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Intermediaries of transition to sustainability: influences and perspectives

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Objective: This investigation aimed to understand the role of intermediaries in the socio-technical transitions toward sustainability, according to the literature from 2010 to 2022.
Methodology: For this, a systematic literature review was carried out from the Methodi Ordinatio, which resulted in an analysis of 42 papers considered most relevant according to the topic addressed.
Originality/Relevance: Transitions to sustainability and intermediaries are configured as an emerging field of research. This study is, therefore, relevant in identifying advances in scientific production, highlighting intrinsic aspects of the subject, as well as gaps for future research.
Results: Based on the characterization of the studies, the results show growth in the publications in recent years, with the largest expansion from 2018. The greatest focus was empirical studies, especially regarding sustainable transitions in the energy sector, followed by the industrial, agricultural, mobility and transportation, and civil construction sectors. Moreover, we found that intermediary actors may contribute to sustainability transitions in several ways. They perform roles in supporting innovation, financing projects, managing networks, mobilizing resources, transferring technology, aligning goals, and supporting the implementation and renewal of policies, for instance.
Social contributions to management: Understanding the process in which intermediaries are configured in the transitions to sustainability is essential to understand the changes of an environmental, social and economic nature in the most diverse sectors in contemporary times.

Keywords: Systemic approach; sociotechnical transitions; sustainable development; transition intermediaries.

Intermediários de transição para a sustentabilidade: influências e perspectivas

Resumo

Objetivo: Esta investigação teve como objetivo compreender o papel dos intermediários nas transições sociotécnicas para a sustentabilidade, segundo a literatura de 2010 a 2022.
Metodologia: Para isso, foi realizada uma revisão sistemática da literatura a partir do Methodi Ordinatio que resultou na análise de 42 artigos considerados mais relevantes de acordo com o tema abordado.
Originalidade/Relevância: As transições para a sustentabilidade e intermediários configuram-se como um campo de pesquisa emergente. Esse estudo é, portanto, relevante ao identificar os avanços na produção científica, evidenciando aspectos intrínsecos ao assunto, além de lacunas para pesquisas futuras.
Resultados: Com base na caracterização dos estudos, os resultados mostram um crescimento nas publicações nos últimos anos, sendo a maior expansão a partir de 2018. O foco foi maior em pesquisas empíricas, com destaque para transições sustentáveis no setor de energia, seguido dos setores industrial, agrícola, de mobilidade e transporte e construção civil. Além disso, verificou-se que os atores intermediários podem contribuir de diferentes maneiras para transições de sustentabilidade. Eles desenvolvem papeis de apoio à inovação, financiamento de projetos, gestão de redes, articulação de expectativas das partes interessadas, difusão do conhecimento, mobilização de recursos, transferência de tecnologia, alinhamento de objetivos e apoio a implementação e renovação de políticas, por exemplo.
Contribuições sociais para a gestão: Entender o processo no qual os intermediários se configuram nas transições para a sustentabilidade é fundamental para compreender as alterações de natureza ambiental, social e econômica nos mais diversos setores na contemporaneidade.

Palavras-chave: Abordagem sistêmica; transições sociotécnicas; desenvolvimento sustentável; intermediários de transição.

Intermediarios de la transición hacia la sostenibilidad: influencias y perspectivas

Resumen

Objetivo: Esta investigación tuvo como objetivo comprender el papel de los intermediarios en las transiciones sociotécnicas hacia la sostenibilidad, según la literatura de 2010 a 2022.
Metodología: Para ello se realizó una revisión sistemática de la literatura utilizando el Methodi Ordinatio, que dio como resultado un análisis de 42 artículos considerados más relevantes según el tema abordado.
Originalidad/Relevancia: Las transiciones hacia la sostenibilidad y los intermediarios se configuran como un campo de investigación emergente. Este estudio es, por lo tanto, relevante para identificar avances en la producción científica, destacando aspectos intrínsecos del tema, así como lagunas para futuras investigaciones.
Resultados: Con base en la caracterización de los estudios, los resultados muestran un crecimiento en las publicaciones en los últimos años, con la mayor expansión a partir de 2018. El foco fue mayor en la investigación empírica, con énfasis en las transiciones sostenibles en el sector energético, seguido por los sectores industriales, agricultura, movilidad y transporte y construcción civil. Además, se encontró que los actores intermediarios pueden contribuir de diferentes maneras a las transiciones de sostenibilidad. Desempeñan funciones en el apoyo a la innovación, la financiación de proyectos, la gestión de redes, la articulación de las expectativas de las partes interesadas, la difusión de conocimientos, la movilización de recursos, la transferencia de tecnología, la alineación de objetivos y el apoyo a la implementación y renovación de políticas, por ejemplo.
Aportes sociales a la gestión: Comprender el proceso en el que se configuran los intermediarios en las transiciones hacia la sostenibilidad es fundamental para comprender los cambios de carácter ambiental, social y económico en los más diversos sectores en la contemporaneidad.

Palabras clave: Enfoque sistémico; transiciones sociotécnicas; desenvolvimiento sustentable; intermediarios de transición.

Introduction

The globalized economy requires constant evolution from companies, which is why innovation is one of the tools that private and/or public companies use to be at the forefront. Now, more than ever, considering the environmental and social impacts of human actions on

the environment, the importance of changes in consumption habits and sustainable practices, as well as the development of capacities such as flexibility and adaptability, must be realized to the complex contexts in which organizations are inserted.

For this, in order to be competitive, it is necessary to promote the transition to a greener future in the most varied sectors and segments, such as the energy sector, sustainable construction, urban mobility, clean industrial production, agri-food systems and biodiversity. From the great challenges for these changes, it is essential that the relationship between sustainability and transitions must be improved, through a systemic and long-term perspective (Schot & Geels, 2008).

Transitions to sustainability correspond to an emerging field of research, which has been gaining ground, and is consistent with a process of disruptive change that modifies the prevailing socio-technical systems in search of solutions that meet the environmental, social and economic pillars of sustainability (Loorbach, 2007; Markard, Raven & Truffer, 2012).

In this context, intermediaries have the potential to play an important role in the socio-technical sustainability transitions (Kirk, Robson-Williams, Fenemor & Heath, 2022; Talmar Walrave, Raven & Romme, 2022). They can, for example, contribute to the functions of the technological innovation system (Kanda, Río, Hjelm & Bienkowska, 2019). From disruptive sustainability innovations, intermediaries became necessary links for transitions. It is possible to consider that these intermediaries, facilitators of the transition, are those that contribute to changes in innovation processes, for example, enabling the relationships between the various actors normally involved (Kivimaa, Boon, Hyysalo & Klerkx, 2019a). In addition, intermediaries also present a series of interaction patterns for the transition in different socioeconomic environments (Mattes, Huber & Koehrsen, 2015).

Several studies point out the importance of intermediaries and identify their roles in different transition contexts (Seyfang, Hielscher, Hargreaves, Martiskainen & Smith, 2014; Mignon & Kanda, 2018; Kivimaa et al., 2019a; Aspeteg & Bergek, 2020; Sovacool, Turnheim, Martiskainen, Brown & Kivimaa, 2020; Masuda, Kawakubo, Okitasari & Morita, 2022). However, we still lack a broader, more integrated understanding of the relationship between intermediaries and transitions in socio-technical systems. Considering this research gap, this study aims to understand the role of intermediaries in socio-technical transitions to sustainability in the period from 2010 to 2022. The study is based on a systematic literature review from the *Methodi Ordinatio* that resulted in the analysis of the most relevant articles considering the topic addressed.

This study makes it possible to establish a broad relationship between intermediaries and sustainability transitions, highlighting the advances in the subject in the literature. The discussions held provide some insights that allow reflections on the role of intermediaries in socio-technical transitions for the development of more sustainable and resilient communities.

