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A multi-level perspective analysis of urban mobility system dynamics: What are the future transition pathways?

Afsaneh Moradi, Emidia Vagnoni*

University of Ferrara, Department of Economics and Management, Via Voltapaletto 11, - 44121 Ferrara, Italy

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ABSTRACT

Transport sector is one of the main contributors to air pollution, greenhouse gases and CO₂ emissions, especially in urban areas, and is the only sector that has not yet achieved sustainability objectives. Increasing concerns about emissions from the transport sector highlight the need for urgent actions for change to more sustainable systems that consider the needs of all social groups, be more affordable and less polluted. Transition studies focus on actions and plans used to change the current system to more sustainable ones, a radical shift in incremental steps. Multi-level perspective considers the transition as a nonlinear process of change resulted from the interactions of social and technological factors at different levels. While most studies focused on historical transition reviews or future pathways and scenarios, this paper is a study of current system as the change process is performed. The paper aimed at identifying the main mobility regimes and dynamics of low carbon mobility transitions to see what are the current pathways and most probable pathways in the scope of 2030 targets. A comprehensive review of related literature combined with stakeholder interviews in a qualitative data analysis process to see what the driving and restraining forces of transition process are and which innovations has the greater potential to get aligned in future mobility regimes. The paper contributed to transition studies through combining multi stakeholder and MLP approach for detailed investigation of passenger urban mobility transition dynamics. The results can also help urban mobility planners to know the factors that can help or challenge them in planning for more sustainable transport systems.

1. Introduction

Transport systems were introduced as the backbone of economic and social progress in the twentieth century (Gudmundsson et al., 2016), but beside all their positive functions, transport activities have several negative impacts including traffic congestion, pollution, greenhouse gas emissions, fatalities and injuries, energy consumption and other environmental impacts. Transport activities are the main cause of unsustainability patterns especially in urban areas. European Commission reported “Despite significant efforts to reduce emissions, transport has not yet achieved its decarbonizing targets. If these trends continue, transport is expected to contribute 50% of all CO₂ emissions in the EU by 2050, if not within the next two decades” (European Union, 2012). The European Union aims at cutting its greenhouse gas (GHG) emissions by 40% from 1990 levels by 2030, and continue this

course to an 80–95% reduction by 2050. To achieve those targets, the necessary transition to a low-carbon systems is under way.¹ Looking at the transport sector objectives for transition towards low carbon transport systems, EU programs reserved a specific attention to urban transport regarding the urban population in the EU (Schoemaker et al., 2012).

The world is increasingly urban and ever more mobile, urban mobility is acquiring more and more central role (Jiménez Herrero, 2011). More than 50% of the world's population (World bank, 2017) and around 75% of Europe's population (EC (European commission), 2012;² EEA, 2006³) live in urban areas. Cities highly affect the world's sustainability (Wittmayer et al., 2014) and are considered the key context to apply sustainable development and climate change policies and strategies. In Europe, 25% of greenhouse gas emissions, and more than 30% of the total energy consumed in 2010, was due to the

* Corresponding author.

E-mail addresses: mrdfnh@unife.it (A. Moradi), vgnmde@unife.it (E. Vagnoni).¹ Strategic note #17: Towards low emission EU mobility.² EC: European commission.³ EEA: European Environment Agency.

transportation sector (Staricco, 2013). Urban transport has been estimated to account for around 25% of the CO₂ transport emissions responsible for climate change, almost all attributed to road transport from which 58% is due to passenger transport (EEA, 2013).⁴ In this regards, sustainability is a key concern for modern transportation systems (Jiménez Herrero, 2011), and so for urban planning (Pinna et al., 2017) and the organizations involved in the process. Effective and integrated solutions for sustainability can only be found – and efficiently implemented – in cities and urban areas (Dodman, 2009; McCormick et al., 2013; Roseland, 1997; UN-Habitat, 2010; Wheeler and Beatley, 2010). Literature provides an analysis of the effects and the implications of transition in the transport sector. However, the focus of the studies is mainly on historical trends (e.g. from horse carriage to car, or from sail to steam ships, see Geels, 2002), or on forecasting future transition pathways and scenarios (Crozet and Lopez-Ruiz, 2013; Dhar and Shukla, 2015; Marletto, 2014; Silvester et al., 2013; Spickermann et al., 2014). This paper aims at filling a gap in transition literature focusing on the study of the current mobility regimes in practice, and on the definition of the dynamics affecting the transition process to low carbon urban mobility. Thus, the present paper is not a study of past trends, nor the study of future scenarios, but is a study of current system change factors as it is going on in practice. The paper contributes to previous studies of transition towards low carbon mobility systems by combining multi stakeholder and MLP approach in the detailed investigation of passenger urban mobility transition dynamics.

