



# Revitalizing varieties of capitalism for sustainability transitions research: Review, critique and way forward

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## ABSTRACT

Despite recent calls for more critical views of capitalism in sustainability transitions research, a starting point for transitions researchers is lacking. Recognizing the potential of the varieties of capitalism (VoC) approach to bring capitalism deeper into transitions research, this paper constitutes a review of VoC in the sustainability transitions literature, returning to its theoretical foundations in coordination and strategic interactions and their relations to innovation and socio-technical system transformation. The review finds the most common application of VoC to be in the energy dimension of transition, nevertheless revealing a shallow engagement with the approach that reinforces the need for conceptual development for sustainability transitions purposes. Potential areas for development relate to the enrichment of core VoC concepts – coordination, strategic interaction and comparative institutional advantage – and to competing growth and sustainability objectives of existing (and beyond) capitalist systems. There is a further need to expand the scope of VoC application beyond ideal-form national archetypes to infiltrate across scales and levels, as well as to go beyond the traditional range of sectors to shed light on understudied actors, roles and power relations for transitions. Despite typical delegation to political economy, VoC is highly interdisciplinary, applicable to common frameworks used in transition studies and amenable to social scientists interested in power and agency in transitions. As a strategy for moving VoC forward in transitions research, it is recommended to place it at the core of studies taking institutions, stakeholder interactions and sector coordination in their contextual situations seriously.

## 1. Introduction

For more than 30 years since the opening of major socialist regimes to global markets, the world's economies have converged towards capitalism as the one dominant economic system, with few national exceptions [1]. At the same time, the enduring and unsustainable link between resource consumption and economic growth, in itself a long-standing hallmark of capitalism, has raised the urgency for system-wide transformations to avert catastrophic global environmental crisis [2]. International initiatives to address sustainability challenges, such as the United Nations Sustainable Development Goals [3] and Paris Agreement [4], have recently been transposed into multiple policy fields, forming the basis for high-level strategies to transform socio-technical systems through the so-called 'decarbonization' of society [5,6]. Nevertheless, increasing attention to sustainability transitions from multiple

disciplinary perspectives has belied a 'blindness to capitalism', leading to calls for a more critical turn in transitions research [7] and raising alternative economic paradigms for discussion [8–10]. A starting point for incorporating capitalism into sustainability transitions research is, however, lacking. To address this gap, this paper constitutes a review of the sustainability transitions literature using one of the most dominant comparative political economy approaches suited to that task, varieties of capitalism (VoC) [11], asking: *How and to what ends is VoC used in sustainability transitions research?*

VoC provides an established approach for analysing political and economic aspects of socio-technical systems which are often at the heart of transitions research. As argued in the approach [11], political-institutional differences between countries create variation under the umbrella of capitalism. The differences distinguishing one form of capitalism from another can be traced in a multiplicity of ways,

*Abbreviations:* CME, coordinated market economy; LME, liberal market economy; MLP, multi-level perspective; SNM, strategic niche management; TIS, technological innovation systems; TM, transition management; VoC, varieties of capitalism.

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but the traditional view of political economy has focused on a state, firm and labour sectoral division [11] which nevertheless lacks relevance for interdisciplinary transitions research, broadly.

An alternative view more conducive to transitions frameworks may, however, have a wider scope than the traditional state, firm and labour division, which focuses on discrete bargaining groups, to instead look at state, market and social dimensions of transition. This aligns with the sectoral approach used for transitions that calls up wider sets of actors, vested interests and power in transitions (for example, see Refs. [12–15]), transcending a simple view of actors (who is on what side) and scaling towards spheres of influence and interaction (how the power is balanced and the direction of development can be shifted). While there is no clear-cut approach to state, market and social distinctions, each tends to carry its own associations. On the system level, the state may denote, for example, legal frameworks and institutionalized structures setting the ‘rules’ of the economy, from local requirements to international trade agreements (political approach). The market can denote firm and industry path dependencies, such as positions in global value chains and orientations towards particular modes of state support (economic approach). The social can relate to cultural norms and practices in capitalist economies, from *laissez-faire* individualism to intersectoral consensus and collaboration affecting the organizational and individual levels alike (i.e., adherence to vertical and horizontal hierarchies, qualities of entrepreneurialism, etc.) (sociological approach). Emphasizing difference, but also opportunities within particular political-institutional contexts, the recognition of VoCs based on a more holistic understanding across sectors stands to become central to the development of potential pathways and logics of system transformation, or ‘deep transition’ [16], positioning the transformation of capitalism as a crucial focus of transitions research. In light of that, transitions scholars have acknowledged the potential of VoC to contribute to sustainability transitions research broadly [17], but it has yet to be fully exploited in its traditional use, and there is a strong need for further conceptual and empirical development within the field.

To orient VoC towards sustainability, some challenges must also be addressed. VoC has been conceptually limited by the inherent capitalistic logic of economic growth as the prime objective for national well-being (cf [18]), similar to the field of political economy on the whole [19]. It is also limited by its focus on actors within the traditional state-firm-labour division and their interactions. Additionally, despite growing attention to social science contributions in transitions research, there has been a traditional focus on technological disciplines and aspects in the subfields of transitions research. To address these, Buch-Hansen [19] proposed that sustainability could replace growth as a key parameter of success in a reorientation of comparative political economy for sustainability transitions. Given the absence of new developments in this direction and the rapid growth of sustainability transitions research as an interdisciplinary field, transitions scholars are well positioned to pursue such a reorientation.

To address the disciplinary challenge, there is a particular space of opportunity, considering the rising role of the social sciences in one of the most popular but technical fields of transition, renewable energy [20–22]. Energy is a basic condition for economic development across VoCs; yet, energy production, and therefore development, have been historically linked with carbon emissions, making it a key sector for sustainability transitions. This has recently been met by strategies for decarbonizing the energy sector, for example, in the European Green Deal which aims to address all sectors of society [5]. Energy research from the natural sciences has traditionally neglected to incorporate contextualized political and social aspects affecting the implementation and uptake of energy technologies [23]. Referring to the state, market and social factors distinguishing VoCs, the expanding energy research agendas could provide an entryway into understanding the same neglected political and social dimensions of VoCs, which challenge the traditionally growth oriented, rationalist view of conventional actors. Indeed, renewable energy scholars are already spearheading topics that

would inform VoCs from state, market and social perspectives, for example, strategies to disrupt fossil regimes [24], experimentation with novel business models [25] and widening stakeholder participation and social innovations [26] and social acceptance of renewable energy [27, 28]. A key challenge across these regards the (re-)configuration of innovative technological advancements [29] with diverse political and legal frameworks, as well as social models of actors operating in and mutually constructing markets. However, despite cross-fertilization between international (comparative) political economy and sustainability transition studies of energy – highlighting, for example, technology, complexity, public policies, vested interests and conflicts – applications of the political economy perspective (e.g. VoC) to system transformation have been lacking [30]. Thus, researchers are called to delve deeper into political and social aspects to investigate power relations and uncover new patterns of interaction, which tangible sustainable and renewable energy projects involving specific, highly motivated actors in rapidly shifting technological landscapes are poised to inform.

