Review

Strategic Niche Management for Sustainability: A Systematic Literature Review

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Abstract: With the aim of achieving a sustainable future, a new research area dealing with “sustainability transitions” has emerged. The focus on socio-technical niches and the related management activities are paramount to understand their aptitude to replace the dominant socio-technical regime. Strategic niche management (SNM) has become a renowned analytical framework for understanding the introduction and diffusion of very new sustainable innovations through societal experiments. With an emphasis on SNM, a systematic literature review (SLR) mainly looking at the environmental dimension of sustainability was carried out adopting the PRISMA statement. The increase in publications over the years, the enlargement of the geographical borders interested, the presence of points of reference in the literature, as well as the adaptability of the theoretical framework to both a generic and specific issue related to sustainability, demonstrate the centrality of SNM for studying the transition towards sustainability in socio-technical systems.

Keywords: strategic niche management; systematic literature review; sustainability transition; PRISMA statement; Google Scholar

1. Introduction

Over the past 25 years, the way to reach the transition towards sustainability of the daily activities has increasingly interested innovation studies [1,2]. Sustainability transition (STR) refers to the transformation in response to the persistent problems challenging the current modes of production and consumption [3]. According to the multi-level perspective (MLP) there are three analytical levels for appreciating socio-technical systems [4]: (i) the landscape, that represents the macro-level of the analysis, the external context that allows and binds the opportunities for regime change, the whole of structures, cultures and practices with partial-external and partial-independent functioning; (ii) the regime, that constitutes the meso-level of the system, the set of rules and institutions that permits and limits the behavior of actors; and (iii) the niche, that represents the micro-level of the system, the protected space that allows to develop and apply an innovation, the new set of rules and institutions, the whole of alternative structures, cultures, and practices aimed at the accomplishment of social needs.

The particular relevance of transformations at niche level spurred the introduction of the concept of SNM [5]. It represents the creation, development, and controlled phase-out of protected niches for the improvement and use of innovations through experimentation, aiming at the understanding of their desirability and increasing the rate of their application [5]. The theoretical background of SNM represents an effort to bring insights social sciences and innovation studies into evolutionary economics, inverting the perception of the technological change from casual to controlled, and underlining the role of the niche as absolute and relative space [6] in which technological innovation are examined, developed, and sheltered from the ordinary competition [7]. Wrongly considered in its early stage as a traditional policy tool, such a framework does not suggest a top-down creation of
niches by governments, but a direction of actions by societal groups oriented to a particular mission (see [8] for hydrogen and SDGs). Indeed, SNM can be perceived as a form of reflexive governance, emerged by means of collective enactments, which its basic idea is the substitution of dominant (polluting) technologies with new (sustainable) ones [9].

During the last few years—especially due to the growing interest given by different fields of research on the ways to reach a transition towards sustainability in the socio-technical systems—SNM has become a renowned analytical framework. In this respect, the goal of this review is the understanding of the perspectives from which literature has been developed so far by means of a SLR. Differently from Jenkins and Sovacool, (2018) [10] who analyzed peer-reviewed articles published between 2002 and 2016, pairing the term “Strategic Niche Management” with “energy”, “electricity”, “buildings”, “transport”, and “vehicles”—this study examines the first 100 results obtained on Google Scholar by querying “Strategic Niche Management” without applying temporal frames or other keywords to the research.

Investigating the focus, the development and the implications of the SNM literature, the paper introduces in Section 1 the background of the research, in Section 2 presents the materials and methods adopted, in Section 3 shows the results obtained, and in Section 4 gives final conclusions.

2. Materials and Methods

SLR is a method for examining a corpus of scholarly literature, to develop insights, critical reflections, future research paths, and research questions [11–13]. Being a rigorous, robust, and transparent method to research for trends and possible future study paths [14]—by adopting the PRISMA statement [15]—the SLR has been selected as a research method to assess and evaluate the existing knowledge on SNM.

2.1. Search Strategy

This study was realized by means of Google Scholar and Discovery Sapienza. While the first provides a way to widely search for scholarly literature searching across articles, theses, books, abstracts, and court opinions from academic publishers, professional societies, online repositories, universities and other web sites, the second allows the access to scholarly eResources, utilizing the Sapienza University catalogue, subscribed ejournals, eBook collections, databases, and the Sapienza PhD Theses repository. The choice to use Google Scholar and to examine the first 100 results (out of the about 350,000) obtained by querying “Strategic Niche Management” is motivated by the possibility to implicitly classify the publications on their relevance.

First of all, is important to recognize that Google Scholar uses different classification algorithms based on whether the search of the term is applied on the full text of the document (adopted for this study), on the title, using the “related articles” or the “cited by” function. Secondly, is of paramount relevance the understanding the elements classification affecting the outcome of the query, namely: the quotation count of the publication, the presence of the search term in the title, the presence of the search term in the publication full text and its frequency, the age of the document, as well as the author and journal names.