To meet the proposed objective, this study is organized as follows: First, the theoretical aspects of sustainability transitions and intermediaries that underlie the work are presented. Next, the methodological procedures used in the selection of papers are described. Subsequently, the results and discussions are presented, according to the analysis of the selected studies. Finally, the concluding remarks that denote the main reflections and inferences obtained through the guiding discussions of the object of study are listed.

Theoretical Framework

The investigations concerning the transitions to sustainability have been significantly deepened in the last 20 years. Understanding the literature in this sense, to locate some of its concepts, is always necessary and opportune. Furthermore, in this context, transition intermediaries play an important role in understanding the process and should also be highlighted. These topics are covered in the following section.

Transitions to Sustainability

Transitions, according to referential literature, are defined as the process of changing from one state to another. For Loorbach (2007) and Loorbarch, Frantzeskaki and Avelino (2017), the term transition is related to a change in the state of the system, through a period of non-gradual disruptive change. This transformation is due to the interaction of several changes at different levels and domains that interact and reinforce each other to modify a complex system (Markard et al., 2012; Köhler et al., 2019).

During the 1990s, the concept of transitions emerged in different spaces of the scientific community as a new concept to address large-scale social change, innovation research, environmental studies and sustainability. In the case of the transition to sustainability, three perspectives prevail: Socio-technical, which basically encompassing technology in a social context and analysis of innovation journeys; socio-institutional whose focus is on institutions, agency, power, network analysis, social innovation and governance; and socio-ecological with an emphasis on ecology, socio-ecological relationships, analysis of system vulnerability and capacity for transformation (Loorbarch et al., 2017).

In the context of the transition to sustainability, theorists correlate the transition to four central analytical concepts: The multilevel socio-technical perspective, the approach to technological innovation systems, the strategic niche management and the transition management. About the multilevel perspective, it is understood as a way of exploring transitions, which broadly distinguishes three heuristic levels: Niche, sociotechnical regimes and sociotechnical scenarios/landscapes. It is in niches that radical innovations emerge and put pressure on existing regimes. Regimes create stability in the direction of technical development. In turn, the landscape is composed of external factors such as values,

institutions, policies, social and cultural norms that influence the technological direction (Geels, 2002). For Hopkins (2017), the multilevel perspective is characterized by a co-evolutionary, systemic and action-based approach, comprising a comprehensive theoretical framework that unites studies in science, technology and evolutionary economics.

Concerning the approach to technological innovation systems, it is essential to understand the centrality of the concept of innovation, since it focuses on the emergence of new technologies and changes from institutional and organizational perspectives that correlate with technological development. According to Carlsson and Stankiewicz (1991), technological innovation systems occur from the systemic interaction between companies and other actors, under a specific institutional infrastructure, as the essential factor behind the production, diffusion and use of technological innovation. Some scholars in the area also address in their work on transition and correlate it with the concept of technological innovation systems, such as Freeman (1988), Geels, (2006), Schot and Geels (2008) and Kanda, Kuisma, Kivimaa and Hjelm (2020).

Strategic niche management highlights the essential role of government, companies and stakeholders in system change and diffusion of innovations in order to overcome regime blockages. Niches are spaces for incubating disruptive innovations and must be protected through management that helps overcome market failures and system failures (Greenacre, Grosso & Speirs, 2012; Loorbach et al., 2017)

It is noteworthy that transition management demands the assessment of existing industries, such as complex and adaptive social systems, based on management models, as a reflexive and evolutionary governance process (Nill & Kemp, 2009). The guiding principles of transition management can be used as a research and participation strategy in numerous regional and national policy projects in which transition management operationalizes the combination of structuring and problem forecasting. In these, multiple stakeholders develop new coalitions to implement actions on experiences, evaluating and monitoring the process (Rotmans et al., 2001).

It is also worth highlighting the role of stakeholders in sustainability transitions. They are agents that affect or are affected by an organization (Freeman, 1984). Steurer, Langer, Konrad and Martinuzzi (2005) already explored the importance of the company's relationship with the stakeholders for seeking sustainable development in the social, environmental, and economic scopes. Recently, multisector initiatives in the form of network governance that gather representatives from all stakeholders are acknowledged as significant for promoting sustainability transitions in socio-technical systems (Konefal, 2015). For Gonzales-Porras, Heikkinen, Kujala and Tapaninaho (2021), the collaborative engagement of the stakeholders at the individual, business, industrial, or social levels is important for potentializing sustainability transitions. Köhler et al. (2019), for example, stress the importance of local

movements, consumers, and civil society organizations for transforming energy, transportation, and food systems, besides the general systems of production and consumption. They generate support for transition policies and promote spaces that protect innovation, besides influencing values and broader cultural beliefs. Other noteworthy roles are the stimulus and support for implementing innovation, creating organizational capabilities, cocreating knowledge, and establishing collaborative spaces in the search for common solutions (Gonzales-Porras et al., 2021).

There is also a broad section of literature that approaches the stakeholder theory in urban management (Conti et al., 2019; Beck & Storopoli, 2021; Catzín-Tamayo, Frausto-Martínez & Arroyo-Arcos, 2022). We understand that the articulation between different stakeholders in the collaborative governance systems contributes to sustainability transitions and enhances the reach of SDG 11 – sustainable cities in the urban context by making the contribution from different points of view and the identification of local problems possible (Conti et al., 2019; Catzín-Tamayo et al., 2022). Beck and Storopoli (2021) state that sustainable urban management and strategy must meet the expectations of the stakeholders and create value through collaborative governance. The authors, reviewing the literature, identify three main components in the study of the stakeholder theory in the urban context: sustainable urban strategy, which considers the stakeholders' role in the sustainable urban development of habitation, transportation, solid waste, safety, and infrastructure; the power of networks, related to the importance of stakeholder interaction and engagement in social networks for promoting a more sustainable urban society; and urban marketing, which concerns constructing an attractive urban image from the perspective of stakeholders. Every component contributes to value creation, by meeting the expectation of the stakeholders, creating collaborative governance, creating an urban identity based on the stakeholders' perception, and delivering a sustainable urban system. Thus, we observe the central role of stakeholders in sustainability transitions, including sustainable urban transitions.

It is worth stating that the intermediaries, the focus of this investigation, are also seen as stakeholders who perform a central role in the transitions by constructing bridges between other stakeholders at different levels and scales (Gonzales-Porras et al., 2021). They will be discussed more in-depth in the next section.

Concerning transitions to sustainability, the literature points out that recent research works are important for understanding the complex and multidimensional changes considered necessary for the adaptation of society in economically and culturally sustainable ways, modifying the forms of production and consumption in different needs human (Geels, 2006; Loorbach, 2007; Grin, Rotmans & Schot, 2010; Smith, Voß & Grin, 2010; Köhler et al., 2019).

Studies on the transition to sustainability currently constitute a multi, inter and transdisciplinary field of research of high social relevance, considering the countless

sustainability challenges of contemporary business (Markard et al., 2012). This can be seen from the sharp increase in the number of published studies and the emergence of institutional structures that support the formation of a research agenda (Geels, 2006; Loorbach, 2007; Markard & Truffer, 2008; Grin et al., 2010; Smith et al., 2010; Köhler et al., 2019).

Thus, the transition to sustainability is a highly complex field, with a strong focus on transformation processes. Socio-technical transitions to sustainability can be considered as long-term, multidimensional and necessary transformation processes, aimed at shifting to more sustainable modes of consumption and production (Markard et al., 2012).

Identified as systemic, structural and non-linear, changes concern cultural aspects such as shared values, paradigms or discourses (Rotmans et al., 2001; Grin et al., 2010), as well as institutional structures, economic perspectives and physical environments and, of course, social subsystem practices. In this context, these become noticeable in altered routines, behaviors or lifestyles. A particularity of transitions to sustainability is their orientation towards governance, which generally plays an essential role for transformation (Smith, Stirling & Berkhout, 2005).

