Travel Behaviour and Society 2 (2015) 109–123

Contents lists available at ScienceDirect

Travel Behaviour and Society

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

Challenges and opportunities in developing urban modal shift

Paul Batty *, Roberto Palacin, Arturo González-Gil

NewRail – Centre for Railway Research, Newcastle University, School of Mechanical and Systems Engineering, Stephenson Building, Newcastle upon Tyne NE1 7RU, UK

ARTICLE INFO

Article history:
Received 2 July 2014
Received in revised form 19 September 2014
Accepted 6 December 2014
Available online 13 December 2014

Keywords:
Sustainable mobility
Public transport
Modal shift
Passenger quality rankings
Car usage control

ABSTRACT

Continued urbanisation, and the resultant increase in urban trips, presents one of the greatest challenges to the environmental, economic and social sustainability of society. Given that the modal split between transport modes has remained relatively unaltered in recent decades, this suggests that the levels of private car usage will lead to even greater levels of congestion and air pollution in urban areas. Therefore, a modal shift from private to public transport needs to be effected with urgency. However, whilst in theory this could be achieved with relative ease, numerous societal, political and economic barriers have thus far prevented such a shift from occurring. These have been analysed in detail, using a holistic approach which simultaneously considers all stakeholder needs. Recognising that traveller opinions and requirements are fundamental in effecting modal shift measures, the effects of public transport quality attributes on encouraging modal shift are discussed, accompanied by an updated version of the UK Department for Transport's hierarchy of public transport needs. This investigation then proceeds to analyse the effectiveness of methods to control urban car usage, before discussing solutions to address the barriers to a notable, successful modal shift, including guidance on how to design modal shift programmes. This paper provides useful and insightful guidance for all those involved in attempting to evoke sustainable mobility through a modal shift to public transport systems.

1. Introduction

The transport sector accounts for approximately 27% of the energy consumption and CO_2 emissions produced globally, and approximately one third in the European Union (OECD, 2010; IEA and UIC, 2013; IPCC, 2014). Of this, urban transport is responsible for 25–40% depending on geographical location, a figure that is expected to become even greater as levels of urbanisation and motorisation increase (OECD, 2010; EC, 2011). It is expected that by 2025 the global urban population will increase by 40% to 4.5 billion, resulting in a 50% increase in urban trips, with respect to 2005 (UN, 2007, 2008). Transport is a major source of urban air and noise pollution, and is often a major constraint on the quality of urban life (EAC, 2010; Banister and Thurstain-Goodwin, 2011; UN, 2013a). These negative externalities are worsened by congestion, which increases travel times and has a detrimental economic effect (EC, 2011). If the modal split between transport modes is left unaddressed, such problems will be further exacerbated, necessitating a substantial step-change in how urban transport is managed. While curbing mobility would reduce its impact, many parties are understandably opposed to this given its strong historic link to economic growth. Transport has significant and long-lasting economic, social and environmental impacts, and is thus an important dimension of future sustainability (EC, 2011; Haghshenas and Vaziri, 2012).

This demonstrates the need for two areas of focus for urban areas: firstly, to develop their transport system into a seamless, accessible, high-capacity, zero emissions model of sustainable urban transport and secondly, to promote a modal shift from private to public transport (PT), especially high-capacity transport modes. The benefits of modal shift are wide ranging; for example, it would help adhere to the increasingly stringent legislation at national and international level necessitating emissions reduction and air quality improvements (EC, 2008a, 2009a,b, 2011). Several European countries have failed to cut excessive levels of air pollutants in urban areas, which has already resulted in the European Commission (EC) launching legal proceedings against the Government of the United Kingdom – one of the offending countries (EC, 2014). The increase in PT usage over private car usage would also help facilitate societal benefits, resulting in an increase in physical activity and a reduction in congestion levels, traffic accidents and trip times (Rissel et al., 2012; Litman, 2013). The effects of stress brought on by congestion during commuting has been noted to spill over into the workplace, leading to increased absenteeism,

* Corresponding author. Tel.: +44 (0) 191 208 8645
E-mail address: paul.batty2@ncl.ac.uk (P. Batty).

http://dx.doi.org/10.1016/j.tbs.2014.12.001
2214-367X/

reduced job satisfaction and decreased task motivation, effects which are exaggerated by congestion (Wener and Evans, 2011).

Therefore, this paper aims to appraise common methods to achieve these goals from a global, system-level perspective. In order to achieve sustainable, long-term urban transport solutions, such an approach must be used, and should consider land use, transport planning, funding mechanisms and social, environmental and political requirements (Friman et al., 2011). However, before discussing strategies to encourage travellers to change from private to public transport modes, it is worthwhile to provide a brief background on the underlying reasons why specific modes of transport are chosen, which is presented in Section 2.

Fig. 1 describes the subsequent route this paper will take in understanding how to better effect notable, successful modal shift. It is generally accepted that both 'Pull' and 'Push' mechanisms are required to achieve this: 'Pull' mechanisms involve providing an attractive, accessible, affordable PT system that meets the needs of the travelling public, whilst 'Push' mechanisms aim to break private car use habits. Both will be analysed in detail in Section 3, with a particular focus on understanding how passengers rank individual public transport qualities, to allow for a better focus of investment.