The most influential factor is the quotation count, generally ranking documents with more citations in higher positions, and implying an easier finding of the literature owning a point of view close to the mainstream. The second relevant factor is the presence of the search term in the title (without the consideration of synonyms), and then its occurrence in the full text of the source, assigning to the frequency of the search term a scarce impact on the outcome. In addition, the database ranks recent publications in a higher position than the older ones, considers the relevance of the author as well as of the journal name, and does not index the text in the images [16]. On the other hand, the documents have been analyzed with the usage of the catalogue of Discovery Sapienza for filtering the sample identified by Google Scholar, permitting to focus the attention of the study exclusively on peer-reviewed articles.
2.2. Exclusion Criteria

After careful processing, the following were excluded from the results: book chapters; PhD, Master and Bachelor theses; reports; conference, discussion and working papers; duplicates; articles not peer-reviewed, not recognized by the database, not available, and not written in English. In doing so, the number of the publications observed passed from 100 to 57, subsequently classified for timing of publication, geographical distribution, number of quotations and content.

The process introduced is represented by the PRISMA 2020 flow diagram in Figure 1 below.

Figure 1. PRISMA 2020 flow diagram, adapted from [17].

3. Results

Ordering the titles for year of publication within a range that goes from 1998 to 2020, the results show an increase of the number of publications starting from 2007, with a peak in 2013 and a stabilization from 2018 (Figure 2).

Even though the development of SNM involved scholars from several European countries, its seminal ideas come from the Netherlands [18,19]. In particular, it arose from a research program started in the middle 1990s by the University of Twente and the University of Maastricht, as an effort to shed light on the relationship between technical and socio-economical changes [20]. Classifying the titles for origins, the results show the involvement of 24 different countries/states, which combined with the number of publications, returned the following outcomes (Table 1).
Figure 2. Number of publications for year.

Table 1. Number of publications for different country/state.

| Country/State          | No. Publications |
|------------------------|------------------|
| Australia              | 1                |
| Bulgaria               | 1                |
| California (USA)       | 1                |
| China                  | 3                |
| Denmark                | 1                |
| Finland                | 5                |
| France                 | 1                |
| Germany                | 4                |
| India                  | 1                |
| Italy                  | 1                |
| Michigan (USA)         | 1                |
| Netherland             | 25               |
| New York (USA)         | 1                |
| Ohio (USA)             | 1                |
| Pakistan               | 1                |
| Scotland               | 1                |
| Singapore              | 1                |
| South Africa           | 1                |
| South Korea            | 2                |
| Spain                  | 2                |
| Sweden                 | 5                |
| Switzerland            | 1                |
| Tanzania               | 1                |
| United Kingdom         | 15               |
The counties demonstrating the greatest number of publications are the Netherlands, respectively followed by the United Kingdom, Finland, Sweden, and Germany, evidencing a leading involvement of the Northern European countries. These results are principally due to the fact that during the years SNM has been studied as research model and policy tool by Dutch scientists through several research projects carried out over the years and funded by the EU. The analysis continues with the observation of the number of quotations obtained by the publications. For a more intuitive reading of the results, Table 2 divides the quotations into five ranges that score from 0 to 100, from 100 to 200, from 200 to 300, from 300 to 500, and greater than 500. The most relevant range, containing 31 publications, is the first one, followed by the second with 12 titles, the third with 8, and then by the fourth and the fifth, each one with 3 publications. The Dutch dominance over SNM literature is once again demonstrated by the articles of Kemp et al., (1998) [18] and Schot and Geels, (2008) [21] receiving respectively 3048 and 1869 citations.

Table 2. Number of publications for quotations.

| No. Quotations | No. Publications |
|----------------|------------------|
| 0–100          | 31               |
| 100–200        | 12               |
| 200–300        | 8                |
| 300–500        | 3                |
| >500           | 3                |

When moving to the content analysis and after carefully processing the results, the publications have been divided in two macro-categories, General and Specific, containing in turn sub-categories. The first macro-category gathers all the articles that apply SNM generically, without focusing on a single subject. The sub-categories identified are: sustainability transition, networks, renewable energy, and other (which deals with topics such as governance, radical innovations, SNM competence kit, etc.). On the other hand, the second macro-category collects articles that utilize SNM to study specific subjects. The sub-categories identified are: electric vehicles, biofuel, transport, solar power, community energy, biomass, and other (concerning topics such as organic food, sanitation, hydrogen economy, etc.).

3.1. General Articles

3.1.1. Sustainability Transition

In the following part, first examining the general and then the specific articles, we organize the results for author(s)/year, title, synthesis, and sub-category. The tables are followed by deeper descriptions of the articles. Table 3 reports general topics of sustainability transition.

