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Reducing the Need of Travel through ICT

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Abstract— This paper is concerned with the Climate change and on the increasingly urgent search for "green growth," that is to say for alternative economic strategies that meet the needs of the present without compromising the opportunities of future generations. It is also widely recognized that new technologies, particularly ICTs, play very important role in achieving this reduction. The Climate Change Act commits Government to legally binding carbon budgets and an overall emissions reduction of 34% by 2020. Transport must therefore play vital role in achieving this reduction. Although this strategy recognizes there can be opportunities for reducing the need to travel through the use of information technology, it does not identify any specific policies to achieve this or to contribute to the 14% reduction identified. Making mobility sustainable is not only about reducing CO2 emissions though. It can also help reduce congestion, improve health including reducing obesity levels, improve air quality; reduce noise, and increase wellbeing and social cohesion.

Keywords- ICT, Climate change, CO2 emissions, etc

I. INTRODUCTION

Information communications technology (ICT) could play a vital role in bringing the vision for convenient, joined up, multi-modal sustainable mobility to reality. In order for the Mobility 2020 vision to be achieved, ICT would be needed to ensure that people could easily find accurate and up to date information on how they could make their journey, how long it would take and how much it would cost. Having chosen their preferred option, it would allow them to make reservations, book tickets or simply know where to go. It could also ensure they were able to get the best price and pay for their journey quickly and conveniently. Once travelling, ICT could help ensure the journey was made as efficiently as possible, that any delays were minimized and even that the journey time itself could be productively used. Of course ICT could also reduce the need to travel altogether. It was therefore decided
to explore the potential for ICT to support sustainable mobility.

The use of ICT in transport is a large and diverse subject and covers a much broader scope than purely improving the sustainability of transport. The IT industry has claimed for some time that it could reduce global emissions by as much as 15 percent by 2020 – a volume of CO2 five times its own footprint.[1] Transport and logistics are among the areas where it is claimed that the most significant contributions could be made.

Where ICT can help

The role that ICT can play within these four categories is examined in more detail in the following section.

1. Reduce the need to travel
2. Influence travel mode choice
3. Change Driver behaviour
4. Change Vehicle behaviour

1. Reduce the need for travel

ICT can facilitate travel demand reduction through video-conferencing and telepresence systems, net meetings, voice over internet protocol (VoIP) systems such as Skype and Hotmail messenger which now include video facilities, facilities to enable home or remote working (including work hubs), shopping ordered from and delivered to homes, and even via synthetic environments such as 'Second Life'.

1.1 Home Working

According to the Smith Institute's report Can Homeworking Save the Planet? The necessary equipment to turn an office worker into a homeworker is a high speed broadband connection, a telephone line and a laptop.[2] The report reviews the available evidence for carbon reductions attributable to homeworking and concludes that "It is highly likely that, in most circumstances, homeworking is positive in carbon terms, and often considerably so." The likely net reductions in travel would also reduce accidents, air pollution and noise. There is some evidence that while the daily commute may be avoided, home workers make additional journeys during the working day.[3] Overall though, the evidence indicates a net reduction in travel is likely. A study found that British Telecom (BT) teleworkers reduced their car travel by 193km per week on average despite making additional trips that they would not have made if working from the office.[4] The conclusions of this report into the sustainability of teleworking were mainly positive

1.2 Video Conferencing

ICT offers a realistic alternative to physical meetings. In other words, if reduced travel is an aim, videoconferencing is a powerful tool to help achieve it, provided that the policy context is right. More sophisticated forms of video

conferencing exist such as telepresence which utilises large video screens to create life-size images of meeting attendees giving the illusion that everyone is sitting around the same table in the same room. This enables participants to interact in a more natural way. However, it should be noted that the energy consumption of such systems is not insignificant. Anecdotal evidence received in the course of research for this project indicates that a telepresence meeting between offices in the same city might use more energy than travelling to meet face to face.[5] Estimates received from one source suggested that telepresence units use between 0.4kW and 14.2kW per room depending on the size of the facility(and including extra air conditioning and lighting requirements). A WWF report suggests that the carbon footprint of video conferencing is approximately 2% of flying if 'rebound' effects are excluded.20 In a demonstration of Cisco's Telepresence system, SDC was told the energy consumption of the system was approximately 3kW per room.[6] It should be noted that a comparison of energy use between video conferencing and travelling to a meeting does not take into account the additional sustainability benefits of not travelling which include reduced congestion, air and noise pollution, and risk of accidents. Last year Tata Communications launched a worldwide network of both public and private telepresence rooms. By offering 'hosted' rooms that can be booked by the hour, they enable smaller businesses who may not be able to invest in the technology for themselves the chance to benefit from this technology.[7]

1.3 Synthetic Environments

Perhaps the most extreme or unusual use of ICT for travel avoidance is through the use of synthetic environments such as "Second Life". Here users create 'avatars' – fictional characters which inhabit a virtual world via the internet. Users can meet, converse, give presentations and hold workshops within this virtual world.