Given the state of research in energy and innovation, amongst sustainability transitions more generally, the limitations of current perspectives towards capitalism in transitions research point to a need to better understand current uses of VoC in order to suggest directions for its future development. In pursuit of this, the paper continues with a deeper background of the VoC approach, focusing on core elements which can be made more relevant to sustainability transitions research. It then presents the methods and results of a systematic literature review, followed by a critical discussion and conclusions.

## 2. Foundations of varieties of capitalism and sustainability transitions

### 2.1. Origins and limitations to transitions research

To better understand potentials of VoC for transitions research, it is necessary to briefly delve deeper into its origins, associations with relevant concepts to transitions research as well as the limitations brought by its most common usage. First, VoC is a relatively young approach coined in 2001 [11], with a basis in the flourishing neo-institutional and organizational studies of the post-socialist globalizing period of the 1990s (see Refs. [31–33]). It is worth noting that the neo-institutionalist approaches underpinning VoC transcend institutions to include actors and relations that shape and are shaped by institutions, policies, norms, etc. [31]. Hall and Soskice introduced VoC for several purposes: to explain the effects of mainly national institutional differences on economic performance, termed ‘comparative institutional advantage’; to develop an analytical framework; and to open new perspectives for economic and social policymaking [11]. While the authors intended for the approach to evolve, its interpretation remained largely fixated on the initial state, firm and labour division and the institutional variations that resulted from differences in the balance of power amongst these groups in the early sets of published cases (as shown, for example, by the role of state intervention and relations between bargaining groups). Continuing along this line has enriched the approach for political economists often focused on specific sectors within national systems, but it has also become a liability for its further development. Its main critiques focused on the limited extent of variety represented by the approach, based on the core archetypes of ‘liberal’ and ‘coordinated’ market economies (LME and CME, respectively) [34], while disparaging attempts to create additional archetypes with limited explanatory value [35].

Despite its quest to open new perspectives, environmental policymaking and economic- and socio-ecological interactions were not foreseen in the development of VoC. Still, VoC is recognized in transitions research, even if not widely used. In defining a comprehensive agenda, the Sustainability Transitions Research Network places VoC under the theme of ‘politics and power in transitions’ [17]. When understanding the approach’s foundations in interactions between firms and other

stakeholders as well as neo-institutional applications [31], VoC could however become an integrative approach for transitions across wider political, economic and social dimensions. Other relevant streams on the agenda therefore include but should not be limited to ‘governing transitions,’ ‘businesses and industries in sustainability transitions,’ ‘movements, culture and civil society in transitions’ and the ‘geography of transitions’ [17]. Given the potential for its expansion, it is worthwhile for users of common transitions frameworks (including the multi-level perspective (MLP), technological innovation system (TIS), strategic niche management (SNM) and transition management (TM) approaches amongst the most influential [36]) to consider their compatibility with VoC more deeply. In the following, foundations of VoC including coordination, strategic interaction and innovation are updated for sustainability transitions.

## 2.2. The role of coordination

Core to VoC since its early conceptualization has been its focus on the role of stakeholder coordination in producing comparative advantages. Often the nuances of coordination go unexplained, and whether research is focused on between- or within sector analysis, coordination can relate to vertical and horizontal interactions – vertically, as top-down or bottom-up direction-setting (e.g., state-industry/firm), and horizontally, as competitive or collaborative interactions (e.g., firm-firm, firm-labour). For practical purposes, it is thus possible to speak of both coordination of stakeholders and coordination between stakeholders, most often under institutional arrangements that tend to be set at the national level. As such, coordination often translates to the role of the state as a main factor of analysis.

Attention to the role of the state, in turn, likens coordination to state intervention, which is a main differentiating characteristic of the two main VoC typologies, LME and CME. Being based primarily on Western and Northern European economies, CMEs are characterized by higher and more transparent state intervention than their LME counterparts (e.g., United Kingdom, United States) but also have strong traditions of intersectoral and inter-firm collaboration supporting more socially equitable outcomes. While the degree of state intervention tends to spark debate along ideological grounds (cf. Mazzucato [37] and Brown [38] on mission-oriented innovation policy; Schot and Steinmueller [39] and Fagerberg [40] on transformative innovation policy), conventional wisdom acknowledges a role of the state in shaping the external factors of the business environment in which firms (ergo, industries and sectors) operate. The role of the state in the VoC literature has hitherto been analysed for its effect on creating comparative institutional advantages supporting economic growth (i.e., the developmental state). A sustainability oriented approach could rather see the role of the state in the context of the environmental state [41], for example, wherein the main concern is the health and welfare of citizens founded on ecological sustainability. Expanding VoC to sustainability transitions requires wider consideration of the role of the state in structuring not only markets but also the political and social interactions that are of concern for transitions. Moreover, as transition scholars have recognized, it is crucial to not conflate the power of coordination with the power of the state as the only powerful actor. Therefore, a renewed approach should consider power at all levels. The commonly used transition framework, multi-level perspective (MLP), most directly deals with vertical coordination situated within the state system, but could open analyses of coordination and power to other levels.

On the sub-national level and moving towards horizontal coordination, VoC has also been related to systems and sub-systems of coordination that mutually reinforce each other, revealing “key VoC notions of functional coherence, coordination, and complementarity” (p. 4) [35]. Here we find more focus on sectoral, industry and regionally bounded research subjects. Transition frameworks such as technological innovation system (TIS), strategic niche management (SNM) and transition management (TM) start to unravel different types of horizontal (while

not excluding vertical) coordination [42,43], and energy transition notably comes out as a field of active research [22,44].

