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Reconfiguring Energy Consumption Practices in Beijing: Integrating Pathways to Sustainability

Usman Sattar, Dunfu Zhang*

School of Sociology and Political Science, Shanghai University, Shanghai, P.R. China

Abstract While cities are responsible for most of the carbon emissions worldwide, they also hold a significant capacity to be resilient and sustainable. Beijing has repeatedly experienced a gridlock situation due to very unhealthy smog episodes. This paper combines the capacity of different sectors to transform the carbon-intensive development path. The study adapts the multi-level perspective to transform the existing patterns of prosumer activities causing energy consumption and CO_2 emission in Beijing. A methodic literature review guided by a wide array of subjective scrutiny is adopted to conceptualize different strands of cross-disciplinary work. This study classifies the capacity of potential stakeholders and their interventions at niche level. The paper concludes that the capacity of niche component is crucial for the grass-root sustainability initiatives. The study further finds that the capacity of niches is interconnected and interdependent to other components suggested by the multilevel framework, and a joint interplay of multilevel capacity components can potentially alleviate the current itineraries of consumption-led CO_2 emission and reconfiguring the environmental sustainability. Thus the study is useful for urban stakeholders to transform the energy consumption practices in Beijing.

Keywords Sustainable Consumption, Sustainability Transitions, Multilevel Perspective

1. Introduction

Cities are facing unintended consequences of efficiency myopia worldwide [1]. A massive growth of urban complexes—industrialization, urbanization, and motorization, especially in megacities rebounding in ‘lock-in’ consumption patterns of energy, transportation, housing, and food mainly, which derives 80% of global greenhouse gas (GHG) emissions [2, 3]. Currently, 51% of world’s population is living in urban areas, and the figure can reach up to 70% together with a substantial growth of GHG by 2050 [2]. Against the given scenario, the Intergovernmental Panel on Climate Change (IPCC) has alarmed that cities must reduce CO_2 emission by 40-70%; whereas, other scholars [4] calls for 80% emission reductions by 2050.

In the year of 2015, the United Nations Framework Convention on Climate Change (UNFCC) reached a great global agreement on the reduction of carbon emission [5]. However, the second largest emitter of GHG emissions—The United States of America withdraws from the landmark pact recently [6, 7]. The United Nations General Assembly (UNGA) vows to transform cities and communities into more resilient and sustainable by ensuring responsible production and consumption under the umbrella of “Sustainable Development Goals” 2015. Such a transition from ‘just development' to ‘sustainable development' requires a high global will, time and patience to transform its current consumption patterns in favour of long-term environmental sustainability. The most populous and the largest developing economy in the world—The People's Republic of China is the leading emitter of global GHG emission by sharing 27% [8, 9], which mainly comes from the various form of energy consumption in megacities [2].

From December 2016 to January 2017, the new year brought several haze episodes with multiple red alerts for the citizens of greater Beijing. A substantial amount of studies have unveiled the findings of general and sector-wise decomposition analysis of carbonization process in Beijing [9-14]. On the other hand, a substantial amount of studies have recommended many systematic and sector-wise adjustment paths to overcome the alarming situation [1, 2, 11, 17]. Furthermore, Global Research Forum (GRF) on Sustainable Production and Consumption conducted its second annual conference on the similar issue in Shanghai in June 2014. A special volume (SV) has been published [5] to summarize the conference findings, with a particular focus on the multilevel understanding of socio-spatial transition processes in Chinese cities including Beijing.

The above-mentioned studies of carbonization processes, sector-wise adjustments and the SV of GRF found that a consistent framework for a systematic understanding of the

* Corresponding author:
paulchang@staff.shu.edu.cn (Dunfu Zhang)
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interplay between multilevel processes involved in shaping such an undesirable production and consumption patterns as well as adjustment trajectories to support the agenda of urban sustainability transitions is still under construction [18, 19]. Thus, the question remains still persistent that *what might enable Beijing to decouple the path of carbon-intensive prosumption patterns and make a move from a 'weak sustainable consumption' to a 'strong sustainable consumption' direction to realize a systematic change in Beijing* [1].