Kemp et al. (1998) [18], referring to the non-sustainability of the directions of technical change in transport and agriculture industries, illustrated how technical change was locked in ruling technological regimes, presenting the niche management as a method to stimulate a conversion into a new regime. Caniëls & Romijn, (2008a) [22] reported about SNM as a theoretical framework that leads a socio-technical transition towards a more sustainable development. Referring to SNM, the authors focused on its facilitation in the introduction of new sustainable technologies by means of sheltered societal experimentations in fields such wind energy, biogas, public transport systems, electric vehicle transport, and eco-friendly food production, and on its contribution to a wider shift towards sustainable development. Schot & Geels, (2008) [21] examined experimental conclusions and theoretical contributions of the 10 years before in SNM, underlining that sustainable innovation paths can be eased by creating technological niches. The study concentrated on the function of different niche-internal mechanisms (visioning, networking, and learning) and the interaction between
local experiments and global regulations that direct actor behaviors. Nill and Kemp, (2009) [23] discussed how, although in the past years evolutionary policy approaches have been progressively recommended, seeming ready for supporting sustainable innovation policies, the success of development approaches that comprehend radical or systemic changes is not demonstrated. In the paper, the authors assessed the theoretical principle, instrumental features, and the handling of policy limitations related to SNM, transition management, and time strategies.

Table 3. General articles on sustainability transition.

| Author(s), Year | Title                                                                 | Synthesis                                                                 | Sub-Category              |
|-----------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------|
| Kemp et al., (1998) [18] | Regime shift to sustainability through processes of niche formation: the approach of strategic niche management | Consideration of niche management as method to foster the conversion into a new sustainable regime | Sustainability Transition |
| Caniëls & Romijn, (2008a) [22] | Strategic niche management: towards a policy tool for sustainable development | Introduction of new sustainable technologies by means of sheltered societal experimentations | Sustainability Transition |
| Schot & Geels, (2008) [21] | Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy | Evaluation of technological niches as enablers for sustainable innovation paths | Sustainability Transition |
| Nill & Kemp, (2009) [23] | Evolutionary approaches for sustainable innovation policies: from niche to paradigm? | Assessment of the theoretical principle, instrumental features and the management of policy limitations related to SNM, transition management, and time strategies | Sustainability Transition |

3.1.2. Networks

Table 4 reports general articles on the role of networks for the niche management.

Table 4. General articles on networks.

| Author(s), Year | Title                                                                 | Synthesis                                                                 | Sub-Category |
|-----------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|
| Caniëls & Romijn, (2008b) [24] | Actor networks in strategic niche management: insights from social network theory | Consideration of the centrality of networking for the development of new technologies | Networks     |
| Hermans et al., (2013) [25] | Niches and networks: explaining network evolution through niche formation processes | Study of network practices applied to the agriculture niche in the Netherlands by using SNM | Networks     |

Caniëls and Romijn (2008b) [24], due to the fact that networking among actors is a fundamental element for the successful development of new technologies [26], tried to shed light on the way such success is related to the characteristics of the network using Social Network Analysis. Hermans et al. (2013) [25], using the perspective of SNM to explore the network practices of a collaborative innovation network, described a method to construct longitudinal two-mode affiliation networks by means studying the network characteristics of an agriculture niche in the Netherlands.

3.1.3. Renewable Energy

Table 5 lists general articles on renewable energy and SNM.

Verbong et al. (2008) [27] analyzed long-term innovation policies and development paths of wind energy, biomass, fuel cells and hydrogen, and photovoltaics by means of the utilization of SNM. Al-Sarihi and Cherni (2018) [28] assessed the potentialities of renewable energy initiatives in Oman by using SNM and the analysis of the three internal niche mechanisms.
Table 5. General articles on renewable energy.

| Author(s), Year | Title | Synthesis | Sub-Category |
|-----------------|-------|-----------|--------------|
| Verbong et al., (2008) [27] | Multi-niche analysis of dynamics and policies in Dutch renewable energy innovation journeys (1970–2006): hype-cycles, closed networks and technology-focused learning | Analysis of Dutch innovation policies through SNM | Renewable energy |
| Al-Sarihi & Cherni, (2018) [28] | Assessing strengths and weaknesses of renewable energy initiatives in Oman: an analysis with strategic niche management | Study of potentialities of renewable energy initiatives in Oman by adopting SNM | Renewable energy |

3.1.4. Other

Table 6 reports other topics dealing with sustainability and SNM.

Table 6. General articles on other.

| Author(s), Year | Title | Synthesis | Sub-Category |
|-----------------|-------|-----------|--------------|
| Lovell, (2007) [29] | The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice | Discussion of the lack of governmental policy in spreading the introduction of new technologies | Other (governance) |
| Hommels et al., (2007) [30] | Techno therapy or nurtured niches? Technology studies and the evaluation of radical innovations | Discussion of the application of insights from technology studies to policy decisions related to the development and management of radical technological innovations by considering SNM and the PROTEE approach | Other (radical innovations) |
| Raven et al., (2010) [31] | Transitions and strategic niche management: towards a competence kit for practitioners | Development of guidelines for the management of transition experiments | Other (SNM competence kit) |
| Coenen et al., (2010) [4] | Local niche experimentation in energy transitions: a theoretical and empirical exploration of proximity advantages and disadvantages | Discussion of closeness benefit in innovation procedures by the point of view of SNM and innovation literature | Other (proximity benefit) |
| Quitzau et al., (2012) [32] | Local niche planning and its strategic implication of energy-efficient technology | Overcoming of the gap between policy visions and their practice execution by adopting new transformative ideas in spatial planning in relation to SNM | Other (spatial planning) |
| Kivimaa, (2014) [33] | Government-affiliated intermediary organizations as actors in system-level transitions | Analysis of the role of government-related intermediary organizations in systems-level transitions by adopting theories on innovation intermediation and sustainability transitions | Other (government-affiliated intermediary organizations) |
| Barrie et al., (2017) [34] | Leveraging triple helix and system intermediaries to enhance effectiveness of protected spaces and strategic niche management for transitioning to circular economy | Study of a new decentralized governance structure for sheltered niches that, presenting the obstacle of SNM, recognizes the connection with the triple helix innovation system and innovation intermediation | Other (triple helix and system intermediaries) |

