



Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Stimulating urban transition and transformation to achieve sustainable and resilient cities



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ARTICLE INFO

Keywords:

Transition
Transformation
Triggers of change
Barriers
Climate change adaptation
Conceptual framework

ABSTRACT

Political decision-makers need to consider the various challenges and opportunities that climate change can bring, and they must take decisions under high uncertainty to achieve resilient cities. Here, we synthesise the push and pull approaches reported in the literature and employed in practice to achieve sustainable and resilient cities.

First, we present a literature review which identified the major research fields on transition theories, frameworks and methods that underpin this concept. We analyse the conditions for change, identify enablers or triggers for change at governance level for transitioning a city towards sustainability and resilience. We discuss the theories, frameworks and methods which can be used to address the urban climate change challenge at city level.

Second, we present an empirical approach based on stakeholder participation that we conducted to detect the conditions for change. We report on the design and implementation of stakeholder exercises that helped us detecting the conditions for changes.

Third, we combine the information obtained from these stakeholder exercises with that extracted from the literature in order to provide a fuller picture on how stimulate the transition and transformation to achieve sustainable and resilient cities. Based on our literature review and empirical approach, we formulate an integrated conceptual model for transition that enables the design of adaptation (and mitigation) strategies that consider the triggers of change. Uniquely we identified 8 triggers of change, including authority and political leadership, learning from disasters, co-responsibility, increased public-private interface, social participation and the living lab approach to innovation. The proposed model can be applied to the whole city or to a certain sector of the city (e.g. energy). We demonstrate that triggers of change help to overcome planning and implementation barriers and move the socio-ecological and socio-technical systems of any city towards those of a resilient city.

1. Introduction

More than half of the world's population lives in cities and faces the challenges of climate change [1–3] and urban development. This situation necessitates a change in present governance in order to acquire the capacity to generate long-term, flexible and sustainable policy instruments to address problems. However, such change should involve the coordination of pre-existing authorities, organised interests and knowledge [4]. Heidrich et al. [5] investigated the relationship between climate change strategies at urban level and EU and national climate policies. Of the 200 cities surveyed, they found that only 56 cities (23%) had adaptation strategies. This highlights the need to strengthen the

capacity of local authorities and develop tools and resources that enable them to plan and respond to their specific climate change problems.

Generally speaking climate change has two areas mitigation i.e. to reduce the causes of climate change via for example renewable or sustainable energy systems, and climate change adaptation i.e. to reduce the negative impacts that climate change may bring for example energy, heat island, flooding or vulnerability [6]. Besides, the policy response should integrate both areas [7]. A clear example of this is the new merged Covenant of Mayors for Climate and Energy which integrates mitigation and adaptation issues to achieve the EU energy and climate targets [8].

Therefore, the cities challenge lies on designing workable

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governance instruments to support low carbon energy transition [9] and stimulate urban transition and transformation to achieve sustainable and resilient cities [10,11]. Energy consumption model and greenhouse gases reduction is highly dependent on the urban characteristics (e.g. urban form) [12,13]. In turn, cities should take action to both reduce the greenhouse gas emissions and adapt the system to reduce the negative impacts of climate change [12].

A few studies have focused on urban energy resilience [14] this paper would like to highlight the importance of transitioning the whole city but also discusses specific sectors like energy at the same time as they both have common planning and design criteria (e.g. land use, urban geometry and morphology, governance, socio-demographic aspects). Therefore, it is hoped that the review and the transition model presented here can help in the adaptation and mitigation to climate change of the whole city, that is applicable in various sectors like energy, water and transport.

Several approaches (e.g. incremental, transformative or reformist adaptation) and conceptual models (e.g. Adaptation Action Cycles, Transition Handbook) to study climate change mitigation and adaptation have been presented to determine how to transition towards sustainable urban development can achieve more resilient and sustainable cities [10,15,16]. Two research communities have emerged that address the transition and transformation of the cities: climate adaptation and transition communities. The climate adaptation community addresses problems related to climate change, which has improved the analysis and quantification of climate change impacts (consequences of climate hazards), developed vulnerability assessment methods, provided strategies for adaptation and identified opportunities but also barriers to adaptation [10,17]. Meanwhile, there is another community - the transition community - that has been focused on the transition of urban governance tools to achieve e.g. sustainability, low carbon energy systems and resilience [14,18,19]. In this latter community, sustainable transitions have entered the academic debate [20–22] about the governance, methods and tools necessary to help cities attain sustainable living, cleaner energy and resilience.