As a country of about 60% urban population (World bank, 2017), Italy has been chosen as the study context. The country has the second highest number of private vehicles registered in Europe, with 604 vehicles per 1000 inhabitants; this high motorization rate is caused by the lack of valid alternative transportation that fostered private ownership of high number road motor vehicles (Pinna et al., 2017). Furthermore, being Italy an EU member state, the European regulation and recommendation on sustainable urban mobility contributes to depict its institutional context.

The study aimed at identifying the current path of low carbon mobility transition in Italy through an analysis of passenger urban mobility system dynamics. In order to achieve this aim, the main regimes of urban mobility and the dynamics of the transition process that affect those regimes in all levels are identified. Thus, the main research question is expressed as follow: what are the most probable pathways for transition towards low carbon mobility?

Consequently, two secondary research questions have been developed:

- Which mobility regimes play an important role in low carbon mobility transitions?
- What are the regime dynamics at macro, *meso* and micro level?

To answer to the previous questions, a qualitative data analysis was conducted through the investigation of the scientific literature, administrative and national reports, enriched with interviewing urban mobility stakeholders.

2. Methodology

A qualitative research methodology was applied to identify the dynamics of transition towards low carbon urban mobility in Italy. The research aims at finding the most probable transition pathways by examining and analyzing transition forces through collecting literature evidence and empirical data.

Given the aims of this research and the available knowledge, there is

⁴ These are updated estimates for 2010 based on the PRIMES-TREMOVE model and are not from official statistics, a short description of the model is provided in the impact assessment accompanying the 2011 Transport White Paper.

a need to identify the factors that affect each dimension of current mobility regimes. Those factors are identified through the collection of qualitative data, recommended to be used when the investigated phenomenon is new and when the investigator seeks to answer “why” and “how” questions (Yin, 2014). Thus, a combination of different qualitative data gathering methods was adopted: literature reviews and semi-structured interviews, as described further in this section.

2.1. Data collection methods

Both primary and secondary qualitative data are collected in this research process. Firstly, a review of the literature on transition studies was conducted to identify the variables that affect emission reduction targets. To analyze the transition dynamics and identify the factors that affect the transition process and objectives we reviewed the literature on: urban transport management and mobility planning; emission reduction strategies, policies and challenges; and country reports on barriers and drivers of low carbon mobility transitions, both in Italy and in the international context.

The literature also used for identifying the main stakeholder groups. After that, specific stakeholders were selected from those groups, to share their viewpoints about the research questions. Thus, 11 individual face-to-face and 2 group interviews were conducted to discuss the mobility regimes and their dynamics. The groups of stakeholders, their related categories and representation bodies in Italy who participated in the interviews are presented in Table 1.

Interview participants were selected based on purposive sampling, which seeks to maximize the depth and richness of the data to address the research question (Kuzel, 1992). Here, respecting the multi stakeholder view, we tried to have at least one interviewee from each stakeholder group. In addition to knowledge and experience, the availability, willingness to participate, and ability to communicate experiences and opinions has been considered in the selection of interviewees (Bernard, 2002; Spradley, 1979).

The semi-structured interviews were conducted based on a ‘loose’ guide (Kvale, 1996). Thus, general questions were designed to open up the conversation about the topic, and a few follow up questions developed regarding interviewees’ role to clarify doubts and learn from the interviewees the real practice (suggested by Sekaran, 1992, p. 197 for face to face interviews). Semi-structure interviews were used because they allowed the researchers to develop new questions based on the ideas that may be formed during the interviews.

Interviews were conducted by both researchers at the interviewees’ work place; interviewees were acknowledged of the aim of the interview, at least a week in advance. All the interviews were conducted between September 2014 and September 2015. The interviews were recorded, and they last on average 75 min each. Memos were written during and after each interview to be used for developing questions in current or future interviews, as some interviewees pointed out the factors that needed to be handled or provided by other stakeholders (usually at higher levels of authorities).

Individual interviewees were the decision makers at international and national level (2) managers of local transport providers (3), head and managers of R & D sector in vehicle manufacturing companies (3), researchers including university and research center members engaged on sustainable low carbon mobility (2), civil society members (1) (nonprofit organizations, such as biking associations,).

Two focus groups were conducted with regional and local authorities of urban mobility system in which the problems and difficulties of public transport system and clean transport niches where investigated.

2.2. Analysis process

Data analysis started while the research process was still ongoing. The process of analyzing qualitative data began when the raw data were prepared through general reading, followed by careful reading and

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