Lovell (2007) [29], discussed how—although SNM regards (also) how governments can spread the introduction of new technologies—the low-energy housing niches built during the 1900s has been leaded by entrepreneurs and not by the Government policy. Hommels et al. (2007) [30], by examining SNM and the PROTEE approach, discussed about the application of intuitions from technology studies to policy decisions with regard
the development and management of radical technological innovations in mobility and transportation. Raven et al. (2010) [31], reviewing the literature on transition and niche management, showed the presence of a strong analytical core and the absence of a managerial perspective. For such reason the authors developed a competence kit that provides guidelines to practitioners involved in transition experiments. Coenen et al. (2010) [4] discussed how SNM concerns to closeness benefit in innovation procedures, as recognized in the geography of innovation literature. The authors highlighted how, differently from the latter, SNM does not explicitly claim the locations in which innovations come out as intentional and following specific models. Simulations and policy scenarios for sustainability are paramount [35]. Quitzau et al. (2012) [32] wrote about the necessity to overcome the gap between policy visions and their practice execution, underlining the need of specific forms of strategic work in accordance with new transformative ideas in spatial planning compared to SNM. Kivimaa (2014) [33] examined the role of government-related intermediary organizations in system-level transitions drawing from two theoretical areas: innovation intermediation and sustainability transitions. The analysis indicates how to get from niches to transition, describing systemic intermediaries—such as government-affiliated intermediaries—as fundamental in delineating new visions and expectations. Barrie et al. (2017) [34] showed a new decentralized governance structure for sheltered niches in the scenario of transition to circular economy that meets present obstacles of SMN by recognizing the connection with the triple helix innovation system and innovation intermediation. Figure 3 briefly depicts the macro-categories and sub-categories discussed above.

![Figure 3. General articles and sub-categories.](image)

3.2. Specific Articles
3.2.1. Electric Vehicles

Table 7 reports specific articles of electric vehicles SNM.
Table 7. Specific articles on electric vehicles.

| Author(s), Year                  | Title                                                                 | Synthesis                                                                                                                                                                                                 | Sub-Category   |
|----------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Truffer et al., (2002) [36]      | The coupling of viewing and doing: strategic niche management and the electrification of individual transport | Study of the application of sustainable technologies on the individual transportation, considering SNM as a tool for closing the gap between the long and short-term visions                                    | Electric vehicles |
| Temmes et al., (2013) [37]       | The emergence of niche protection through policies: the case of electric vehicles field in Finland | Study of the development of electric vehicles field in Finland by showing the way SNM policies alter the existing ones                                                                               | Electric vehicles |
| Steinhilber et al., (2013) [38]  | Socio-technical inertia: understanding the barriers to electric vehicles | Study of key tools and strategies that facilitate the introduction of new technologies and innovations by focusing on the case of the electric vehicles in the UK and Germany                                   | Electric vehicles |
| Green et al., (2014) [39]        | Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market bias | Discussion on how policies intending to spread the diffusion of electric vehicles should target early adopters and market niches by using SNM                                                               | Electric vehicles |
| Sushandoyo & Magnusson, (2014) [40] | Strategic niche management from a business perspective: taking cleaner vehicle technologies from prototype to series production | Study of the development and introduction of electric vehicles by a manufacturing firm in London through the filter of SNM                                                                          | Electric vehicles |
| Xue et al., (2016) [41]          | Adopting strategic niche management to evaluate EV demonstration projects in China | Analysis of the transition to electric vehicles in China by using SNM                                                                                                                                  | Electric vehicles |
| Borghei & Magnusson, (2018) [42] | Niche aggregation through cumulative learning: a study of multiple electric bus projects | Examination of learning processes in niche aggregation by analyzing the fast-charged electric bus system in Europe                                                                                     | Electric vehicles |
| Jin & McKelvey, (2019) [43]      | Building a sectoral innovation system for new energy vehicles in Hangzhou, China: insights from evolutionary economics and strategic niche management | Analysis of the rise of an innovation system for new energy vehicles in Hangzhou (China) by adopting insights from evolutionary economics and SNM                                               | Electric vehicles |