Effective governance of transitions requires the capacity to deal with complexity and uncertainty, manage big data and conduct in-depth analysis. It must also involve a broad range of stakeholders in these processes. In this respect, several scientific communities have addressed the governance of urban transition. In one hand, the transition community has developed the transition management (TM) approach [15,23–27], a governance model focused on society and technology. Urban transition management is a variation of transition management which focuses on city-specific challenges and employs the same principles as transition management [28]. Meanwhile, in the other hand, the climate adaptation community has proposed the adaptive governance approach, which consists of creating adaptability and transformability in socio-ecological systems. Although initially formulated as an adaptive management approach [4,25,29–31], it differs in considering broader social contexts [30]. Whereas adaptive management focuses on the interaction between social and natural dynamics [32–36], adaptive governance is a broader concept adopted by the climate adaptation community that uses adaptation to increase the resilience of socio-ecological systems [34].

Despite their different approaches, both these scientific communities (transition and climate adaptation communities) address the urban system with the same aim: to increase resilience and sustainability and prepare for the global challenges ahead, i.e. cleaner energy or flood protection as responses to the threats and opportunities of climate change [11]. Resilience provides the capacity to absorb disturbances while maintaining function [32], endowing the system with the capacity to reorganise itself after a disturbance [37], and to adapt and learn [25,38,39]. Sustainability is a multidimensional systemic concept that embraces the environment, society and the economy and adopts a long-term vision for energy generation and consumption [38,40,41].

Therefore, specific governance models are required to enhance resilience and sustainability in this uncertain world. Wise et al. [31] have argued that the analytical focus in climate adaptation science is changing from a problem-orientated (provide evidence-based advice for decision-makers) to a decision-orientated approach (which aims emphasising the need for robust decision making under deep uncertainty). This change has been prompted by the need to assist decision-makers in adaptation planning, in which policy options must be assessed and implemented within highly uncertain, dynamic and complex socio-ecological systems. Moreover, city systems require dynamic adaptive plans rather than static robust plans.

Last but not least, in order to develop effective governance for transitioning, the barriers and drivers must be considered. In this context, barriers are “social factors and conditions [that] hamper our ability to adapt proactively to future environmental changes” [42]. Elsewhere, barriers have been defined as “obstacles that can be overcome with concerted effort, creative management, change of thinking, prioritisation, and related shifts in resources, land uses, institutions” [43], or with sufficient political will, social support, resources and effort [17,44]

There is a danger that using the terms “barriers” and “drivers” in the context of climate change policies may suggest a clear-cut causality between human activities, processes and patterns impacting on adaptation efforts [17]. We acknowledge that neither barriers nor drivers imply monocausality, i.e. no one specific driver or barrier causes or prevents a specific impact or behaviour.

The aim of this paper is to synthesise the push and pull approaches described or employed to achieve resilient cities. To this end, we established the following objectives:

- Collect published peer-reviewed and grey literature
- Review and analyse push and pull approaches
- Categorise methodological differences between these approaches
- Design and conduct empirical exercises to identify the city conditions for change
- Advance the understanding and applicability of the different approaches by providing a theoretical/conceptual framework
- Discuss the findings in terms of resilience, adaptation and energy

We identified major research fields in transitioning, detecting the theories, frameworks, approaches, methods and tools to determine which can be used to address the urban climate change challenges.

The literature that analyses barriers and drivers also explores the reasons for the limited transfer of assessments, agendas and plans to transition, as well as examining how barriers are transformed into enablers. Therefore, both scientific communities (transition and climate adaptation) identify the conditions for change in order to determine those necessary to promote transition to achieve sustainable and resilient cities. In addition, we designed an empirical approach to detect the conditions for changes and combined this information with that reported in the literature.

The information obtained from our literature review and empirical approach enabled us to define an integrated conceptual framework for transition. The purpose of this framework is to serve as a basis for developing a systems-based approach that considers trade-offs and synergies and interlink ages between social and environmental issues, combining top-down and bottom-up approaches.

2. Materials and methods

We conducted a systematic literature review to summarise the two main communities' approaches to the subject of transition by performing a keyword search using search engines Google Scholar, Science Direct and Web of Science (WOS). WOS and Science Direct were selected as they are the most powerful, up-to-date, comprehensive and widely used search engines available for the analysis of

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