## 2.3. Strategic interactions

While coordination potentially deals with the full scope of stakeholder interactions, the concept of ‘strategic interactions’ lends a focus to coordination that, under capitalism, produces and reinforces comparative institutional advantages. The VoC literature tends to examine strategic interactions on a more micro level, such as within sectors, industries and even firms, and different forms of coordination emerge. For example, Höpner [45] distinguishes between functions of coordination and organization, whereby coordination refers to the voluntary action between firms to maximize their interests and organization refers to the next step of institutionalizing such coordination (e.g., through policies, standards, norms) to serve greater collective interests. This frames coordination as strategic interactions in the language of VoC, the institutionalization of which leads to comparative institutional advantage involving degrees of state intervention to serve collective interests. An example is the scope of coordination as revealed in dominant modes of corporate governance, shareholder and stakeholder models in Switzerland and Germany, respectively [46], which suggest differences in seemingly similar VoCs (both termed CMEs) with implications for participants’ strategic interactions and objectives.

To relate strategic interactions to transitions research, there is a clear link between the VoC literature and transitions frameworks focused on the sector, industry and firm levels. SNM, for example, specifically links niches to external processes affecting their development [43,47], thereby requiring strategies for firm and industry survival and growth. In another vein, TM brings the strategic act of visioning [48] to the more macro task of governing transitions across multiple interrelated systems [49]. For transitions research, the consideration of ‘strategy’ may lead researchers to study more coordinated economies for examples, due to the relatively active creation of institutional advantages supporting the coordinated disruption of existing systems. This introduces a potentially political aspect of coordination, alluding to what Mazzucato [37] describes as setting the direction of markets. Furthermore, as it becomes more apparent that a certain degree of coordination and state intervention is required for sustainability transitions, it is more useful to consider economies on a continuum of coordination (i.e., less to more coordinated) rather than imagine purely liberal or coordinated markets (i.e., LME and CME archetypes). As coordination and strategy are shown to be highly relevant for sustainability transitions, VoC presents a conceptual background that can be used to bring capitalism into transitions research while continuing to work with established transition frameworks. Moreover, by adapting VoC to break free of its limiting aspects, like the LME and CME archetypes, researchers will be able to work flexibly with comparative methods, engage deeply with cases and feed back novel contributions to VoC theory.

## 2.4. Innovation and socio-technical regimes

Finally, VoC and sustainability transitions have a common interest in innovation and complex systems, seen in terms of economic development and institutions, from the comparative political economy side, and socio-technical regimes, from the transitions side. The VoC literature has drawn associations between coordination (or lack thereof) and innovation, supposing that liberal economies are more risk-taking when it comes to investments in research and development and are faster to disrupt systems due to lower institutional barriers to change. However, recent literature on public innovation does away with the notion that more liberal economies are devoid of state intervention [37], and the traditional view can therefore be challenged given the highly political nature of sustainability transitions.

Research on state capacities for radical and incremental innovation to address climate change has found that relatively liberal economies

typically associated with radical innovation could fail to implement systemic transformations due to political factors [50]. On the other hand, state intervention in relatively coordinated economies relates to developed governance capacities to deal with tensions between accelerated and just transitions [51]. Drawing from Mazzucato [37], more coordinated economies conventionally associated with incremental innovation and a slow pace of change may excel in making public investments in technology and infrastructure and in fostering the system coherence needed for successful transitions. As an example, the coordinated economies in the European Union generate system coherence through supra-national policy and market-shaping activities associated with the European Green Deal, reinforcing the speed and durability of transition [5]. Decarbonizing the European energy system is but one type of transition being pursued in this way. The potential advantage of more coordinated economies in the area of sustainability transitions thus runs counter to typical associations of more liberal market economies with radical innovation and rapid change, pointing to a paradox of coordination and innovation.

Research connecting innovation and transitions can help to reframe technological challenges in terms of structure-agency problems in socio-technical system transformation. Stakeholder coordination dynamics are a key area of interest in innovation systems research, such as amongst actors in TIS, but much work needs to be done to understand dynamics in environmentally focused innovation studies and socio-technical system transformation. Amidst criticism of being too inward focused [52,53], the TIS perspective has been expanded to incorporate situational context, e.g., actors, networks and systems [54], but where the object of study is still the technology rather than context. To enable a shift in attention to the context of socio-technical systems ‘permeated by capitalism’ [7], the critical perspective of VoC can bring aforementioned neo-institutionalist approaches informing context (i.e., structure) deeper into transitions research, especially considering that contextual ‘assemblages’ of institutions are an important yet less studied aspect of technological innovation (see Ref. [55]). From the social aspect, institutional stability and change across capitalist contexts is also associated with patterns of behaviour, thereby interpreting the core VoC concept of coordination as ‘behaviour’ in the presence (or absence) of supportive institutions [56].

Finally, it is necessary to acknowledge the interplay of innovation, neo-institutionalist approaches and sustainability transitions in regional studies. Research on regional innovation systems increasingly highlights the political-institutional dimension shaping regional development paths, not only in terms of institutional structures but also agents operating within them [57]. Recent research has focused on bridging individual actor agency and the social structure of innovation [58,59] to address network structure and knowledge flows in innovation networks.

The concept of relatedness has also been developed to describe such networks of interaction [60]. It is possible then to distinguish internal from external relations and to locate them on different spatial levels. The homogeneity of VoCs can be challenged as different patterns of interaction are found within a singular state system, such as in the case of two Germanys [61], suggesting regional variation and a need to investigate alternate scales and levels (recall the MLP). Studies bridging evolutionary economic geography and socio-technical transition in the context of regional development also highlight the importance of agency in policy experimentation, market nurturing, resource configuration and policy mix coordination [62]. Attention then returns to VoC’s critical lens on interactions, moreover for sustainability transitions, in the pursuit of new ‘green’ path developments serving societal goals [63].

With the above advancements within transitions fields and their related frameworks in mind, what is needed to bring capitalism deeper into sustainability transitions research is not a new framework but rather a perspective that enables capitalist critique in existing frameworks. For that, a revitalized VoC lens can enrich the analysis of sustainability transitions by opening up fundamental questions about political, economic and social systems and relations within existing capitalisms, the understanding of which is needed to pursue transformative change in socio-technical systems.

### 3. Methods and analysis

The following analysis presents a literature review assessing VoC usage in the sustainability transitions literature to date, thereby enabling a discussion of potentially underdeveloped areas of application and future directions for VoC in transitions. The methodological approach employed is befitting to interdisciplinary social science perspectives on transition, drawing inspiration from Xiao and Watson [64] on literature reviews for planning studies as well as literature-extending and thematic style reviews focused on concepts [65]. The method is consistent with Petticrew and Roberts’ [66] systematic reviews for the social sciences, which have amongst their purposes to paint an overall picture of past research to inform future directions. The approach to the review thereby differs from systematic reviews for the natural sciences which also focus on empirical results (e.g., meta-analyses). It is systematic in that it critically appraises and summarizes the literature across a vast and interdisciplinary field that is otherwise difficult to grasp [66]. It is critical in that it questions the actual applications of the VoC approach against its theoretical potentials and flags possible biases in its application for discussion.