Truffer et al. (2002) [36] discussed how, although previsioning is widely accepted in industry and governments for strategic formulation, its effect on technology development is still vague. The authors proposed the SNM to strengthen the link between the long-term visions and the short/medium-term actions by developing technological niches. In their view, the improvement of the latter can be fostered by means of field experiments, such as those analyzed related to the application of sustainable technologies on the individual transportation. Temmes et al. (2013) [37], through an extensive study on the development of electric vehicles field in Finland, argued how SNM policies alter the existing ones showing how actors protect technologies through such policies and how politicians choose technologies to be protected. Steinhilber et al. (2013) [38] contributed to the understanding of the key tools and strategies that facilitate the introduction of new technologies and innovations by analyzing the barriers to electric vehicles in the UK and Germany. Green et al. (2014) [39] underlining how plug-in electric vehicles (PEVs) could represent an occasion for decreasing energy usage and transportation emissions, remarked how policies intending to spread their diffusion should avoid being focused on mainstream consumers, by instead targeting early adopters and market niches by adopting SNM. Sushandoyo and Magnusson, (2014) [40], presenting the efforts to develop and introduce hybrid-electric vehicles of an actor in the heavy vehicle industry, examined SNM from the point of view of a manufacturing firm in London. Xue et al. (2016) [41] analyzed the transition processes.
of electric vehicles in China adopting the SNM to discover the kind of niche protection used and the barriers fostering the development of electronic vehicles. Borghei and Magnusson (2018) [42], joining the SNM and project management literature, examined how learning processes support niche aggregation in the analysis of the fast-charged electric bus system in Europe. Jin and McKelvey (2019) [43], considering intuitions from evolutionary economics and SNM, investigated the rise of an innovation system for new energy vehicles in Hangzhou, China.

3.2.2. Biofuel

Table 8 lists specific contributions on biofuel and SNM.

Table 8. Specific articles on biofuel.

| Author(s), Year | Title                                                                 | Synthesis                                                                 | Sub-Category |
|-----------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|
| Van der Laak et al., (2007) [44] | Strategic niche management for biofuels: analyzing past experiments for developing new biofuel policies | Analysis of policies to foster biofuels in the Netherlands by adopting SNM | Biofuel       |
| Van Eijck & Romijn, (2008) [45] | Prospects for Jatropha biofuels in Tanzania: an analysis with strategic niche management | Application of SNM to study the production of biofuels in Tanzania | Biofuel       |
| Caniëls & Romijn, (2008c) [46] | Supply chain development: insights from strategic niche management | Study of a biofuel supply chain in East Africa by adopting SNM | Biofuel       |
| Kwon, (2012) [47] | Strategic niche management of alternative fuel vehicles: a system dynamics model of the policy effect | Exploration of market obstacles and policy options related to alternative fuel vehicles with SNM | Biofuel       |
| Koistinen et al., (2019) [48] | Stakeholder signaling and strategic niche management: the case of aviation biokerosene | Comparison of the stakeholder management theory and SNM on the case of the transition to aviation biofuel | Biofuel       |

Van der Laak et al. (2007) [44] argued about the development of successful policies to promote biofuels by analyzing in depth three experiments in the Netherlands and using the SNM to justify success and failure of these projects. Van Eijck and Romijn (2008) [45], using SNM as analytical tool, presented a study in Tanzania centered on the production of biofuels through a plant called Jatropha Curcas Linnaeus. Caniëls and Romijn (2008c) [46] adopted SNM to study the supply chain design from the point of view of complex dynamics systems analyzing the development of a new biofuels supply chain in East Africa. Kwon (2012) [47], to expand the market share of alternative fuel vehicles, explored the market obstacles and possible policy options, presenting SNM as an effective tool able to strengthen the policy consequence of financial incentives, especially when present a strong network effect. Koistinen et al. (2019) [48] explored a case of stakeholder management in sustainability transitions on aviation biofuel to analyze the complications around signaling in SNM processes. Comparing stakeholder management theory and SNM, regarding the illegitimacy of a technology in its initial phase of development, the authors presented a view of the latter as in part given by its reputation.

3.2.3. Transport

Table 9 gathers specific articles on transport and SNM.

Ieromonachou et al. (2004) [49] introduced SNM to discuss the problem related to the congestion, the rising energy use and the pollution of the UK transport system, exploring the transferring of this technique for evaluating travel demand management policy measures. Shah et al. (2009) [50], suggesting a mechanism to generate, expand, and manage a niche, presented an overview on intelligent transport systems in developing countries using an outlook that considers compatibility, cost, technological composure, and institutional preconditions to evaluate the general effectiveness. Turnheim and Geels
(2019) [51] utilized the SNM to study the French infrastructure systems, focusing their attention on the modern tramways.