Thus, sustainability transitions may be considered long-term and multidimensional transformation processes of established socio-technical systems. These large-scale transformations are responses to present social and environmental challenges and aim to establish radical and necessary changes. In this context, stakeholders and intermediary actors play a central role, collaborating in an active and integrated manner in the transition process toward a more sustainable society.

Intermediaries

In the wake of the environmental problems and agendas of the last decades, there is a growing field of studies that seeks to scale these issues and propose solutions that converge with sustainability. Currently, the literature points to the relevance of the mechanisms of organizational studies and information that collaborate to the cooperative dialogue between ecosystems and organizations (Smith et al., 2010; Kivimaa & Martiskainem, 2018; Mignon & Kanda, 2018; Kivimaa et al., 2019a). In this sense, intermediaries are an integral part of the eco-innovative support system (Fichter, 2013) and are also a positive influence on sustainability transition processes by establishing relationships between actors, activities, skills and resources (Kivimaa et al., 2019a; Kirk et al., 2022; Talmar et al., 2022).

Wolf et al., (2021) define intermediaries as organizational or individual actors that exert a positive influence on sustainability transitions, connecting stakeholders, skills and resources. Several actors are identified as intermediaries, such as: Social enterprises, network organizations, innovation agencies, consultancy, users, local authorities, government agencies, universities, among others (Sovacool et al., 2020).

Intermediaries in transition processes can be classified according to their roles, membership or level of activity. Kivimaa et al. (2019a), for example, classified transitional intermediaries based on the level of action, emergence, the object of intermediation and normative position. Thus, they formulated five types of intermediaries:

- Systemic intermediaries: They are responsible for articulating demands and aligning the actors involved in the transition process, and they have a high degree of legitimacy. Therefore, they play a fundamental role as facilitators of transitions due to the complexity of innovation processes.
- Regime-based intermediaries: They are part of the regime's established intimidations and have the mandate to promote new socio-technical processes. They also act in confrontation with agents who do not support a transition.
- Niche intermediaries: They work with companies and individual projects and, between them, establish connections and share experiences, knowledge and new approaches to innovation.
- Process intermediaries: They play a supporting role in the execution of specific projects within the transition process niche, or even in broader transition processes. They help to articulate the degree of intended change and the direction that will drive the process. Process intermediaries can help advance the transition as they work with neutral and impartial actors.
- User intermediaries: They support organizations with the role of connecting them with niche technologies and assisting in users' daily practice. Helping users can be established from the daily application of innovation to setting goals for the transition process.

Thus, different actors will have different intermediary roles, which complement each other and make socio-technical transitions possible (Gasparro, Zerjav, Konstantinou, & Casady, 2022).

In transitions, intermediaries connect, translate and facilitate information flows between different actors (Kirk et al., 2022). In addition, they fill structural deficiencies to allow for transitions, promote networking and investment in new businesses (Talmar et al., 2022). Other roles are related to exchanging knowledge, creating expectations and visions and supporting the implementation and renewal of policies (Masuda et al., 2022). Specifically, Ehnert, Egermann & Betsch (2021), establish the following functions for intermediaries: Visualizing and articulating change needs, aggregating knowledge and facilitating learning processes, creating a shared institutional infrastructure, coordinating activities at the local levels, building networks and partnerships, advocating for policy change and mobilizing support.

For Mignon and Kanda (2018), it is important to highlight the influence of policy on transition processes that can be designed to increase the effectiveness of intermediaries. However, the effectiveness of intermediation for political purposes will depend on the visibility and importance that the government grants to the transition processes, and this will result from the reality of each place.

In this approach, it is observed that intermediaries play an important role in the transition processes, positively influencing actors and useful platforms for the socio-technical transition process towards sustainability. Their roles are related to scaling resources, establishing connections, creating new ways of collaboration between niche technologies and demonstrating possible transformations that can overcome dominant and unsustainable socio-technical configurations.

Methodology

The present study aims to analyze how intermediaries are viewed in the literature on socio-technical transitions to sustainability. The method comprised a systematic literature review following the Methodi Ordinatio methodology, with a qualitative and exploratory approach due to the need to deepen the knowledge on the subject. The Methodi Ordinatio consists of a multi-criteria decision-making methodology for the selection of scientific papers to compose a bibliographic portfolio. The process comprises nine steps, described as follows: The first step consists in establishing the research intent represented by keywords. Steps two and three consist in exploring the bibliographic database to search for papers within the research goals and defining the search syntax. To carry out the search for paper, the electronic databases ScienceDirect, Scopus and Scientific Electronic Library Online (Scielo) were used. The search terms used were: “Transition” OR “transitions” AND “intermediate” OR “intermediaries” AND “sustainability” OR “sustainable development” OR “sustainable”. In steps four and five we downloaded the metadata from databases and applied the filtering procedures. The filters applied to the fields of titles, abstract and keywords, selecting as a criterion “only papers”, with a temporal delimitation for the period from 2010 to 2022. The articles were also restricted by language, selecting only studies in English, Spanish and Portuguese. The search was conducted on August 12, 2022 and resulted in 700 studies, with 430 in Scopus, 255 in SienceDirect and 15 in Scielo. With the help of Zotero reference manager, 153 studies were removed in duplicate, leaving 547 papers for analysis, according to the following inclusion and exclusion criteria:

a) Inclusion criteria: 1) Papers that establish the relationship between transitions to sustainability and intermediaries, highlighting the roles and influence of intermediaries in transition processes.

b) Exclusion criteria: 1) Papers published in events or similar of a different nature, (other than a scientific article); 2) papers that deal with sustainability without referring to transition processes; 3) papers that do not highlight the role of intermediaries in transitions to sustainability; and 4) papers linked to other areas of knowledge such as chemistry, architecture and engineering, whose object is not related to the subject of study.

In steps six and seven, the papers were selected and ordered through an equation that considers the year of publication, the impact factor of the journal and the number of citations of the paper, allowing us to create a portfolio with relevant studies in the area (Pagani, Kovaleski & Resende, 2015; 2017).

After reading and classification, 59 studies were selected for analysis of scientific relevance through the InOrdinatio.

$$InOrdinatio = \left(\frac{If}{1000}\right) + a^{*} \left[10-(YearRes-YearPub)\right] + \left(\sum Ci\right)$$

Where:

If = Journal impact factor, in this study obtained by the Journal Citation Reports (JCR) of the last year (2021).

a* = Coefficient attributed by the researcher to the relevance of the year of publication, which may vary from 1 to 10, factor 10 being considered in this study, allocating great importance to the period of publication.

YearRes = Year in which the research in the databases was carried out.

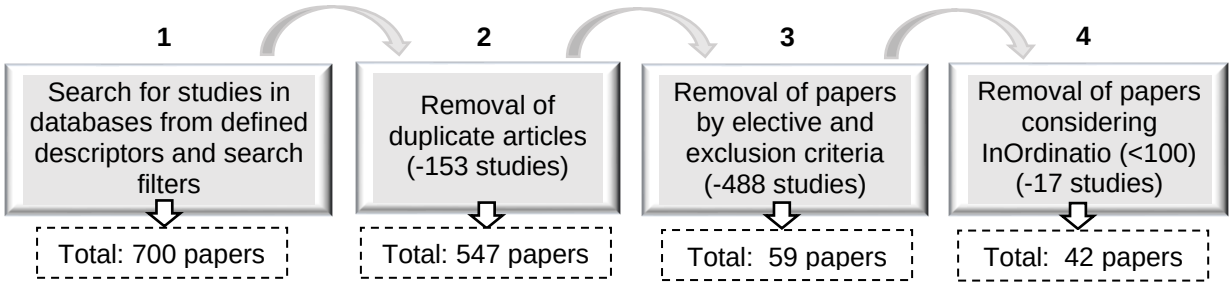
YearPub = Year of publication of the paper.