There are many other examples of the potential for ICT to reduce the need to travel. Internet shopping with home delivery is increasingly popular. Online banking, rated as the second most useful online activity[8] has reduced the need to visit a local branch. Other examples include direct streaming of films and music via high speed broadband; transactions such as vehicle excise duty payment online; and the post office's website allowing payment and home printing of stamps for parcels. Indeed the growth area now is expected to be the move of services such as online banking to mobile phones.

II INFLUENCE TRAVEL MODE CHOICE

Once the decision has been made that a journey is necessary, the next area in which ICT can help promote sustainable travel is by influencing the choice of the mode of travel. This can be done in a number of ways:

2.1 Mode specific journey planning

There are various journey planning tools available which are tailored to specific modes for example bus, train, car, bicycle or walking. The website www.WalkIt.com provides users with recommended walking routes in UK cities. The site provides information on the time the journey will take, the number of calories burnt and the CO_2 emissions savings through avoiding motorised transport. According to the website's developers, surveys of their users show almost 80% have been encouraged to switch away from a motorised mode to walking at least once.[9]

2.2 Multi-modal Journey Planning

Websites such as www.transportdirect.info and www.traveline.info allow users to plan their journey by choosing between different modes and by examining the price, time taken and, in the case of TransportDirect, an estimate of the carbon dioxide emissions resulting from their choices. Globally there are many more examples of travel and trip planning information being made available through websites and mobile phones. Google's "Transit" pages allow users to plan journeys using public transport in over 260 towns and cities across the world. A website shows real-time locations of all buses and trams.[10] Stockholm's planner also has real-time information on buses and trains and is available via mobile phones.[11] In Switzerland, the movements of all trains on the entire rail network can be tracked on the http://www.swisstrains.ch website an unofficial "mash-up" of Google maps and timetable information (rather than actual train positions). In Japan, the travel planning site http://www.hyperdia.com/cgienglish/hyperWeb.cgi offers information on both high speed and normal train services and allows cost and time comparisons to airline services. Nokia has integrated its phone-based map service more closely with its PC-based "Ovi" service. Users can plan the route on a PC then synchronise it with their phone. This makes it easier for the user and also means that the route processing doesn't have to be done on the phone itself. The website www.travelfootprint.org focuses solely on providing information on the environmental footprint of your journey and transport choices enabling users to compare the carbon dioxide, nitrogen oxides and particulates emissions associated not just with the journey itself, but the fuel and vehicle production.

2.3 Improving the travel experience

ICT can influence travel mode choice in less direct ways, for example through the use of ICT to make a mode more attractive. Examples of this include the provision of wifi internet connections on trains, buses, coaches and even ferries. The ability to stay connected and turn travel time into productive work time can be a significant attraction for business travellers ICT can also help make travel more convenient. The internet is increasingly being used to book tickets in advance of travel which can then be picked up at automated ticket machines often avoiding queues. Services are now available to try to reduce the inconvenience of congestion, cancellations and delays. For motorists, the Highways Agency's traffic website allows users to check real-time traffic information[12] and also to review predicted traffic conditions at different times of day[13] for a specific journey they are thinking of making. Predictions are based on historical data. This service can be more useful than real-time congestion information which is often too late for the traveller

to take action. Predicted data allows people to make changes to their travel plans to take account of likely congestion and could help to make more efficient use of the road network. Google Maps includes a "Traffic" feature which uses traffic information from the Highways Agency for the UK, and at the time of writing also covers large parts of France and America. The system enables users to view "live" traffic conditions as well as the predicted conditions at any given time and day of the week. However many drivers do not check road conditions before travelling - 62% say they never do.[14]

III Change Driver Behavior

There are many ways that ICT can be used to influence driver behavior. The most significant potential for improving sustainability in this area, due to the number of vehicles, is influencing car drivers to drive in a more fuel efficient and safer manner. Drivers of public transport buses and trains and freight operators can also benefit from this technology.

