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Exploring the impact of ICT on urban mobility in heterogenic regions

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Abstract

Information and Communication Technologies (ICTs) have been widely applied in the monitoring, operation and management of transport services, while they were proven to have a great potential to increase the efficiency in the use of urban transport infrastructure and at the same time reducing negative impacts on the environment. The aim of this paper is to explore the impact of ICTs applications in reducing carbon dioxide emissions and costs in different regions across Europe: a) Bucharest - Ilfov (Romania), b) Centro Region (Portugal) and c) Extremadura (Spain). Through different scenarios we estimate potential emissions savings and damage costs for carbon dioxide. The total emissions in each scenario were calculated using COPERT 4, while the estimation of the total emission costs was based on the updated values of damage costs (€ per tonne, 2010) that are provided from European Commission's Handbook on External Costs of Transport. Results show that ICT measures can have significant impacts in terms of costs savings and can contribute to the rapidly reduce of carbon dioxide emissions.

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Keywords: Information and Communication Technologies; Intelligent Transport Systems, Urban Mobility, Transport External Costs, Impact Assessment

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1. Introduction

Information and communication technologies (ICTs) have the potential to bring a significant change in the way people move, offering greater flexibility in their travel patterns (Banister, 2008) and contributing in reducing congestion, air pollutants, noise and fatalities (Baptista et al., 2012). Their use can greatly influence people's mobility behaviour as allow better planning and managing of their activities (Line et al., 2011) by providing them with real time information about traffic, delays, available transport modes and services etc. ICTs is already a key component in transport policy and have been widely applied in the monitoring, operation and management of transport services expecting to alleviate urban environmental issues (Cohen et al., 2002).

In many cities and regions of the world, the use of ICT tools in transport systems has brought significant improvement in terms of performance and reduction of congestion, emissions, noise, and road accidents. The Stockholm congestion charging systems decreased traffic around 20% and contributes to the reduction of emissions (Eliasson, 2008), while in the city of San Francisco, greenhouse gas emissions declined by 30% in areas like SFpark, where a smart parking system was installed (SFMTA, 2014). However, the transfer of an indisputable good practice from one area to another with different socioeconomic and environmental characteristics may not has the expected results. For instance, the annual report of Central London Congestion Charging Scheme showed in 2007 an increase of 5% in traffic volumes (Transport for London, 2008), while Percoco (2013) indicated in his study that the emissions reductions were insignificant in the city of Milan after the introduction of the road pricing policy.

In the last decades the extensive implementation of new technologies and tools in urban areas has led to a growing body of research on the impacts of ICT on road transport sector (Baptista et al., 2012). However, limited data on actual results have been published so far and to the best knowledge of the authors, there is no sufficient literature examining the transferability of such measures to different areas. Furthermore, the emissions reduction potential granted by ICT's contribution is rarely assessed economically. This work recognises that each ICT measure could have different effects based on their areas of application and there is need of extensive study (simulations, modelling, data collections, surveys etc.) before their deployment. However, the aim of this paper is not to develop a new or improve an existence methodology that estimates in detail the effectiveness of ICTs applications but to highlight their importance by exploring their potential environmental and economic impacts in a set of cities and regions with heterogenic characteristics.

2. Literature Review

The quantification of the potential environmental and economic impacts of ICT interventions in transport networks is impossible to be based on real world traffic measurements because of the complexity of transport systems (Grote et al., 2016). Various initiatives have tried to developed different approaches to simulate the effects of ICT measures on emissions, although the estimation of road transport externalities has to consider several uncertainties (Korzhenevych et al., 2014) and the existing emissions calculation methodologies have significant limitations in terms of data availability and reliability (Grote et al., 2016). Moreover, several studies have outlined a number of additional shortfalls of the existing traffic and emission models which are used to predict the impacts of ICT on mobility (Samaras et al., 2012) making each methodology more unreliable.

The ICT-Emissions project proposed a methodology based on the integration of various simulation models (vehicle control model, traffic model and emissions model) in order to estimate the impacts of ICT technologies on carbon dioxide emissions (Monzon et al., 2017). The combination of the different models require several sources of information and also data collection to acquire the necessary input data (Samaras et al., 2012) but in most cases governments and transport authorities lack the resources for modelling and data experiments (Grote et al., 2016). The ICT-Emissions methodology is aiming to simulate with great accuracy the effects of the measures (Monzon et al., 2017), although the use of complex models has greater demand of input data in terms details which is more sensitive in regards of estimation and collection (Grote et al., 2016).

In Finland, a transport policy tool for the reduction of carbon dioxide emissions was developed which estimates the impacts of the interventions based on trends and forecasts. Unfortunately, the entire methodology requires also a number of data sources (travel surveys, statistics, trends etc.) (Järvi et al., 2015) subjected the whole procedure depends on data quality and availability.