∑ Ci = Quantity of citations of the article, obtained from the Google Scholar platform.

All these data, with the help of JabRef reference manager, were compiled into a Microsoft Excel spreadsheet in which the equation could be calculated. Considering the results obtained, the first 42 studies were included for analysis, with the works that presented a positive score greater than 100 points on the relevance scale. In this sense, Figure 1 presents, in summary, the filtering procedures adopted for the selection of papers.

Figure 1

Filtering procedures



Source: Own elaboration.

The selected studies were then read in full and had their information extracted, according to pre-established categories, such as authors, year, title, journal, objective, study focus, intermediary typology, transition focus, sector covered, country of study, methodology and main conclusions. Discussions and results are presented in the following section.

Results and Discussions

Based on the information extracted from the analysed papers, this section presents two main subdivisions: One whose objective is to characterize the studies, and another that intends to emphasize the similarities and distinctions of the studies in terms of addressing socio-technical transitions to sustainability and the role of intermediaries.

Characterization of Selected Studies

To elucidate the results of the search performed, Table 1 presents the selected studies, ordered according to relevance criteria determined by *InOrdinatio*.

Table 1

Papers selected according to InOrdinatio

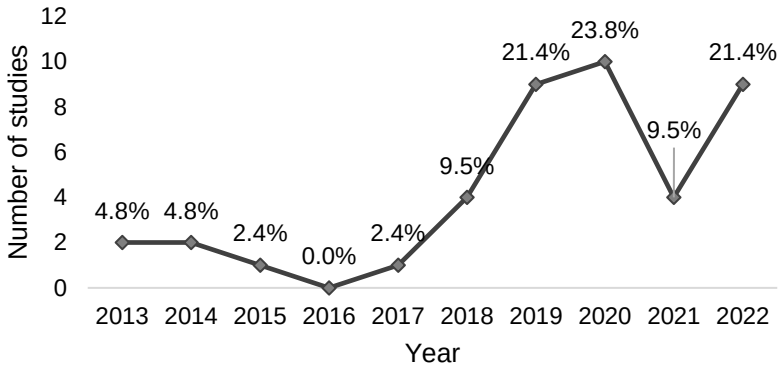
Nº	INORDINATIO	PAPER	Nº	INORDINATIO	PAPER
1	612.160	Hargreaves, Hielscher, Seyfang & Smith (2013)	22	116.799	Talmar et al. (2022)
2	522.377	Seyfang et al. (2014)	23	116.514	Bjerkan, Hansen & Steen (2021a)
3	447.473	Kivimaa *et al*. (2019a)	24	114.884	Rohe & Chlebna (2022)
4	339.473	Kivimaa (2014)	25	114.514	Kivimaa & Martiskainen (2018)
5	205.377	Kivimaa *et al*. (2019b)	26	114.377	Forrest & Wiek (2019)
6	204.576	Mattes *et al*. (2015)	27	113.696	Masuda et al. (2022)
7	200.072	Gliedt, Hoicka & Jackson (2018)	28	111.377	Bergek (2020)
8	155.072	Hamann & April (2013)	29	104.544	Van Lente, Boon & Klerkx (2020)
9	142.514	Sovacool et al. (2020)	30	108.576	Decuypere, Robaeyst, Hudders, Baccarne & Sompel (2022)
10	142.377	Mignon & Kanda (2018)	31	107.946	Gasparro et al. (2022)
11	141.377	Kanda *et al*. (2020)	32	107.072	Aspeteg & Bergek (2020)
12	132.072	Kanda *et al*. (2019)	33	106.377	Vihemäki, Toppinen & Toivonen (2020)
13	124.072	Patala, Salmi & Bocken (2020)	34	106.080	Gaitán-Cremaschi *et al*. (2022)
14	123.473	Rainville (2021)	35	104.908	Groot-Kormelinck, Bijman, Trienekens & Klerkx (2022)
15	121.514	Ambole *et al*. (2019)	36	104.444	Chen, Mirza, Huang & Umar (2022)
16	121.072	Kundurpi, Westman, Luederitz, Burch & Mercado (2021)	37	104.000	Barrie Zawdie & João (2017)
17	120.157	Turner *et al*. (2020)	38	103.388	Bjerkan, Ryghaug & Skjoksvold (2021b)
18	118.514	Brown, Kivimaa & Sorrell (2019)	39	101.777	Gustafsson & Mignon (2019)
19	118.377	Naidoo (2020)	40	101.000	Kirk et al. (2022)
20	117.299	Crifo, Durand & Gond (2019)	41	100.377	Kivimaa, Primmer & Lukkarinen (2020)
21	117.072	Barrie Zawdie & João (2019)	42	100.377	Boyer (2018)

Source: Own elaboration.

Considering the 42 papers covered in this analysis, some information should be highlighted. As for the year of publication of the studies, there is a growing trend, as can be seen in Figure 2.

Figure 2

Year of publication of the studies



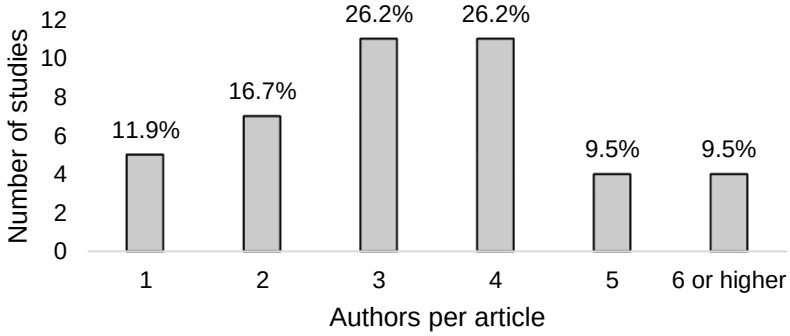
Source: Own elaboration.

The curve denotes, over time, how the discussions were highlighted. There is growing interest in the subject from 2018, which intensifies during the other years, 2019, 2020 and 2022, where 9, 10 and 9 studies were identified, respectively. Given the fact that the survey was carried out at the beginning of the second semester of 2022, it assumes that the trend for the current year will expand and more papers will make up the portfolio. This reveals a particularly new field of research, driven by rising concerns related to sustainability transitions and intermediaries.

Regarding the authorship of the papers (Figure 3), it is noted that partnerships usually occur in the performance of the studies, which is evidenced in 88.1% of cases, usually with 3 or 4 authors working together (26.2%).

Figure 3

Number of authors per paper



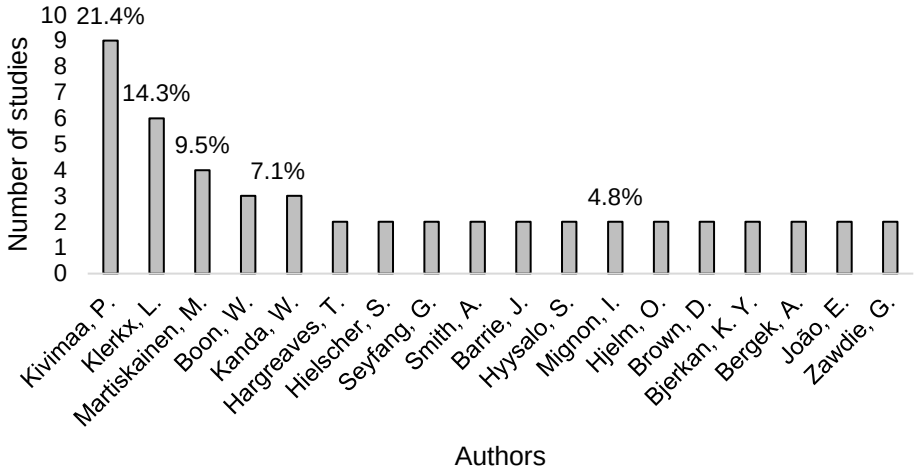
Source: Own elaboration

On this issue, it is also possible to identify a small concentration of authorship in publications: Among the 42 papers evaluated, the author Kivimaa contributed to 9 studies (21.4%). In addition, Klerkx was part of 6 studies (14.3%), Martiskainen participated in 4 studies (9.5%), Boon and Kanda contributed in 3 papers (7.1%), while Hargreaves, Hielscher,

Seyfang, Smith, Barrie, Hyysalo, Mignon, Hjelm, Brown, Bjerkam, Bergek, João and Zawdie had 2 participations (4.8%) (see Figure 4). The other identified authors (total of 100) participated in a single production.

