright, 2019). This in turn signals a turn away from grassroots driven transitions following the institutional logic of communities, and sheds light on the role of political power in polycentric settings (Morrison et al., 2019). These changes have implications for the study of scaling; ones which are undeniably present in existing empirical studies. The formalization of initiatives and

the drive to ensure their financial viability indicates a shift away from a community logic (Bauwens, 2021), to one characterized by a greater market logic and a hollowing out of energy citizenship.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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