Given the study gap, this paper synthesizes the capacity of three dimensions at niche level [37-41]. We have combined these multidisciplinary adjustments as a guide for policymakers, urban planners and researchers to transform the socio-technical regime (stable patterns and procedures rebounding unwanted outcomes of prosumer activities and CO_2 emission) towards a sustainable path.

Thus, the ambition of this paper is applied under the domain of sociology. The study serves a baseline for the incubation of niche capacity components—a way forward to avoid the repetition of lock-in position and realize the desired change in Beijing. Section 2 sets out the deductive methodology used for this study. Section 3 lays out a conceptual framework for potential adjustments in niches to improve the air quality in Beijing.

2. Approach and Method

A multilevel perspective covering a wide array of subjective analysis is undertaken for this study. We combined different strands of multi-disciplinary research into a framework based on a *methodic literature review* [15, 20]. we have confined potential capacities to transform the gridlock situation at niche level, We segregated potentials of various capacity components together with potential agents and their interventions are given for a categorical and systematic understanding to reshape the existing patterns of energy consumption practices—3 main sectors [21]. In the end of discussion, a brief idea of different categories is compiled into a conceptual framework to facilitate endeavors aiming at reducing carbon emissions at each level at niche level. The framework sketches out operational mechanisms, which might be useful for urban stakeholders to perform environmental innovation and sustainability transitions in Beijing.

3. Reconfiguring Pathways

Beijing has proven capacity to transform its energy consumption patterns and polluted air. There are few examples in Beijing's history where the stakeholders have made wonderful efforts to reduce carbon emissions and improved the air infrastructure of the city. For instance, the time of the Olympic games in 2008. Beijing took a series of policy measures and actions including "Clean Air Action Plan" and "Air Pollution Prevention and Control regulations" to transform the prosumption patterns to make sure blue sky during this mega event. A number of 23,000 old vehicles got retired, and local-vehicle-emissions were controlled by restricting private vehicles on roads based on their even-odd registration number, and about 300,000 heavily emission-intensive vehicles were banned on streets in Beijing [21]. Resultantly, Beijing achieved a 35% reduction in pollution during the pre-Olympics period 2005 to 2008 [22]. Therefore, it is evident that the city has proven capacity to transform its prosumption patterns and air infrastructure. Following the guidelines of MLP framework for a systematic change, here we provide a framework to address transformations by conceptualizing possible capacity components at niche level.

Table 1. Niche Components

NC.1	R&D institutions	NC.3	users' demand (small markets)
NC.2	Subsidy projects		

3.1. (NC.1) R&D Institutions

Beijing will just have to step up 'strong sustainable consumption patterns [1] at some point by encouraging innovative development strategies (NC2) for realizing a systematic change. In the transport sector, the use of carbon neutral vehicles such as hybrid or electric cars can reduce CO_2 emission as compared to fossil-fuel consuming vehicles. Scholars [23] endorse that, although advancement of energy structure can potentially reduce carbon emission from the transport sector yet the problem remains that, the technology is relatively new and the related infrastructure is currently not sufficiently available. For example, hybrid or electric cars are comparatively expensive, and car charging stations are not sufficient, and users and companies like to save their time and money.

In other sectors such as market businesses and industrial production, local entrepreneurs should realize their capacities for developing innovative business models beyond sharing economy and technical advancements in production structure—weak sustainable consumption [1]. Furthermore, academician can further expand their inquiries beyond material aspects and explore innovative lifestyles, and development standards without copycatting the consumption culture of the global north [16, 17, 24]. However, such kind of projects requires a multilevel support from diverse sectors.