Table 9. Specific articles on transport.

| Author(s), Year | Title | Synthesis | Sub-Category |
|-----------------|-------|-----------|--------------|
| Ieromonachou et al., (2004) [49] | Adapting strategic niche management for evaluating radical transport policies: the case of the Durham Road Access Charging Scheme | Analysis of the transport system in the UK by using SNM | Transport |
| Shah et al., (2009) [50] | Strategic niche management of intelligent transport systems deployment and development in developing countries | Evaluation of the general effectiveness of the Intelligent Transport Systems in developing countries by means of SNM [50] | Transport |
| Turnheim & Geels, (2019) [51] | Incumbent actors, guided search paths, and landmark projects in infra-system transitions: re-thinking strategic niche management with a case study of French tramway diffusion (1971–2016) | Study of the French infrastructure system by using SNM | Transport |

3.2.4. Solar Power

Table 10 reports specific articles on solar power and SNM.

Table 10. Specific articles on solar power.

| Author(s), Year | Title | Synthesis | Sub-Category |
|-----------------|-------|-----------|--------------|
| Huijben & Verbong, (2013) [52] | Breakthrough without subsidies? PV business model experiments in the Netherlands | Study of the initiatives on photovoltaic in the Netherlands by adopting intuitions from the business model and transition studies literature | Solar power |
| Elmustapha et al., (2018) [53] | Comparing two pathways of strategic niche management in a developing economy: the cases of solar photovoltaic and solar thermal energy market development in Lebanon | Analysis of the success and failure of the development and the spreading of solar energy technologies by adopting SNM | Solar power |
| Mirzania et al., (2020) [54] | One technology, two pathways? Strategic niche management and the diverging diffusion of concentrated solar power in South Africa and the United States | Identification of success factors able to foster the assimilation of concentrated solar power in developing countries by using SNM | Solar power |

Huijben & Verbong (2013) [52], by using insights from both business model and transition studies literature (such as SNM), contributed to the understanding of the increasing number of initiatives started experimenting on photovoltaic in the Netherlands. Elmustapha et al. (2018) [53], to confront the niche development of solar thermal energy and solar photovoltaics in Lebanon, analyzed the success and failure of the development and the spreading of solar energy technologies (for the economic viability at country level see [55]). Mirzania et al. (2020) [54] investigated the reasons for the lag of the concentrated solar power with respect the other renewable technologies, comparing the advanced situation of the US with that of South Africa. Using SNM analysis, the authors identified success factors that could foster the assimilation of concentrated solar power projects in developing countries.

3.2.5. Community Energy

Table 11 lists specific articles on energy innovations, local communities and SNM.
Table 11. Specific articles on community energy.

| Author(s), Year | Title                                                                 | Synthesis                                                                                   | Sub-Category               |
|-----------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------|
| Hargreaves et al., (2013) [56] | Grassroots innovations in community energy: the role of intermediaries in niche development | Analysis of the work of intermediary actors in spreading novel innovations in the UK community energy sector adopting SNM | Community energy             |
| Smith et al., (2016) [57] | Making the most of community energies: three perspectives on grassroots innovation | Application of SNM, niche policy advocacy and critical niches to study grassroots innovations by considering empirical research on community energy in the UK | Community energy             |
| Ruggiero et al., (2018) [58] | Understanding the scaling-up of community energy niches through strategic niche management theory: insights from Finland | Study of the community energy sector in Finland by means of SNM | Community energy             |

Hargreaves et al. (2013) [56] analyzed the work of the intermediary actors in reinforcing, increasing, and spreading novel innovations in the UK community energy sector by using SNM for highlighting the important roles played by them. Smith et al. (2016) [57] considering several empirical studies on community energy in the UK and using recent support from national governments as a case study, studied grassroots innovations for sustainability applying three analytical perspectives: SNM, niche policy advocacy, and critical niches. Ruggiero et al. (2018) [58] examined through the lens of SNM how in Finland a small sector such as community energy—conceptualized as a socio-technical niche with the potential to foster a transition to renewable energy—could increase the change in energy production. This is in line with empirical analysis on bioenergy (see [59]).

3.2.6. Biomass

Table 12 deals with topics related to biomass and SNM.

Table 12. Specific articles on biomass.

| Author(s), Year | Title                                                                 | Synthesis                                                                                   | Sub-Category   |
|-----------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|
| Verbong et al., (2010) [60] | Strategic niche management in an unstable regime: biomass gasification in India | Study of biomass gasifiers in India by adopting SNM | Biomass         |
| Romijn et al., (2010) [61] | Biomass energy experiments in rural India: insights from learning-based development approaches and lessons for strategic niche management | Application of different learning-based methods to biomass energy projects in India showing their analogies with SNM | Biomass         |

Verbong et al. (2010) [60] studied the development and implementation of biomass gasifiers in India by using the SNM framework, concluding that contrary to theoretical forecasts, niche development undergoes from regime precariousness rather than regime stability, as investors and customers need more security. Romijn et al. (2010) [61] investigated the sustainability and limitations of the SNM in the scenario of developing economies of South and East Asia. The authors, showing their analogies with SNM, applied different learning-based methods to four biomass energy projects in rural India recognizing decisive factors of success and failure.