In practice, the review combines quantitative and qualitative analytical methods, from bibliographic analysis for characterizing the scope and reach of the literature, to thematic content analysis for

**Table 1**  
Search criteria and keywords.

	Inclusion	Exclusion
	<p><b>Round 1:</b> “varieties of capitalism AND “sustainability transitions”</p>	
<i>Search terms and keywords</i>	<ul style="list-style-type: none"> <li>• Within results: “capital*,” producing combinations: “neoliberal capitalism,” “comparative capitalism,” “modes of capitalism”</li> <li>• Within results: “sustainability transitions,” flagging “green” and “shift” and producing combinations: “green capitalism,” “green transition,” “green shift,” “greening”</li> </ul> <p><b>Round 2:</b> (“varieties of capitalism” OR “comparative capitalism”) AND (“sustain*” OR “green*”)</p> <p><b>Round 3:</b> (“varieties of capitalism” OR “comparative capitalism”) AND (“sustain*” OR “green*”) AND (“transitions OR shift”)</p>	<ul style="list-style-type: none"> <li>• For sorting, terms denoting fields of management and business administration, e.g., “corporate governance,” “corporate social responsibility,” “sustainability accounting,” “SDG reporting”</li> </ul>
<i>Types of publications</i>	<ul style="list-style-type: none"> <li>• Peer-reviewed journal articles</li> <li>• Edited volumes</li> <li>• Chapters in edited volumes</li> </ul>	<ul style="list-style-type: none"> <li>• Registered working papers</li> <li>• Grey literature</li> </ul>



investigating the use of the VoC approach. Recent reviews covering similarly emerging, broad and interdisciplinary topics in energy, innovation and sustainability transitions also balance bibliographic and thematic elements, thereby indicating soundness of the approach. Included amongst these, for example, are reviews on the emerging field and prospects for sustainability transitions [17,36], on renewable energy and national development [67], on experiments in sustainability transitions [68], and on integrating science and technology studies with energy social science [23]. Nonetheless, reviews devoted exclusively to the conceptual aspect can also be found, for example, on political power and renewable energy [69] and on understandings of social innovation in energy systems [70].

The literature amassed for review includes published peer-reviewed academic articles, books and book chapters but excludes registered working papers and grey literature. Table 1 summarizes the inclusion and exclusion criteria including search terms and keyword combinations flagged in three rounds of searches described in further detail below.

The review began with three rounds of keyword searches within Google Scholar, Web of Science and EBSCOhost, conducted in January 2021, the results from which were compared and compiled in one dataset comprising the literature corpus. Only papers from peer-reviewed sources available in full-text were selected. Several peer-reviewed pre-prints were included in the initial rounds, but registered working papers were excluded. While assessing the topicality of initial results, the field of management and business administration was excluded, specifically, papers focused on corporate governance, corporate social responsibility, sustainability accounting and SDG reporting. The search results were reduced as articles were read for relevance, sorted and coded through the summer of 2021.

**Round 1.** An exploratory search of “varieties of capitalism” and “sustainability transitions” returned 289 results in Google Scholar which were checked for relevance based on titles and highlighted keywords. This search was used to scope the literature and flag alternative keyword combinations and synonyms to include in the advanced searches. Titles appearing to be relevant were searched for “capitalism” and its derivatives (i.e., “capital”), flagging keyword combinations such as neoliberal capitalism, comparative capitalism, modes of capitalism, etc. Regarding sustainability transitions, the interchangeable use of “green” and “sustainable” as well as “transition” and “shift” was shown in keyword combinations such as “green capitalism,” “sustainability transition,” “green transition,” “green shift” and “greening” of the economy or specific industries. This round resulted in 59 papers deemed relevant.

In addition, the reference lists of these papers were checked to identify 32 potentially relevant papers, which were kept in a separate list. These were kept separate to eventually ensure that they did not together flag any important keywords that should otherwise be included.

**Round 2.** An advanced literature search was conducted in Web of Science using the keyword combination: (varieties of capitalism OR comparative capitalism) AND (green\* OR sustain\*). The Web of Science search returned 62 results, of which seven included the keyword “transition”. The full list was retained and compared to the 59 results from Google Scholar and 32 in the reserve list.

**Round 3.** An advanced search of EBSCOhost Academic Search Complete (search terms: (varieties of capitalism OR comparative capitalism) AND (sustainab\* OR green\*) AND (transition OR shift)) finally identified eight additional papers.

The results from the three rounds were combined and duplicates removed, resulting in a total of 133 papers for reading and sorting. Through this process, 64 papers were retained and analysed according to the categories outlined in Table 2. These categories gather both quantitative and qualitative information, focusing on the latter for critical assessment of the literature in connection with major themes of transitions research conveyed in section 2. Several of the categories can be overtly determined (e.g., bibliographic information, type of article, transitions framework applied, related terms), while others require interpretation due to grey areas of interdisciplinarity (e.g., dimension(s) of transition, scientific discipline). The latter were coded thematically based on keywords in the title and abstract, first, and then through reading of the full text. When not indicated explicitly in the text, scientific discipline was determined with the help of the journal title, methodology and, lastly, by referring to the affiliation of the lead author. The categories requiring the most extensive qualitative analysis were ‘Application of VoC’ and ‘Centrality of VoC,’ which required full reading of the text and content analysis of key passages relating to VoC. These ranged in length from one or two sentences to full sections and could thus be judged to be central or peripheral to the paper’s main topic. The analytical categories are further described along with the results below. In accordance with the aim and approach, the analysis does not attempt to assess ‘correct’ usage of VoC but rather ‘actual’ usage in order to inform and critically reflect on potential future directions. Due to the relatively young age of the literature, impact or citation analysis of the articles to identify emerging branches was not conducted.