3.2. (NC.2) Subsidy Projects

The validity of innovative R&D mechanisms should be checked by the first-hand experience in consumer markets through pilot-projects. In markets, marketing managers are crucial for promoting cleaner products at the regime level by raising community awareness through different advertisement programs. The marketing of cleaner commodities and incentivizing accessibility of green products in the marketplaces is significantly supportive. At

the same time, the government can play a vital role in encouraging the grass root sustainability initiatives [25, 26]. The success of such sort of environment-pro market endeavours should be reflected in consumer choice architecture. A sense of responsibility or community ownership should be developed through awareness campaigns. City administration can set limits on carbon emissions from supply chains, and push private corporations for the measurement of carbon footprints from their product lifecycle [27]. Incentives for renewable energy projects and import/create the latest technologies. Set penalties at the enterprise level and ruling emission trade/reform subsidies.

Table 2. Conceptual Framework of Niche Innovations

No.	Stakeholders	Intervention	Ref.
NC.1 R&D Laboratories	Educational institutions, business organizations, Entrepreneurs companies/ firms	"Create in China" not "Made in China"—socio-technical innovations, and developing alternative fuels/products—transforming lifestyles and application of clean energy to daily life uses. Explore innovative business models like product-service systems (PSS) that minimizes production and cuts material use by 30%.	[16] [14] [9] [17] [24]
NC.2 Subsidized Projects	Business managers, Govt. bodies, Community Organizations, Logistic industrialists/ supply chain managers Non-Gov. organizations (NGOs) City administrations	Marketing cleaner commodities—incentivizing accessibility of green products in the marketplaces. Collaborative consumption—goods and services sharing mechanism between collectives—in theory, this leads to sustainable consumption. Environmental measurements of supply chains and product lifecycle, ensuring circular business like Taiyuan Iron and Steel Corporation. Sustainability movements—establish awareness campaigns about green products and environmental issues. Incentives for renewable energy projects and import/create the latest technologies. Set penalties at the enterprise level and ruling emission trade/reform subsidies.	[25] [28] [16] [29] [27] [30] [16] [31] [9]
NC.3 Users' Special Demand	Marketplace leaders Celebrities, community leaders	Promoting green products and push companies to produce carbon emissions report—assessment of carbon footprints from businesses. Intervene in positional consumption, invoking in existing norms and role modeling through influential people at the community level—social change.	[1] [16] [32] [33] [34]

3.3. (NC.3) Small Markets with Special Users' Demand to Support Emerging Innovations

A recent study [35] has analysed the conditions under which grass root market initiatives might have substantial incremental success at the regime level. From individual niche actors to an organization of groups, and then inter-group communication among networks of the particular users can potentially gain access to the regime or landscape level. A collective vision of networks and stakeholders having common goals supported by the governmental policy and supportive infrastructure can potentially achieve incremental success at regime level [5]. At this stage, the study [36] gives weight to participatory development processes and recommends that cooperatives are crucial to make sure community participation, transformation, and sustainable growth. Trade corporations are required to play their due role in corporate social responsibility (CSR), and the same time, consumers should boycott the carbon-intensive market products, and encourage sustainability initiatives by giving priority to green products [37, 38].

4. Conclusions

Niche components suggest innovative business models powered by carbon-neutral energy technologies and improving product services systems for maximum utilization of products. The government needs to provide more subsidize to cleaner production technologies in the private sector, and push personally-owned companies to submit their carbon emission reports for monitoring and evaluation. At the niche level, celebrities can also play a vital role in promoting wise consumption lifestyles and intervening in norms of positional consumption. The study finds that the capacity of each component to transform the energy consumption practices is deeply integrated and interdependent at three levels as suggested by MLP. Although a considerable attention is being paid to manage the landscape arrangements in cities yet much work in the form of strong sustainable consumption [1] is still missing to reshape the carbon-intensive linear consumption path. Thus, the framework specifies multilevel adjustment trajectories—subject areas, capacity components, actors and interventions within their specific domains. The framework

can be used as a baseline for developing low-carbon transitions in other cities as well. The study endorses MLP as a valuable approach to transform the energy consumption for addressing the air quality issues in cities. However, the issue requires further attention of possible options guided by MLP and make Beijing more resilient and sustainable.

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