3.2.7. Other

Table 13 reports other topics dealing with sustainability and SNM.
Table 13. Specific articles on other.

| Author(s), Year | Title                                                                 | Synthesis                                                                 | Sub-Category                  |
|-----------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|
| Smith, (2006) [62] | Green niches in sustainable development: the case of organic food in the United Kingdom | Study of the organic food niche in the UK by examining the relationship between new radical socio-technical practices and the incumbent regimes | Other (organic food)          |
| Hegger et al., (2007) [63] | Niche management and its contribution to regime change: the case of innovation in sanitation | Analysis of the innovation development in sanitation in Western Europe in consideration of SNM | Other (sanitation)            |
| Agrolucci & Ekins, (2007) [64] | Technological transitions and strategic niche management: the case of the hydrogen economy | Study of a possible wide-ranging transition to hydrogen as an energy source through SNM | Other (hydrogen economy)      |
| Monaghan, (2009) [65] | Conceptual niche management of grassroots innovation for sustainability: the case of body disposal practices in the UK | Analysis of the conceptual niche management applied to the UK body disposal | Other (body disposal practices) |
| Schilpzand et al., (2010) [66] | Strategic niche management (SNM) beyond sustainability. An exploration of key findings of SNM through the lens of ICT and privacy | Review of six main outcomes of SNM and of a case study related to NFC technologies by also examining the functionality of SNM for other socially beneficial changes | Other (ICT)                   |
| Witkamp et al., (2011) [67] | Strategic niche management of social innovations: the case of social entrepreneurship | Application of SNM to social innovations not based on technical artefacts | Other (social entrepreneurship) |
| Rehman et al., (2012) [68] | Distribution of improved cook stoves: analysis of field experiments using strategic niche management theory | Analysis of two projects related to cooking technology modalities in India by using SNM | Other (cook stoves)           |
| Verbong et al., (2013) [69] | Smart grids or smart users? Involving users in developing a low carbon electricity economy | Examination of practices and perceptions of stakeholders on including users in smart grinds experiments in the Netherlands by adopting SNM | Other (smart grids)           |
| Fam & Mitchell, (2013) [70] | Sustainable innovation in wastewater management: lessons for nutrient recovery and reuse | Analysis of the early experimentation on sustainable management of wastewater by using SNM | Other (wastewater management) |
| Mlecnik, (2014) [71] | Which factors determine the success of strategic niche developments? Reflections from the emergence of a passive house network | Description of the rise of a passive house innovation network in the Flemish Region by underlining the element of success and unsuccess of SNM | Other (passive house network) |
| Carvalho, (2015) [72] | Smart cities from scratch? A socio-technical perspective | Study of socio-technical challenges deriving from the implementation of the smart cities of Songdo and Plan IT Valley by means of SNM | Other (smart cities)          |
| Ivanov, (2017) [73] | Fostering sustainable innovations and entrepreneurship through strategic niche management: the Bulgarian case in higher education | Application of SNM to three Bulgarian universities by revealing limitations and preconditions for its implementation | Other (education)            |
| Jain et al., (2017) [74] | A governance perspective on net zero energy building niche development in India: the case of New Delhi | Analysis of the state of the governance in New Delhi by using SNM and the governance assessment tool for the adoption of the net zero-energy buildings | Other (net zero energy buildings) |
| Susur et al., (2019) [75] | A strategic niche management perspective on transitions to eco-industrial park development: a systematic review of case studies | Execution of a SLR on case studies related to the transition to eco-industrial park adopting a SMN perspective | Other (eco-industrial park)   |
Table 13. Cont.

| Author(s), Year, Title | Synthesis | Sub-Category |
|------------------------|-----------|--------------|
| Rantala et al., (2020) [76] *Energetic voices on social media? Strategic niche management and Finnish Facebook debate on biogas and heat pumps* | Recognition of autonomous disconnected niches by analyzing the discussion on Facebook related to the national energy reform in Finland | Other (energy policy discussion on Facebook) |
| Tian & Wang, (2020) [77] *Chinese green process innovation in automotive painting: the strategic niche management perspective* | Analysis of the evolution history of Chinese automotive painting by means of a SNM approach | Other (automotive painting) |
| Stiles, (2020) [78] *Strategic niche management in transition pathways: telework advocacy as groundwork for an incremental transformation* | Study of the telework in the US as a case of SNM | Other (telework) |

