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Can new communication technology promote sustainable transport?

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Abstract

Under business-as-usual projections, global car ownership and travel will continue to rise. In future, oil might still be available at higher prices than today, but the climate change implications of oil use will remain. As evidenced by the continued rise in global transport GHG emissions, conventional proposed solutions for mitigation are not working. Accordingly, this paper examines whether the new information technologies can contribute in a major way to the environmental sustainability of global passenger transport. The main finding is that the two technologies considered here—travel substitution and smart cities—could potentially increase or decrease greenhouse gas emissions. Nevertheless, both travel substitution and smart transport, if given the right policy support, could be important means for enabling people and organisations to cope with the need for reduced travel in a climate-constrained future.

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Keywords: global climate change; ICTs; smart transport; sustainable transport; travel substitution.

1. Introduction

Conventional solutions for mitigating transport's impact on climate change, all already used to some extent, include a shift to low carbon transport fuels, major improvements in vehicular fuel efficiency, modal shift, and travel reductions. As evidenced by the continued rise in both transport and GHG emissions [1], these technical fixes are

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not producing the deep transport GHG cuts urgently needed [2]. Dray et al. [3], writing in a European Union context, have argued that meeting transport CO_2 reduction limits needed in that region for 2050 by technical means alone will not be possible, even under optimistic assumptions about adoption rates for vehicle efficiency improvements and low-carbon fuels. In the US, the Federal Highway Administration data show that fuel efficiency is now falling in the US for all light vehicles, and that overall road vehicle-km is again rising, surpassing the previous 2007 peak in 2014 [4].

Given the limited effectiveness or even feasibility of other options, this paper will discuss two alternative approaches to passenger transport GHG reductions, both based on the new communication technologies (CTs). Nowhere is technical progress occurring as rapidly as with the new CTs, as exemplified by Moore's 'Law' for computer technology: for over half a century, the number of transistors on each computer chip has roughly doubled every two years. It is not surprising that some have seen the application of CTs to transport as a key to the resource, pollution, congestion and even cost problems faced by passenger transport. Funk [5] has argued that such application will transform transport by enabling better system design and lower transport costs. Although the possible applications of CT are many, they are here grouped for convenience into two broad categories, treated in turn in the following sections: travel substitution by CT, and 'smart transport,' partly based on 'big data.' Each approach has a long history, preceded by decades the rise of the Internet, various data-gathering platforms, and smart phones. What is new in this paper is a discussion on the transport effects of both approaches being deployed together—as is likely in practice.

Nomenclature

CT	communication technology
GHG	greenhouse gas
OECD	Organization for Economic Cooperation and Development
PTA	Personal Travel Assistant
ST	smart transport

2. Travel substitution by Communication Technology

There has long been a debate as to whether telecommunications and travel substitute or complement each other [6]. The long-term historical record is clear: both have risen in step, with ownership and use of both cars and phones rapidly expanding over the entire 20th century. With the rise of the personal computer in the early 1970s, together with the two oil supply crises of that decade, interest increased in the possibility of 'tele-commuting' (then interpreted as working from home using a desktop computer) as a means of saving (imported) oil [7]. It was also promoted as a way of saving personal commuting time and money costs. The rise in public adoption of the Internet since the early 1990s, and more recently, smart phones and social media, has spurred further interest in this topic. Not only tele-commuting, but tele-shopping (especially for information goods and services), tele-medicine and tele-education (in the form of massive open online courses), are now well-established. The question is of course, whether they have had any discernible effect on travel.

The arrival of peak travel in a number of OECD countries has raised the possibility that CTs, particularly the widespread use of smart phones, are now being used as a substitute for travel [8]. However, they are a variety of other possible causes for this decline, and it is unlikely that a single cause will be responsible in any country. A list of the more important reasons could include:

- Rising overall travel costs over the relevant time period
- Falling average travel speeds over the relevant time period
- Changing demographics, with a higher proportion of age groups that travel less in the general population
- Changing urban land uses which promote less vehicular travel
- Changing population attitudes towards vehicle licence-holding, travel, and the environment
- Changing spatial inequality, with a higher share of high income households living in areas with lower transport needs, such as the inner suburbs of cities