**Table 2**  
Analytical categories of literature corpus.

Analytical Category	Description
<b>Bibliographic summary</b>	Publication data – name, year, etc.
<b>Type of article</b>	Classification as conceptual papers (models, frameworks, agendas), empirical papers (case studies) or miscellaneous (reviews, editorials)
<b>Dimension of transition</b>	The topical focus or aspect of transition addressed in the article; e.g., global economy, energy, energy democracy, energy efficiency behaviours, energy justice, energy transition, energy transition policy, climate change, climate targets, electric vehicles, renewable electricity, solar power, wind power, waste-to-energy, bioenergy, natural resource management, sustainable development, innovation, socio-technical transformation, just energy finance, low carbon energy investment, green transition, ‘greening’ work, green business strategy, politics of ST, IPE of energy
<b>Scientific discipline</b>	Most prominent disciplinary perspective taken by the authors; e.g., political science, political economy, comparative political economy, critical political economy, environmental political economy, geographical political economy, international political economy, sociology, economic sociology, economic geography, evolutionary economic geography, urban economic geography, institutional economics, science and technology studies, industrial ecology, industrial relations, organizational studies, innovation studies, business and finance
<b>Theoretical framework</b>	Use of framework or model from sustainability transitions research [36]
<b>Application of VoC</b>	Context of the appearance of VoC in the text, revealing dominant themes through content analysis
<b>Centrality of VoC concept</b>	Context of VoC in the text as a central organizing concept (implicit or explicit, central or peripheral), revealing level of engagement with the literature
<b>Related terms</b>	Emergent related terms, VoC synonyms and surrogates, informing the literature search and revealing authors’ understandings of the VoC literature landscape; e.g., comparative political economy, critical political economy, comparative capitalism, (varieties of) green capitalism, stakeholder capitalism, institutional configurations governing activities/transactions, institutional constellations and system logics, institutional advantages, state capacity to intervene, state-market relations, capitalist diversity, institutional diversity, historical institutionalism

#### 4. Results

The 64 papers representing the body of literature were assessed for the following information shown in Table 2: bibliographic summary data; type of article; dimension of transition; scientific discipline; sustainability transitions theoretical framework; application of VoC; centrality of VoC concept; and VoC related terms. These analytical categories were determined based on the needs of the review as it unfolded. For each of the eight categories, the trends in the literature are summarized and supported with key papers, when appropriate. See Table 3 in the Appendix for the full list of sources reviewed.

**Bibliographic summary.** Analysis of bibliographic information shows the increasing frequency of publications on VoC and sustainability transitions since the first paper published in 2008 (Fig. 1). The 64 articles appeared amongst 43 different journals or books, covering a diverse range of disciplines including economics and business, political science, planning, sociology, energy and environmental sciences. Eight journals were responsible for nearly half of the publications, the most frequently being *New Political Economy* (n = 3), *Energy Research & Social Science* (n = 5), *Research Policy* (n = 5) and *Environmental Innovation & Societal Transitions* (n = 9) (Fig. 2). Due to the recent growth of publications in this area, with the majority of results being published within the last four years, citation impact analysis is not yet warranted.

**Type of article.** Articles were classified as either conceptual (n = 28) or empirical (n = 33), with several editorial and review papers not falling into either category (n = 3) (see Table 3 in Appendix). The conceptual papers tended to focus on developing a model, conceptual framework or research agenda, while the empirical papers were mainly based on case studies.

**Dimension of transition.** As a reflection of the multi-disciplinarity of sustainability transitions research, the articles represent a range of dimensions of transition such as energy (including democracy, efficiency behaviours, justice, transition, transition policy) and more specifically electric vehicles and renewables (including solar power, wind power, waste-to-energy and bioenergy), climate change and targets, natural resource management, global economy, finance and investment, innovation, socio-technical transformation, sustainable development, green transition, ‘greening’ work, green business strategy, and politics of sustainability transitions (see Table 2). The dimension most frequently relating to VoC is energy transition.

**Scientific discipline.** While it is not possible to neatly categorize articles across disciplines due to the interdisciplinarity of transition studies, a primary discipline was recorded based on the terms used in each article, the scope of the journal or discipline of the lead author, if indicated. Thus, the range of disciplines covered include political science and, more specifically, political economy (including comparative, critical, environmental, geographical and international variants),

economic geography (including evolutionary, institutional and urban variants), sociology (including economic), science and technology studies, innovation studies, industrial ecology, industrial relations, organizational studies and business and finance (see Table 2). The most common discipline is political economy, which fits with the origins of the VoC approach, followed by economic geography. Apart from three papers that identified with sociology, human-centred social science disciplines like human geography and psychology are notably absent from the literature. Referring to publication titles shows that single papers were indeed published in relevant journals to social disciplines (e.g., *Geoforum*, *Journal of Rural Studies*, *Progress in Planning*, *Regional Studies*), but the papers themselves could rather be identified with other disciplines, as mentioned above.

**Theoretical framework.** Despite drawing from the sustainability transitions literature, few of the articles mention frameworks from transition studies, let alone integrate VoC with them. Referring to four main theoretical frameworks identified by Markard et al. [36], articles retrieved in this review explicitly relate to the multi-level perspective (MLP) (n = 19) [7,9,17,55,71–85], technological innovation systems (TIS) (n = 8) [17,53,71,72,75,80,86,87], strategic niche management (SNM) (n = 5) [17,72,73,75,76] and transition management (TM) (n = 3) [17,55,75] frameworks. Cooke [76] notably incorporates VoC into the SNM framework, while Wesseling [86] relates VoC to TIS, and others more commonly relate VoC to MLP as a factor on the highest analytical level, i.e., landscape.

**Application of VoC.** This category extracts the explicit or implicit relation to VoC from the text of the article for discourse/content analysis. Comparison of the extract passages allows the identification of themes pertaining to how VoC is used within the intended scope of the paper. Engagement with VoC literature is found in several ways: first, studies loosely align with elements of VoC for the purposes of institutional analysis, whether comparative or not, or critique of capitalist systems; second, empirical studies draw on the LME and CME archetypes to characterize national systems in case studies as a motivation for case selection, to establish contextual differences for comparison, or to support empirical findings; third, conceptual papers relate VoC to other theoretical approaches in political economy or economic geography, sharing concerns with path dependency, innovation and structure-agency problems. In referring to VoC in association with these, they hardly employ its foundational elements, for example, to investigate coordination, strategic interactions or comparative institutional advantages, and usually point to the need for further study.