Figure 4

Most frequent authors in publications

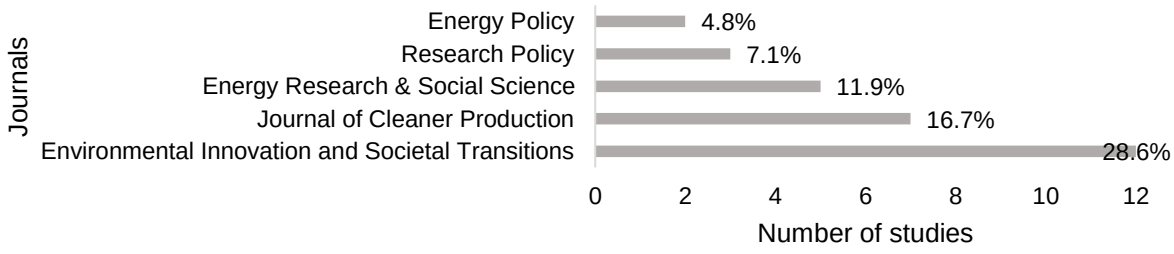


Source: Own elaboration.

A considerable concentration is also identified related to the journals in which the studies are published. In Figure 5, there is a predominance of Environmental Innovation and Societal Transitions, with 12 publications (28.6%), that is a journal with its scope totally focused on discussions of socio-technical transitions, followed by the Journal of Cleaner Production, with 7 articles (16.7%), whose emphasis lies on the theme of cleaner production, the environment and sustainability with notorious relevance in the area. Next, are Energy Research & Social Science, Research Policy and Energy Policy, with 5 (11.9%), 3 (7.2%) and 2 (4.8%) publications, respectively. Other 13 journals have only one publication.

Figure 5

Quantity of papers per journal

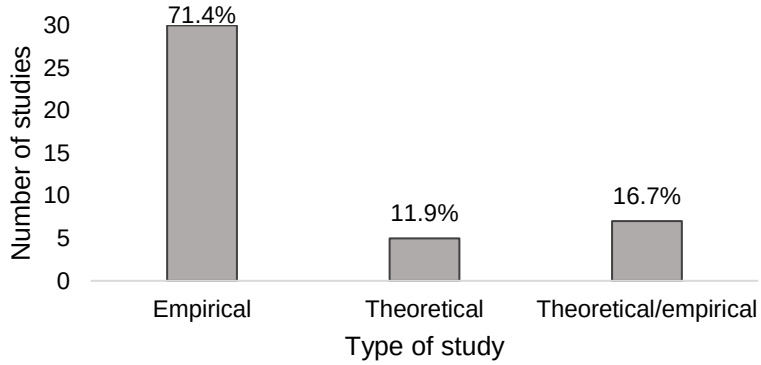


Source: Own elaboration.

Considering the methodology adopted, Figure 6 shows that the majority of papers (71.4%) developed empirical research with case studies based on interviews, observations, focus groups and document analysis. Only 5 studies (11.9%) focused on theoretical research (bibliographic analysis or systematic review) aiming to elucidate concepts and establish relationships, considering that 7 of them (16.7%) merged approaches based on the creation and validation of theoretical models related to the theme. These results corroborate the statement by Kivimaa et al. (2019a), which indicates that the literature referring to intermediaries in transition largely emerges from empirical observations rather than theoretical studies.

Figure 6

Methodology of the covered studies

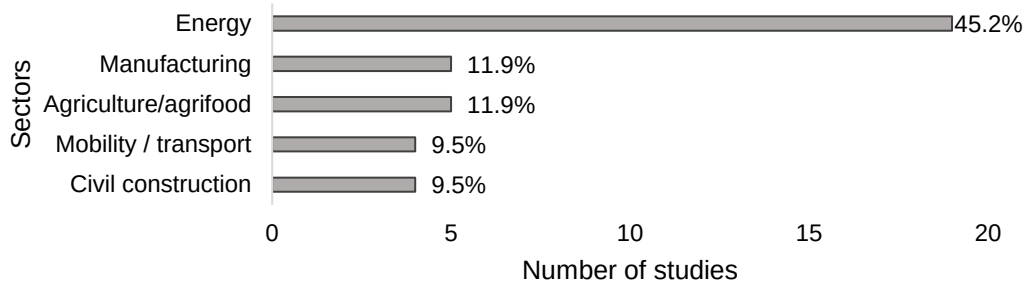


Source: Own elaboration.

Of the studies that specified the cases of investigation, the energy industry stands out, appearing in 19 studies analyzed (45.2%), with a view to transforming them towards the use of more sustainable energy sources. This is justified given the environmental implications of widely used non-renewable energy sources such as oil, coal and natural gas and their finiteness considering exploration sources (Gozgor, Mahalik, Demir & Padhan, 2020). Other industries that stand out in the investigations are industrial manufacturing (11.9%), specifically aimed at the textile and environmental products segment; the agricultural sector associated with agrifood systems (11.9%), the mobility and transport industry (9.5%) and civil construction (9.5%) (See Figure 7). It is noteworthy that some studies focus on more than one economic sector, while others do not determine an analysis focus.

Figure 7

Most frequent industries / segments covered in the studies

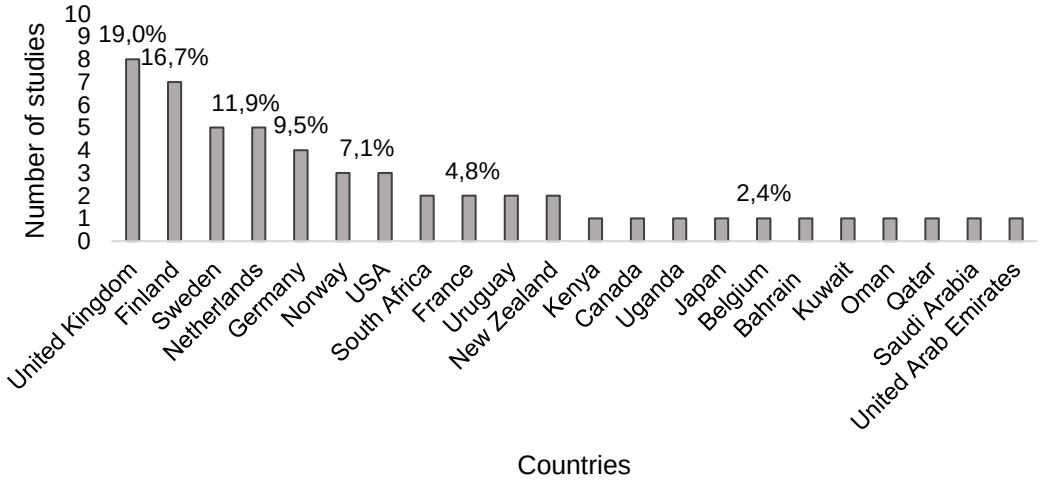


Source: Own elaboration.