However, encouraging private car users to use PT for a greater proportion of their journeys has historically been difficult to achieve to any meaningful degree. This is especially the case in urban areas, where a number of challenges stand in the way of success, in particular towards the success of 'Push' mechanisms. These include technological, cultural and regulatory factors, insufficient/badly-designed programmes to effect modal shift, and the fragmented information currently available to transport policy makers, operators and other relevant organisations (Farla et al., 2010). As such, Section 4 will describe and analyse several methods to overcome such barriers, with reference to both case studies and studies from academic literature.

All involved stakeholders should be aware of the successes and failures experienced in attempts to encourage modal shift, although it transpires that, thus far, many are not. Therefore, through the identification of good practices and amalgamation of information from numerous sources discussed throughout this paper, a series of recommendations for PT stakeholders will be developed in Section 5. They will provide insightful guidance on how modal shift should best be effected, allowing transport policies and funding mechanisms to be appropriately focussed to ensure maximum impact.

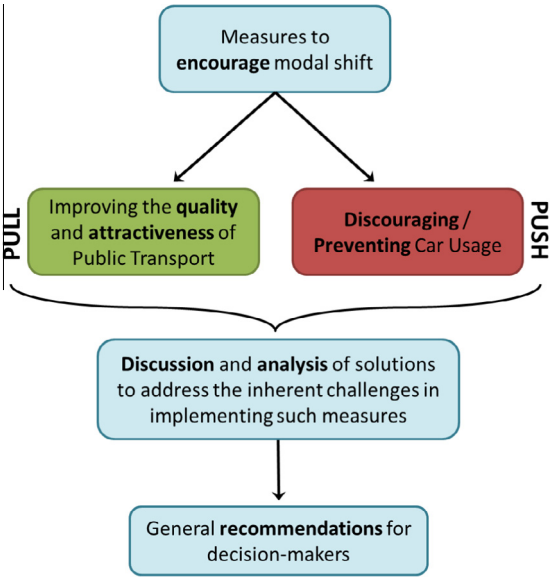

Fig. 1. Methodology used by this paper.

2. Modal choice

The use of private cars is an integral part of the life of many citizens, with many considering the convenience, flexibility and personal space afforded by private cars to be of significant importance (Vredin Johansson et al., 2006; Beirão and Sarsfield Cabral, 2007; Graham, 2010). Therefore, in addition to its perceived advantage as a symbol of status in society, it can often be difficult to instigate modal shift to PT, with many people being strongly resistant to attempts to effect this (Tertoolen et al., 1998; Thøgersen, 2009). Such habits and mobility routines play an important role in travellers' modal choice, which is strongly influenced by their socioeconomic background, values and perceptions about different transport modes (Lesteven, 2014; Skalska et al., 2014). Indeed, research by Lesteven (2014) suggests that the resistance to changing from private transport modes is such that a certain proportion of private car users continue to use their car, even when the congestion levels are of obvious detriment to their journey.

Research published in 2011 by the DfT found that 65% of interviewees claimed they were willing to change their behaviours to help address environmental issues, although only 42% claimed they were willing to do this by engaging in modal shift to PT (Department for Transport (UK), 2011). Furthermore, since the start of the recession in the UK in 2008 the negativity of these attitudes has increased significantly, suggesting pro-environmental behaviours are often only considered when people's lives are economically stable. However, recent travel behaviour research suggests that the dynamism in modal choice is higher than expected, presenting an opportunity for policy makers and PT operators to influence mobility behaviour (Skalska et al., 2014). Therefore, developing a greater understanding of what makes PT attractive/unattractive is an important part of improving PT quality and producing successful policies to encourage modal shift.

Multiple modes are necessary to provide an integrated, accessible and inclusive PT system, but at the core of this system must be a high-capacity, high efficiency mode. The two most common modes – BRT and urban rail – are now compared.

BRTs are most popular in cities with a high urban density and low car ownership, such as Latin American and Asian cities (Hensher and Li, 2012). They are usually more easily implemented than urban rail systems, and are commonly the most appropriate/cost effective solution for smaller cities (Tirachini et al., 2010). It is easier to add stations to a BRT system than it is for an urban rail system, in terms of the lower cost and design constraints, although reducing the distance between stations will intrinsically lower the speed of the trip, despite increasing accessibility (Hensher and Li, 2012). It is accepted that there is a social stigma attached to the low-income status of bus patrons, which dissuades many citizens from using it as a transport mode, although this may not be the case in some higher quality BRT systems (UN, 2013b).

By contrast, citizens have been found to exhibit a much more favourable opinion of travel by rail. This is exemplified in the work of Ben-Akiva and Morikawa (2002), who observed a notable preference for travel using a metro system over bus and BRT systems. They further highlighted that travellers reluctant to use buses may use urban rail systems, since they offer a perceived higher quality of service. Furthermore, (Rojo et al., 2012) found that citizens are much more willing to pay a premium for a quick and frequent rail service than for other urban transport modes, including bus and private car travel. In a study of 811 Stockholm commuters, it was found that, with regard to comfort issues, the bus was