It can be seen that most of the studies explicitly applying VoC utilize the archetypes uncritically, while few publications are critical towards this conventional application (see e.g., Lachapelle et al. [88] and Roberts et al. [89]). Lockwood et al. [90] seem to disagree with the simplification but still interpret VoC in such terms rather than by its

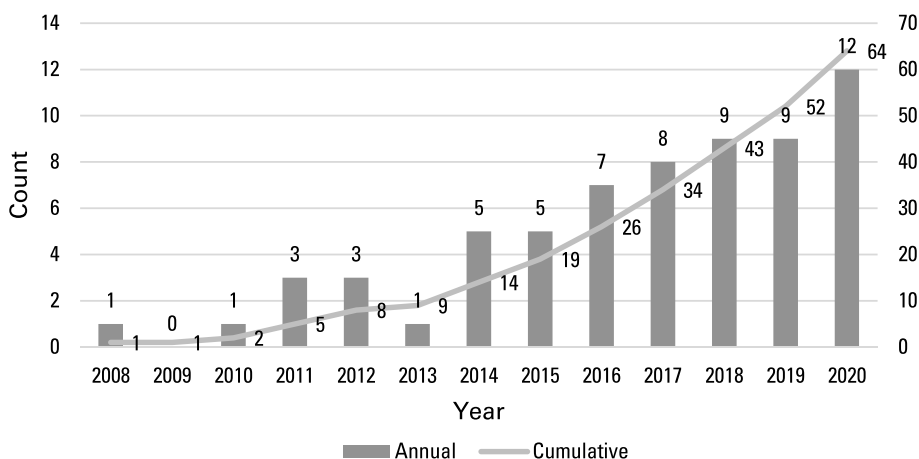


Fig. 1. Annual and cumulative number of publications on VoC and sustainability transitions.

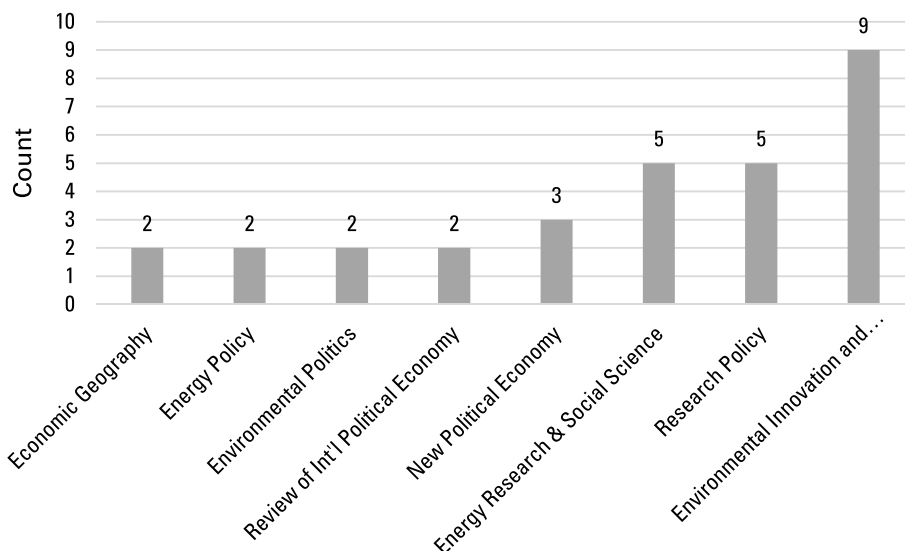


Fig. 2. Journals with more than one article published on VoC and sustainability transitions.

more theoretical comparative institutional basis.

An exception to the limited engagement noted is Mikler and Harrison [50], who investigate radical and incremental innovation to address climate change, a topic with a clear connection to sustainability transitions. They point to the traditional role of national technological systems to achieve economic or political objectives and suggest a need to re-think VoC when approaching innovation for environmental aims. Although their study pre-dates current coordinating policy frameworks like the Paris Agreement and Agenda 2030 which have set directions for the field of environmental innovation, Mikler and Harrison can still serve as an inspiration for more focused work on VoC in this area. Ćetković and Buzogany [91] should also be noted for widening the scope of analysis to include science (academia and research) and civil society sectors, beyond the conventional state-firm-labour divisions.

**Centrality of VoC concept.** Related to the application of VoC, this category indicates the extent to which VoC is used as a central organizing concept (central or peripheral, implicit or explicit) in the texts, and, following, the level of expected engagement with the VoC literature within the scopes of the papers. In accordance with the method of the literature review, the vast majority of papers mention VoC explicitly (implicit mention could not be returned in search results if not for the inclusion of variant keywords) (see Table 3 in Appendix). However, some papers of note identify aspects of VoC without naming the approach (e.g., Kuzemko et al. [83], MacKinnon et al. [84] and Haas [92]). Studies using VoC as a central concept (both central and explicit) tended to be empirical and therefore associated with a limited conventional application, while the conceptual papers tended to mention VoC in passing (explicitly, but as a peripheral concept in the overall approach) in a more theoretical discussion of state-economy contextual differences.

**VoC synonyms and surrogate terms.** Alternate terminologies that could inform the scope of the discourse were noted (see Table 2).

## 5. Discussion

Given the above results, a critical reflection on the usage of VoC in sustainability transitions research is warranted in order to consider the potentials for bringing capitalism into transitions research. The following discussion addresses the main finding being an overall shallow engagement with VoC, followed by the potential to enrich the vocabulary and semantics of VoC with transition perspectives, the need to develop links between VoC and transition frameworks, the missing account of temporal processes across VoCs and transitions and, finally, the

opportunity to extend VoC beyond the current bounds of capitalism.

### 5.1. Deepening engagement with VoC

The main critical finding is that the vast majority of transitions studies claiming to use VoC do not focus on the approach itself or strictly adhere to it. As such, these studies may contribute little to the VoC literature or understandings of capitalism in sustainability transitions. VoC is shown to be primarily used as a straight-forward analytical tool or as a token to account for structural variation across cases. This approach certainly has its purposes in the wider comparative capitalisms literature. Nevertheless, the apparently shallow understanding and un-critical application of VoC highlights the need for deeper engagement in order to harness its potentials for sustainability transitions research. This could, for instance, improve understanding of how elements of capitalist systems are constructed and how they relate to social and environmental aspects (i.e., sustainability, transitions) across multiple scales, from local to global. In particular, the context of specific cases including political-institutional, economic, social and environmental aspects risks being obfuscated by uncritical usage of the traditional VoC typologies. For deeper engagement, it would be useful to return focus to VoC's theoretical foundations of coordination, strategic interactions and comparative institutional advantage and enrich them with the multiple and interdisciplinary perspectives of sustainability transitions research.

### 5.2. Enriching vocabulary and semantics: actors and relations

In light of the limited applications noted above, the multi-disciplinary field of sustainability transitions research has potential to enrich VoC with new semantics that take from and expand the meaning of core VoC concepts. The need for a new conceptual vocabulary for transitions research has been previously recognized, including the potential of VoC to enrich transitions research [71]. For bringing capitalism into sustainability transitions, on the other hand, VoC as an established approach should be adapted to transitions by enriching its own concepts from transitions perspectives. The core VoC concepts – coordination, strategic interactions and comparative institutional advantage – would be better oriented for sustainability transitions by following Buch-Hansen [19] and Koch [93] in replacing the capitalist growth objective with sustainability and opening space for the study of a wider set of actors and processes in socio-technical system transformations. Understandings of each of these concepts stand to be enriched when actors and systems are addressed through sustainability

transition perspectives. Since the traditional VoC approach has been limited by the semantics of firm, state and labour relations, the sectoral approach of sustainability transitions should be adopted into VoC in order to include wider political, economic and social aspects of sustainability in its theoretical foundations and, in turn, bring comparative capitalism into the most important sustainability challenges of the twenty-first century.