Considering the geographic distribution, Figure 8 denotes the quantity of studies carried out by country. It is observed that the United Kingdom stands out, with the largest number of studies (8 in total). Following are Finland (7), Sweden (5), Netherlands (5) and Germany (4). In general, the prevalence of studies in developed countries is observed, which can be explained by a greater concern with issues of sustainability and transitions (Wieczorek, 2018). Papers written in undeveloped countries deal precisely with the notions of the role of intermediaries in transitions in contexts with few possibilities. It is also worth noting that some studies cover case studies in more than one country. In addition, three of them did not specify the location because they are theoretical or systematic review studies and one article defined the European Union as a research focus.

Figure 8

Number of studies carried out per country



Source: Own elaboration.

Therefore, these considerations allow understanding, in a general way, the characterization of research works on sustainability transitions and intermediaries. The

panorama is complemented by the description and analysis of the content of the selected studies.

Sociotechnical Transitions to Sustainability and Intermediaries

Sustainability transitions are configured as current and important demand in light of environmental and social problems arising from anthropic action on the environment, requiring changes in existing socio-technical systems. On this issue, there is recognition in the literature that intermediary actors of different types can play the role of catalysts accelerating change towards sustainable transitions (Mattes et al., 2015; Mignon & Kanda, 2018; Kivimaa et al., 2019a; Talmar et al., 2022).

The papers evaluated denote this relationship in different ways. One of the focuses of research resides in the sectoral approach and local communities with great emphasis on the energy sector. Hargreaves et al. (2013), for example, point out, from a study in the United Kingdom, that intermediaries such as government departments and non-governmental organizations (NGO) and the private sector are important to help with small-scale radical innovations, through supporting the local community, financing projects, planning permission for renewable energy facilities, and managing partnerships with actors outside the community. Mattes et al. (2015) also indicate that intermediaries are important for local energy reorganization processes aimed at sustainability transitions. Ambole et al. (2019), in turn, focuses on the role of academics as knowledge intermediaries that can trigger cross-sector collaborations around innovations for sustainable energy transitions in informal settlements in African cities.

In addition, Brown et al. (2019) address, in their results, that intermediaries play the role of facilitation, configuration and intermediation in transitions to more sustainable energies, through innovation in the business model; and Bjerkan et al. (2021a; 2021b) highlight that port actors as intermediaries are important in the energy transition process with the potential to accelerate transitions in other domains. Finally, Sovacool et al. (2020) point out that incumbent intermediaries, who consider government, market and stakeholder interests, can facilitate systemic change in energy and transport transitions.

With a more generic approach to sustainability transitions, other studies have a local focus, considering cities and communities. Masuda et al. (2022), understand that local governments play an important role as an intermediary to facilitate sustainability transitions with the implementation of the Sustainable Development Goals (SDGs). By analyzing 18 Japanese local governments, the authors observe the roles of articulating expectations and vision, building networks and managing resources, facilitating knowledge and learning processes and supporting the implementation and renewal of policies. Similarly Gustafsson and Mignon (2019), based on case studies in three Swedish cities, see municipalities as

intermediaries for sustainability transitions while mediating, through the delegation of tasks to municipal companies, coalitions with other municipalities, participation in networks and influencing national policy through feedback. Forrest and Wiek (2015), studying four small communities in the United Kingdom, point to intermediaries as an important means of offering the subsidy and resources needed for interventions. Hamann and April (2013), with a focus on case studies in South Africa, similarly highlight that collaborative intermediary organizations are fundamental in urban transitions, especially in low development realities with problems associated with poverty and socioeconomic conditions of extreme inequalities. In turn, Seyfang et al. (2014) suggest that intermediaries can be a determining force for change in local projects and disseminate best practices, influencing the diffusion of innovation, however, they are still configured as an emerging niche that needs to be fully developed from increased political and financial support.

In addition to helping with local projects, intermediaries are considered fundamental for Small and Medium Enterprises (SME) to carry out diversified sustainability actions, contributing with knowledge and resources. This is evidenced in the research by Kundurpi et al. (2021), who precisely analyzed the role of intermediaries in supporting SME.

Specifically considering the innovation factor in transitions to sustainability, Gliedt et al. (2018), sought to understand the relationship of innovation intermediaries. The results show that the connections between innovation intermediaries such as incubators and acceleration centers have the potential to contribute to a green economic development strategy, considering institutional changes. Similarly, Aspeteg and Bergek (2020) focus on diffusion-oriented innovation intermediaries, concluding that they create value primarily through technology transfer and coordination of various actors throughout project planning and implementation. Turner et al., (2020), in turn, understand that innovation platforms (IP) can support transitions to sustainable agriculture from the staging, recognition and explanation of conflicts to shape new perceptions between actors, inducing significant changes. Similarly, Gasparro et al (2022) highlight the role of vanguard projects as intermediation spaces that facilitate sustainability transitions, where central and external project actors negotiate and pursue objectives. The vanguard projects are oriented to the development of new technologies, on a large scale and bring together several actors with a broad cooperative arrangement integrating niche and regime.

Theoretical models are also evidenced in this aspect. Kanda et al. (2019), for example, propose an approach to analyze the roles of intermediaries in eco-innovation in knowledge development and diffusion systems, research guidance, entrepreneurial experimentation, market formation, development of positive externalities, legitimation and resource mobilization. In addition, it aims to support the analysis of the contribution of intermediaries to innovation systems by proposing an assessment scale of contribution in each function. Bergek (2020),

similarly, trying to understand innovation diffusion intermediaries for sustainability transitions describes 4 types of diffusion intermediaries: Dedicated intermediaries (specialized and concentrated in activities in one industry), dispersed (also are specialized, but centered on more than one industry), integrated (non-specialized, centered on only one industry, but involved in various activities and stages of the supply chain) and diversified (non-specialized and comprehensive – active in several industries and playing a set of activities), obtaining the conclusion that intermediaries are not a homogeneous collective.

This diversity can also be proven by the study by Mignon and Kanda (2018) that sought to identify the similarities and differences between intermediaries. The results demonstrate that intermediaries differ in the source of funding, which affects their longevity as an organization, as well as the scope of intermediation, while some target individual actors and others aim to provide support to a broader group of them. Still, there are intermediaries that direct activities towards actors on the supply side of innovation or demand (adopters). Therefore, the authors highlight, based on the results, the need for policymakers to carefully select the type of intermediary.

Other studies also aim to present theoretical models and concepts related to the subject. Kivimaa et al. (2020) created an analytical framework of policy intermediation processes considering the transition literature and the policy cycle. It is observed, for example, that in the policy formulation phase, intermediaries can articulate stakeholder views, expectations and needs. In implementation, intermediation can assist in learning and knowledge sharing accelerating transitions. Kanda et al. (2020) aimed to expand the literature on sustainability transitions and intermediation by proposing a framework that differentiates systemic and non-systemic intermediation, also highlighting the levels of systemic intermediation and the role of intermediaries. The results indicate that non-systemic intermediation occurs between individual entities with one-to-one interaction, for example, consultants who help clients achieve innovation goals. On the other hand, systemic intermediation, according to the model, can occur at three levels: I – intermediate entities in a network (one to many), II – intermediate entity networks (many to many), and III – intermediate actors, networks and institutions (transcendence from horizontal interactions between different networks to vertical interactions between actors and their relevant networks and institutions). It was highlighted that intermediation activities at higher levels are characterized by a greater number of beneficiaries and that the roles of intermediaries are not homogeneous at the various levels of the system. Specifically adopting the conceptualization of systemic intermediaries Van Lente et al. (2020) use positioning theory to understand how three Dutch systemic intermediaries from the agriculture, energy and health sectors obtain legitimate roles in innovation systems and transition processes. As conclusions, the authors highlight that intermediaries face different stages of acceptance and must be explicit about their position and

credibility to operate.