Smith (2006) [62], studying the case of organic food, examined the relationship between new radical socio-technical practices (belonging to niches) and the incumbent socio-technical regimes, arguing that mainstream changes are more easily influenced by niches when they show some affinity with the dominant regime. Hegger et al. (2007) [63] examined the processes by means niches can drive to broader changes at the level of socio-technical regimes analyzing the Western Europe innovation developments in the sanitation. Agnolucci and Ekins (2007) [64] assessed the interest in the possibility of wide-ranging transition to hydrogen as an energy source with regard to technological transition theory and in particular the chance of hydrogen use becoming diffused through SNM. Monaghan (2009) [65], by defining a remodulation of conceptual niche management applied to the UK body disposal, tried to explain how grassroots innovations can be capitalized on and intentionally supported to substitute dominant systems. Schilpzand et al. (2010) [66], reviewing six main outcomes of SNM and a case study on near field communication (NFC) technologies from mobile payment, examined whether SNM is also functional for the study and administration of other kinds of socially beneficial change. Witkamp et al. (2011) [67], identifying theoretical and practical impediments and proposing solutions, examined if and how SNM can be applied to social innovations that do not evolve around a technical artefact, such as social entrepreneurship. Rehman et al. (2012) [68], to develop different cooking technology modalities and using the assumptions of SNM, analyzed two projects applied by The Energy and Resources Institute (TERI) in nine Indian villages. Verbong et al. (2013) [69] examined practices and perceptions of stakeholders on including users in smart grinds experiments in the Netherlands by using the SNM framework. Fam and Mitchell (2013) [70], adopting SNM in view of a sustainable management of wastewater, analyzed how early the experimentation in urine diversion has involved users, observing also whether or not the three internal niche processes have been taken into account. Mlecnik, (2014) [71], describing the rise of a passive house innovation network in the Flemish region, reviewed and discussed the limitations and success elements of SNM with regard the experiences of a company network to boost niche development for integrated design notions. Carvalho (2015) [72], studying the cases of Songdo (South Korea) and Plan IT Valley (Portugal), described how smart city visions centered on information and telecommunication technologies build composite socio-technical challenges that can gain from SNM to promote technological learning and societal enclosure. Seyfang and Longhurst (2016) [1], tested the capability of SNM to be applied to the field of grassroots innovations and movements (see Falcone et al. (2020) [79] for an empirical analysis of grassroots movements and their role towards sustainability) presenting new experimental discoveries from an international study of 12 community currency niches. Ivanov (2017) [73], in a scientific framework that is looking to increase SNM as a tool for politicians and professionals to deal with incremental change in the context of sustainable entrepreneurship, by applying SNM to three Bulgarian universities, revealed some limitation and proposed six precon-
ditions for its application. Jain et al. (2017) [74] assessed the governance context for the adoption and diffusion of the net zero-energy buildings through niche formation in India analyzing the state of governance in New Delhi by using the SNM and the governance assessment tool. Susur et al. (2019) [75], in a scenario that sees the industrial park as the mainstream industrial agglomeration model by conducting a SLR and developing a theoretical relying on eco-industrial park literature and SNM, tried to shed light on how can be reached a transition to eco-industrial park, as well as to create a research agenda that would elaborate on sustainability transitions into eco-industrial park growth. Rantala et al. (2020) [76], underlining the existence of autonomous and disconnected niches, analyzed a social media discussion on Facebook related to the reform of national level energy policy in Finland. Tian and Wang, (2020) [77], to analyze the mechanisms underlying green process innovations, conducted a study on the painting procedure of Chinese automotive industry. By utilizing a SNM approach which supports the contributions of stakeholders, the authors investigated, summarized, and analyzed the evolution history of Chinese automotive painting sector from 1986 to 2018. Stiles (2020) [79] presented telework support in the US as a case of SNM that spurred the transformation of office work location practice in the US. Figure 4 briefly depicts the macro-categories and sub-categories discussed above.

Figure 4. Specific articles and sub-categories.

4. Conclusions

Being a focus on socio-technical niches and the related management activities necessary to understand the replacement of the dominant socio-technical regime, the SNM has become a fundamental analytical framework to comprehend the introduction and diffusion of new sustainable innovations by means of social experiments.

The presented SLR, carried out by adopting the PRISMA statement, investigates the focus, development, and implications of the SNM literature by examining the year of publication, geographical distribution, number of citations obtained, and the contents to which SNM have been applied. The first aspect analyzed shows an increase of the number of articles from 2007, with a peak in 2013 and a stabilization from 2018. The second
demonstrates that the country/state presenting the greatest number of publications are the Netherlands, followed by the United Kingdom, Finland, Sweden, and Germany. The third illustrates how the vast majority of the articles rank in the span that goes from 0 to 100, presenting a gradual decreasing of the number of titles with the increasing of the considered range value. The fourth feature studied allows for a division of the articles in two macro-categories. The first, “General”, gathers all the publications that use SNM generically, without focusing on a specific subject, recognizing in turn four sub-categories: sustainability transition, networks, renewable energy, and other (which deals with topics such as governance, radical innovations, SNM competence kit, etc.). The second macro-category, “Specific”, puts instead together articles that utilized SNM to study a specific subject. In this case, the sub-categories identified are: electric vehicles, biofuel, transport, solar power, community energy, biomass, and other (concerning topics such as organic food, sanitation, hydrogen economy, etc.).

The increase in publications over the years, the enlargement of the geographical borders interested, the presence of points of reference in the literature, as well as the wide adaptability (both generical than specific) of the theoretical framework to the most diverse energy-related fields, allows us to remark the relevance of the SNM for studying the transition towards sustainability in socio-technical systems.

Future research should look at the development of the SNM research also in light of the current pandemic and try to apply a more refined method of paper selection able to accomplish with different spheres and intersections of scientific disciplines.

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