This review suggests that the common use of VoC through national political-economic archetypes continues to create barriers to understanding relevant institutional characteristics in light of alternative sustainability-related objectives in existing capitalist systems. The VoC approach, nevertheless, ought to not be disregarded but transformed by transitions scholars by re-orienting and enriching concepts like coordination, strategic interactions and comparative institutional advantage. There is a particular opportunity to uncover new actors, roles, patterns and relationships for a comparative political economy of sustainability transitions, which also stand to be greatly informed by social science approaches active in transitions research that, as mentioned in the results, could not be detected in this review. Buch-Hansen [19], for instance, highlights roles as revealed through multiple economic configurations and instruments in a sustainability-oriented political economy that includes “work sharing, social enterprises, localised production, eco-communities, community currencies, debt audit, time banks, and job guarantees” (p. 46) which can point to alternate actors and relations for inclusion in the study of coordination.

Given the VoC focus on coordination, transitions research can enrich the study of stakeholder interactions by balancing generally positively viewed coordination with conflicts and contentions amongst other sectors of society (typically seen as negative interactions) in more critical perspectives on transition. This would expand the scope of VoC research to reveal not only what works in terms of comparative institutional advantages, but also what hinders coordination amongst wider stakeholders, drawing linkages to participatory processes and governance models now seen to be crucial in global sustainability initiatives. By adopting a more dynamic view of institutions with regard to innovation and entrepreneurship in VoC [94], alternate dimensions for institutional analysis including trust, performance of innovation systems, dynamics of institutional change and multi-level perspectives can bring together greater alignment with dominant frameworks from transitions research.

### 5.3. Linking VoC with transition frameworks

Theoretical linkages between VoC and common transition frameworks have been mentioned in earlier sections of this paper. Given the results of the analysis, the untapped possibilities for expanding the scope of VoC towards common frameworks are revealed in the almost exclusive application to national system level, which corresponds to the landscape level in the MLP. VoC is therefore called to infiltrate to lower levels, e.g., emerging niches and incumbent regimes [79], to further understandings of actors and networks in entrenched power structures. Extension to the regime level would enrich the approach, enabling a shift in attention to incumbent regimes – including resistance to transition – and a critique of assumptions of capitalism in wider political-economic landscapes. Applying and developing core elements of VoC on the niche level, on the other hand, would put due attention to actors and roles negotiating institutional frameworks and potentially creating new markets through innovative capitalist configurations. Following its clear associations with levels of analysis, VoC could be used to bridge the MLP with other frameworks such as SNM and the multi-actor perspective [14], to investigate power relations under capitalism, within and across levels in transition studies.

### 5.4. Accounting for temporal processes across VoCs and transitions

Further to the shallow engagement with VoC revealed by the review, applications of VoC in transitions research have not grasped upon

common temporal developments across VoCs and sustainability transitions. None of the reviewed papers addressed the construction of markets over time, nor draw from examples of change in economic systems, e.g., from socialism to capitalism in the 1990s, which was partly the inspiration behind VoC [32,33,95–100]. Furthermore, few papers pay regard to neoliberalizing processes across cases, which can be credited with much of the convergence across VoCs today, not to mention its perverse effects on sustainability. While sustainability transitions research is predominantly focused on current developments, historical case studies may inform changing institutions, power structures and actor relations in the evolution of capitalist economies today and in the future.

### 5.5. Extending VoC beyond the current bounds of capitalism

A potential limitation of VoC to contribute to sustainability transitions research is its assumed limited scope of application to the bounds of capitalism. Nevertheless, as a critical approach, it can challenge the bounds of existing capitalisms and provide concepts for transcending ‘beyond’ capitalism [8–10]. Current research is already widening capitalist perspectives, without specifically invoking VoC, which can be welcomed into this camp. For example, Korestkaya and Feola [10] propose a framework for recognizing diversity in capitalist, alternative capitalist and non-capitalist forms in agri-food systems. This highlights a role for VoC to contribute to the beyond-capitalism discourses from the perspective of transforming diverse ‘actually existing’ capitalisms. Once again, social science perspectives in transitions research may offer insights for challenging the bounds of capitalism, just as their treatment of actors and relations may further inform the construction of markets, sector regulation and patterns of interaction more broadly underpinning variants of capitalism. These areas of study demand a potentially broader perspective than the VoC literature has offered to date, to be more critical of foundational aspects defining capitalist systems (e.g., a growth objective). Nevertheless, the transitions literature is well positioned to take that task on and to deepen the knowledge on un- or underexplored contextual factors in the so-far early stages of transforming capitalisms, given that these are likely to be highly dependent on the contexts of political economy, culture and place. The less represented disciplines in the reviewed literature such as economic sociology (and unrepresented disciplines such as human geography, psychology, etc.) have potential to offer much in this regard (see Mikler [101] on the social basis for capitalist relations).

## 6. Conclusions

This review has set out to assess the usage of VoC in sustainability transitions research in response to calls to incorporate notions of capitalism more deeply into transitions research [7] and a general recognition of VoC as a promising approach [17]. In doing so, the review has revealed an overall lack of critical engagement with VoC amongst papers that adopt it, indicating a need to revitalize VoC for transitions research purposes. Instead of bringing capitalism to the core of transitions research, the general usage of VoC amongst a collection of 64 papers is limited to the basics of ideal-form archetypes (e.g., LME and CME). This treatment, however, offers limited analytical value to researchers concerned with the effects of capitalism on sustainability.

While transitions research does tend to be critical of capitalism and calls for deeper incorporation of capitalism into frameworks suited to multiple perspectives on transitions (e.g., political, technological, sociological, business, etc.), the uncritical treatment of VoC may belie a lack of awareness towards its origins and key concepts. Hence, transition scholars may benefit from refreshing knowledge on the VoC approach, on the one hand, and extending and adapting it conceptually to their purposes, on the other, rather than using it ‘off the shelf’. Social scientists engaged in transitions research, in particular, are encouraged to take more liberties with their critical eye, thereby moving towards a



critical VoC approach.