Kivimaa et al. (2019a) also start from theoretical research and conceptualize transition intermediary as:

> Actors and platforms that positively influence sustainability transition processes, linking actors and activities, and their related skills and resources, or connecting transition visions and demands of actor networks with existing regimes to create momentum for system change sociotechnical, to create new collaborations within and across niche technologies, ideas, and markets, and to disrupt dominant unsustainable sociotechnical configurations (Kivimaa et al., 2019a, p. 1072).

In addition, the authors typify five transitional intermediaries, namely: Systemic intermediary, regime-based transitional intermediary, niche intermediary; process intermediary; and user intermediary. Systemic intermediaries who seek system-wide change and niche intermediaries who work to develop niche activities and later influence the socio-technical system are seen as crucial to transitions, but should be complemented by other intermediary types (Kivimaa et al., 2019a). Kivimaa (2014) had also identified that systemic intermediaries are fundamental for new visions and expectations and destabilization of the existing regime, however, the organization's financial independence and the duration of intermediation are also fundamental points for the good result.

Some papers focus on specific sustainability transitions. For example, Barrie et al. (2017; 2020) and Rainville (2021) denote the role of intermediation in promoting transitions to a circular economy. In this sense, Barrie et al. (2017; 2020) conclude that intermediaries of a system based on triple helix and strategic niche management can produce a stimulating effect for these transitions. Rainville (2021) points out that intermediaries play an important role in coordinating government and industry, by aligning project goals, facilitating cooperation between industry participants, and collaborating with the buyer to drive the acquisition of recycled material. Still, in a similar way, Patala et al. (2020) emphasize that to achieve new industrial symbiosis projects that demand alternatives for the reuse of products and waste between industries, external facilitation that can be promoted by collaborative intermediation is necessary.

Two studies aimed to assess intermediaries in the context of transitions to more sustainable food production systems. Gaitán-Cremaschi et al. (2022) sought to assess the role of actor networks in public purchases of food from family farming. According to the authors, these networks, as intermediaries, can promote the necessary changes for the transition to sustainable food systems by creating new alliances, supporting knowledge, innovation and co-creation to overcome barriers, as well as intermediating information between purchasing organizations and family farmer organizations adjusting purchase requirements. In turn, Groot-Kormelinck et al., (2022), investigated ten cases of producer organizations in conventional and organic plant systems in Uruguay in order to understand their potential as intermediaries to

facilitate transitions to sustainable production. These organizations collaborate by providing organic inputs, organizing access to production markets, sharing knowledge and facilitating sustainable production practices. In addition, they participate in lobbying for sustainability policies and engage in community development activities.

With an emphasis on transitions to more sustainable environmental systems, the study by Kirk et al. (2022) sought to understand how intermediaries help communities achieve improvements in freshwater quality. From three case studies carried out in New Zealand, it is concluded that intermediaries can help improve freshwater quality if they have the time and resources to establish long-term relationships with communities and are able to combine their work with related policies.

Another specific industrial focus highlighted is related to transitions to more sustainable buildings and constructions and intermediation. Kivimaa and Martiskainen (2018) analyze the dynamics of transition intermediaries that operate in promoting sustainable socio-technical changes in buildings and point to different types of influence, namely: Piloting and experimentation, influence on the development of standard setting and new legislation, aggregation knowledge in support of policy development, implementation and translation of policy into practice, and creation and management of networks. Vihemäki et al. (2020) also indicate that intermediaries can contribute by influencing policy processes to accelerate the spread of timber construction, however, the low degree of coordination between intermediaries and differences in their transition agendas may limit the effectiveness of their actions. Similarly, Decuypere et al. (2022), deal with intermediaries represented by construction companies, architects and electrical installers. The focus of the study is on the installation of heat pumps as a way to improve energy efficiency. It is assumed that these intermediaries have an important advisory role in the investments made by the owners in energy efficient solutions. Still, Boyer (2018) emphasizes the importance of intermediation for the evolution of niches for regimes, using the Cohousing initiatives in the United States as an example.

Concerning intermediaries, some studies also sought to focus the analysis on the influence of specific intermediaries, such as the financial system. Indeed, Naidoo (2020) highlights financial systems as intermediaries for sustainability transitions. These should, in the author's perception, contribute to the financing of a new sustainable economic state. In the study by Chen et al. (2022), banking institutions can be considered transition intermediaries when engaging in sustainable business financing. Crifo et al. (2019) similarly note that investor and shareholder pressures play a key influence on how companies manage sustainability transitions.

Finally, it is worth highlighting the studies that seek to report the dynamics of the roles of intermediaries in the different phases of transition. The study by Kivimaa et al., (2019b), for example, sought to investigate the role of intermediation in different phases of transition: Pre-

development and exploration; acceleration and incorporation; and stabilization. The results demonstrate that intermediation is fundamental from pre-development to the stabilization of a transition. Talmar et al. (2022), understand the factors associated with the change in the roles of transition intermediaries. From an empirical investigation of a European intermediary in the sustainable energy sector, it was observed that changes in transition support activities occur from meeting the needs of stakeholders, designing new services to meet these demands. In turn, Rohe and Chlebna (2022) focus on network organizations as intermediaries to induce socio-technical changes and seek to understand how their role evolves as transitions progress. The results demonstrate that the initial focus is on obtaining funding, creating positive expectations and pooling resources. As networks advance, relationships expand, including to other sectors and technology systems. This expansion results in heterogeneous members and in tensions that lead to structural changes. Thus, networks do not stabilize once the initial technologies become mature and established.

Overall, the papers address various biases in sustainability transitions. Some address sociotechnical sustainability transitions at the system level, without specifying a particular segment. Others address transitions more specifically at the local or industrial level, including: Energy transitions, transitions to low carbon systems, environmental sustainability transitions, urban sustainability transitions, circular economy transitions, transitions to eco-innovation, transitions to low-energy buildings and sustainable construction, transitions to more sustainable agriculture, business transitions to more sustainable business, and community transitions to more sustainable livelihoods (See Table 2).

Table 2

Summary of the focus of sustainability transitions in the investigated studies

FOCUS OF TRANSITIONS	BIBLIOGRAPHY
Socio-technical transitions of sustainability at the system level	Kivimaa (2014); Gliedt et al. (2018); Mignon & Kanda (2018); Kivimaa et al. (2019a; 2019b); Kivimaa et al. (2020); Van Lente et al., (2020); Bergek (2020); Kanda et al. (2020); Naidoo (2020), Rohe & Chlebna (2022); Gasparro et al., (2022).
Sociotechnical transitions at the industrial/local level	Ambole et al. (2019); Hamann & April (2013); Hargreaves et al. (2013); Seyfang et al. (2014), Forrest e Week (2015); Mattes et al. (2015); Brown et al. (2019); Aspeteg & Bergek (2020); Bjerkan et al. (2021a; 2021b); Masuda et al., (2022).
Energetic transitions	Ambole et al., (2019); Mattes et al., (2015); Brown et al. (2019); Sovacool et al. (2020); Talmar et al. (2022); Decuypere et al. (2022).
Transitions to low carbon systems	Sovacool et al. (2020).
Environmental sustainability transitions	Gliedt et al. (2018); Kirk et al., (2022).
Urban sustainability transitions	Hamann & April (2013).
Transitions to Circular Economy	Barrie et al. (2017; 2019); Patala et al. (2020); Rainville (2021).
Transitions to eco-innovation	Kanda et al. (2019).
Transitions to energy-efficient buildings and sustainable construction	Kivimaa & Mastiskainen (2018); Vihemäki et al. (2021)
Transitions to sustainable food systems	Gaitán-Cremaschi et al. (2022); Groot-Kormelinck et al. (2022).
Transitions to more sustainable businesses	Crifo et al. (2019); Kundurpi et al. (2021); Chen et al., (2022).
Transitions in communities to more sustainable ways of life	Forrest & Wiek (2015); Boyer (2018); Turner et al. (2020).

Source: Own elaboration.

Considering the role of intermediation, several intermediaries with different roles are mentioned. Table 3, below, summarizes the research findings. However, it is noted that many studies, rather than focusing on a specific intermediary actor, investigated the actors supporting sustainability transitions in a systemic way, encompassing various intermediaries within such systems.

Table 3

Synthesis of the types of intermediaries and their roles in sustainability transitions

INTERMEDIARIES	ROLES IN SUSTAINABILITY TRANSITIONS
Energy and freshwater intermediaries, government agencies, departments and organizations, local and national level NGOs, private sector organizations, chambers of commerce, business networks, rural producer organizations, stakeholder networks, incubators, acceleration centers, generators and funders of ideas (innovation intermediaries), discussion forums, agencies that support manufacturing companies, companies developing sustainable projects, port actors, financial institutions, energy efficiency service providers, innovation funds, regional development organizations, consultants, universities, research centers, academics and researchers, central and external actors in cutting-edge projects, institutional investors, municipalities and innovation platforms.	Support for innovation, project financing, management of partnerships, promotion of cross-sector collaborations, articulation of expectations, vision and needs of interested parties, creation and management of networks, facilitation of the learning process, dissemination of knowledge, support for the implementation and renewal of policies, resource management and mobilization, dissemination of best practices, technology transfer, assistance in the experimentation and legitimation process, alignment of objectives, support for co-creation, lobbying for sustainability policies, translation of policies into practice and capacity building efforts.

Source: Own elaboration.

When bringing the focus to the stakeholder theory in cities (Beck & Storopoli, 2021), we observe that, concerning sustainable urban strategy, intermediaries play a significant role in urban development geared toward sustainability. They influence the transitions in sustainable energy systems, low carbon systems, the sustainable buildings sector, waste management and circular economy, more sustainable food production systems, improved water quality and environmental systems, and more sustainable production means and lifestyles. The power of networks also appears in the relationships between governments, non-governmental organizations, and the private sector, which play joint roles in socio-technical change (Gustafsson & Mignon, 2019), and in the importance of systemic intermediation (Kanda et al., 2020). Networks, as intermediaries, may promote the transition to sustainability by creating alliances, supporting innovation, and cocreating (Gaitán-Cremaschi et al., 2022), besides lobbying for policies and sharing knowledge (Groot-Kormelinck et al., 2022). These roles of intermediaries in sustainable urban strategy and in the power of networks make value creation possible, seen as economic, environmental, and social benefits resulting from the socio-technical transitions geared toward sustainability in several segments of the urban context. Intermediary actors also aim to satisfy and integrate other stakeholders (Gonzales-Porras et al., 2021; Sovacool et al., 2022); when they have their expectations met and perceptions considered, value is created from collaborative governance and the delivery of a sustainable urban system (Beck & Storopoli, 2021), capable of even fomenting the fulfilling of SDG 11 (Catzín-Tamayo et al., 2022).

Thus, the great influence of intermediaries in this sustainability transition process in its various segments is evidenced, determined by a diversified and growing field of research.

Furthermore, given the emergence of the study theme, several possibilities for advances are perceived, such as the analysis directed at a specific intermediary and its influence, such as business incubators, NGO and agents from the public and private sector. Likewise, the emphasis on socio-technical sustainability transitions can be broadened by investigating the contribution of intermediaries to transitions across industries, as well as transitions to smart cities (Lanza, Gil-Garcia & Pardo, 2020). Therefore, the present study contributed to the evidence of advances in scientific production on the subject, allowing yet insights for the development of future work according to observed gaps.

Concluding Remarks

The present study pointed out that research on intermediaries in transitions to sustainability is increasing and more necessary. Considering the context of socio-technical transitions to sustainability, understanding this process, in which intermediaries are configured, becomes essential to understand the complex process of change in which the current moment is observed. These are changes in the most diverse sectors, of an environmental, social, as well as economic nature, that need to be broadly described and investigated in their countless consequences.

Based on this investigation, an attempt was made to outline the production on the issue of intermediaries and how it is configured, as it has been developed in the last decade. Far from exhausting the theme, we sought to build a path on how intermediaries are being understood and perceived within the socio-technical transitions to sustainability, what are the main understandings that can be observed and why these studies should be expanded.

The results demonstrate a more accentuated growth of publications from 2018 onwards, with a small concentration of authorship and a predominance of the journal Environmental Innovation and Societal Transitions, as the choice for publication of works related to the theme. Still, a large part of the papers focuses on empirical research, with greater emphasis on sustainable transitions in the energy sector and the prevalence of studies in developed countries.

The discussion demonstrates that intermediary actors can contribute in different ways to sustainable transitions. Various approaches are addressed as the role of different types of intermediaries for sustainable energy transitions, transitions at local/community levels, including realities with low development index, the relationship between transitions, intermediaries and innovation, transitions to a circular economy and sustainable constructions, in addition to presenting theoretical models and concepts aiming to expand the literature on the subject.

Sustainability transitions have significant implications at different levels and domains. Specifically, in the scope of cities and urban management, we point to the need for accelerating

the transitions in urban mobility, energy, waste management, health, water, agriculture, and communication. Intermediaries of sustainability transition may help reach SDG-11, which aims to make cities and human settlements inclusive, safe, resilient, and sustainable. The challenge for intermediaries is influencing transitions in sustainable energy systems, low carbon systems, the sustainable buildings sector, waste management and circular economy, and sustainable food systems, for example, through their several roles identified in this study.

Understanding the roles of intermediaries in these transitions is essential, in order to favor the implementation of actions that contribute to socio-technical changes towards sustainable development. Especially, urban managers and policymakers can encourage the action of intermediary actors from targeted public policies.

As for limiting factors of the study, the lack of coverage of other databases to search for articles can be pointed out, as well as the evaluation of the first 42 most relevant works provided by the applied method, which may have restricted a more comprehensive analysis. It is possible to observe several alternatives to expand the dialogue about intermediaries, still failing to exhaust the theme. We suggest a research agenda based on the findings of this study.

First, we see a research gap in studies on transition intermediaries in developing countries, as well as in social innovation transitions that must be considered in their specifics. Second, studies may further investigate the role of intermediaries in each stage of socio-technical transitions and understand how intermediaries appear in the composition and construction of Technological Innovation Systems by stimulating innovation or business incubators. Third, intermediaries may also be studied within the movement to support entrepreneurs who act in specific niches and require well-directed assistance, in addition to public policies. Fourth, specific sectors, like the renewable energy sector, lack studies. They are structuring themselves and require different actions to survive in a system that contains a solid framework of incumbent organizations. Fifth, investigating the role of intermediaries in developing actions and practices geared toward sustainability in small and medium enterprises (SMEs) is relevant. Sixth, studies may approach innovation intermediaries acting to accelerate the development of green economies, foment and transfer technologies geared toward new projects, and develop and implement actions geared toward sustainable agriculture. Finally, methodologically, as the research field structures itself, we recommend advances in quantitative investigations, which may, jointly with qualitative methods, help us comprehend the investigated phenomena better.

It is evident that there will be resistance to the new solutions, which are necessary within the context of strong climate changes that are going through and that cause catastrophes in several countries regardless of national borders. That is, there is much to be effectively understood in the role and contributions that intermediaries provide in socio-

technical transitions and that need to be researched to effectively learn how and what can be improved in this developing process.

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