In the spirit of contributing a new conceptual vocabulary for transitions [71], transitions scholars may adapt and develop VoC for their own purposes based on rapidly developing theories within their fields. The commonly used transition frameworks already emphasize themes such as actors, roles and interactions in socio-technical system transformations as well as institutional constructs that foster or hinder transition. Key concepts from VoC to enrich with transitions' political, economic and social perspectives include coordination, strategic interactions and comparative institutional advantage, which should be reframed in terms of sustainability rather than economic growth. These concepts can also be used to re-think notions of innovation and socio-technical systems in transitions, once re-considered for sustainability.

Once it benefits from the multiple disciplinary perspectives of transitions research, VoC stands to become greatly enriched. Its critical application can potentially be expanded to include a wider range of stakeholders and prioritize, for example, understudied groups, roles or institutional frameworks in transition processes as well as alternate objectives of the economic system within and as alternatives to capitalism. Other potentials for future application of VoC to sustainability transitions relate to drawing links to common transitions frameworks and accounting for common temporal processes between VoCs and transitions. Social science perspectives in transitions are particularly well placed to enrich VoC and push its boundaries. As transitions research challenges existing capitalist relations and pushes to go beyond capitalism, i.e., to include post-capitalism, alternative and non-capitalist

configurations, a critical VoC would enable the investigation of myriad future developments on top of co-existing systems. To start, better understanding of current capitalist systems through a revitalized VoC approach can be seen as a needed first step for socio-technical systemic transformation.

### Declaration of competing interest

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

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## Appendix

**Table 3**  
Literature reviewed (n = 64), type of paper and centrality of VoC concept

Source	Reference	Type	Centrality of Concept
Andrews-Speed (2016)	[55]	Conceptual	Peripheral - explicit
Benney (2019)	[102]	Empirical	Central - explicit
Borrás and Edler (2020)	[103]	Conceptual	Peripheral - explicit
Boschma et al. (2017)	[73]	Conceptual	Peripheral - explicit
Bridge and Gailing (2020)	[74]	Conceptual	Peripheral - explicit
Buch-Hansen (2019)	[19]	Conceptual	Peripheral - explicit
Četković and Buzogány (2016)	[91]	Empirical	Central - explicit
Četković and Buzogány (2019)	[104]	Empirical	Central - explicit
Četković and Buzogány (2020)	[105]	Empirical	Central - explicit
Četković et al. (2017)	[106]	Empirical	Central - explicit
Cherp et al. (2018)	[75]	Conceptual	Peripheral - explicit
Coenen et al. (2012)	[71]	Conceptual	Peripheral - explicit
Cooke (2010)	[76]	Empirical	Central - explicit
Doering et al. (2011)	[107]	Empirical	Central - explicit
Duit et al. (2016)	[41]	Conceptual	Peripheral - explicit
Eckersley (2020)	[108]	Conceptual	Peripheral - explicit
Evans and Stroud (2016)	[109]	Empirical	Central - explicit
Feola (2020)	[7]	Conceptual	Central - implicit
Fromhold-Eisebith and Fuchs (2012)	[110]	Conceptual	Peripheral - explicit
Fuenfschilling and Binz (2018)	[77]	Conceptual	Peripheral - explicit
Geddes and Schmidt (2020)	[78]	Empirical	Peripheral - explicit
Geels (2014)	[79]	Empirical	Peripheral - implicit
Gilbert and Campbell (2015)	[80]	Empirical	Peripheral - explicit
Haas (2019)	[92]	Empirical	Peripheral - implicit
Hall et al. (2018)	[111]	Empirical	Central - explicit
Hansen and Coenen (2015)	[72]	Conceptual	Peripheral - explicit
Johnstone and Newell (2018)	[81]	Conceptual	Peripheral - explicit
Jones and Lubinski (2014)	[112]	Empirical	Central - explicit
Kirkegaard (2017)	[82]	Empirical	Peripheral - explicit
Koch (2015)	[93]	Conceptual	Peripheral - explicit
Koch and Buch-Hansen (2020)	[113]	Conceptual	Peripheral - explicit
Koretskaya and Feola (2020)	[10]	Conceptual	Central - implicit
Kucharski and Unesaki (2018)	[114]	Empirical	Peripheral - explicit
Kuzemko et al. (2016)	[83]	Conceptual	Central - implicit
Kuzemko et al. (2019)	[115]	Conceptual	Peripheral - implicit
Köhler et al. (2019)	[17]	Conceptual	Peripheral - explicit
Lachapelle and Paterson (2013)	[116]	Empirical	Peripheral - explicit

(continued on next page)

Table 3 (continued)

Source	Reference	Type	Centrality of Concept
Lachapelle et al. (2017)	[88]	Empirical	Central - explicit
Leipprand et al. (2017)	[117]	Empirical	Peripheral - implicit
Lockwood et al. (2017)	[90]	Conceptual	Peripheral - explicit
MacKinnon et al. (2019a)	[84]	Conceptual	Central - implicit
MacKinnon et al. (2019b)	[118]	Empirical	Central - explicit
Magnin (2018)	[119]	Conceptual	Central - explicit
Mans (2014)	[85]	Empirical	Peripheral - explicit
Markard et al. (2015)	[53]	Conceptual	Peripheral - explicit
Meckling and Nahm (2018)	[120]	Empirical	Central - explicit
Mikler (2011)	[101]	Conceptual	Central - explicit
Mikler and Harrison (2012)	[50]	Conceptual	Central - explicit
Moallemi et al. (2017)	[121]	Empirical	Peripheral - implicit
Ochieng (2008)	[122]	Empirical	Central - explicit
Rentier et al. (2019)	[123]	Empirical	Central - explicit
Reusswig (2011)	[124]	Conceptual	Peripheral - explicit
Roberts et al. (2018)	[89]	Conceptual	Central - explicit
Scoones (2016)	[125]	Review	Peripheral - explicit
Shadrina (2020)	[126]	Empirical	Peripheral - explicit
Strambach (2017)	[127]	Empirical	Peripheral - explicit
Stroud et al. (2014)	[128]	Empirical	Central - explicit
Stroud et al. (2018)	[129]	Empirical	Central - explicit
Stroud et al. (2020)	[130]	Empirical	Central - explicit
Szulecki and Overland (2020)	[131]	Review	Peripheral - explicit
Tienhaara (2014)	[132]	Empirical	Central - explicit
Wesseling (2016)	[86]	Empirical	Central - explicit
Wieczorek et al. (2015)	[87]	Empirical	Central - explicit
Wood et al. (2020)	[133]	Editorial	Central - explicit

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