There are a number of specific technologies to cover in this area:

- Enforcement technologies
- Intelligent Speed Adaptation
- Satellite navigation
- Eco-driving

3.1 Enforcement technologies

Perhaps the most well-known example of ICT influencing driver behaviour is the use of cameras to enforce speed limits. Although controversial, Department for Transport evidence is clear that their use reduces speeds, accidents, deaths and injuries.[15] Enforcing the speed limit has also been shown to be a very cost effective way of reducing CO2 emissions from road transport with estimates of a reduction of 1.4 million tonnes of carbon dioxide simply by enforcing the 70mph speed limit.[16] DfT data shows 52% of cars exceed the motorway speed limit. Cameras which measure average speed over a distance are becoming widely used on motorways. These have the advantage that it is not possible to slow down briefly to avoid detection, and also avoid instances of dangerous sudden braking as can happen with traditional speed cameras. In 2009 the Home Office approved average speed cameras to enforce speed limits in urban areas. Cameras are networked together and can be placed at entry and exit points to an area with a fixed speed limit, for example 20 or 30mph. By measuring the time between a vehicle entering and leaving the zone and knowing the shortest route between the entry and exit points, the system is able to calculate if the driver exceeded the average speed limit. Better enforcement of urban speed limits and the adoption of 20mph speed limits in residential areas could have very significant sustainability benefits. Currently 49% of vehicles exceed the 30mph limit. Higher levels of compliance would reduce accidents, deaths and injuries. If drivers adopted slower, smoother driving styles then it would also reduce fuel consumption. By creating a safer urban environment, it would also encourage more people to walk and cycle for short journeys.

3.2 Intelligent Speed Adaptation

Another technology that is currently being examined is the use of 'intelligent speed adaption' (ISA). ISA allows the speed of a vehicle to be automatically limited according to the speed limit of the road on which it is driven. The technology was first investigated by the Department of Environment, Transport and the Regions between 1997-2000. Between 2001-2006 the Department for Transport conducted the ISA-UK project with extensive field trials involving 79 drivers. The report on this work looked primarily at the safety benefits and concluded that "substantial reductions in excessive speed and thereby considerable benefits in terms of safety" could result, with, interestingly "56% of participants approving of compulsory fitting of ISA to all new vehicles."[17] A more recent report by the Commission for Integrated Transport looked at the wider environmental benefits. This suggested that mandatory fitment of ISA to all cars over a 60 year period could result in savings of 25 million tonnes of carbon as well as improving safety.[18] It identified four types of ISA:

- **Advisory** - in which the driver is simply made aware of the current speed limit and warned when it is exceeded
- **Voluntary** - in which the system is linked to the vehicle drivetrain (engine management and possibly braking system) and controls the vehicles' speed to ensure it does not exceed the current speed limit, the system being over-rideable by the driver
- **Mandatory** - as per a voluntary system, however there is no option to override
- **Dynamic** - a system which in addition to knowing fixed speed limits can also acquire information about variable speed limits such as those used on motorways during bad weather or congestion.

3.3 Satellite Navigation

In addition to influencing behaviour prior to the start of the journey in the route planning stage, satellite navigation can also change driver behaviour during the journey. Research commissioned by TomTom suggests that drivers using satellite navigation travel fewer miles and for less time. The study also measured a reduction in driver workload when using Satnav devices allowing drivers to give more attention to the road and potentially improving safety and reducing accidents. A further study conducted by NuStats and funded by Navteq found drivers in Dusseldorf and Munich using satellite navigation benefitted from a 12% reduction in fuel consumption compared to those without. Some satellite navigation systems also display the speed limit on the road currently being used and allow the user to set an audible alarm to warn them not to exceed it. Garmin's Ecoroute system allows the user to choose the route which will use the minimum amount of fuel and can provide fuel and mileage reports. A new Eco-Satnav range was unveiled by Vexia which will advise the driver on how to drive to minimise fuel, indicating what gear to use, and the optimum acceleration and speed.

IV Change Vehicle Behavior

There are various ways in which ICT can be used to ensure vehicles operate more sustainably. Automated reminders for routine servicing, tyre pressure monitors and engine

management system self diagnostics can help ensure that vehicles run at optimum efficiency. A GPS-based database of speed limits can be linked into a vehicle's cruise control system to automatically set cruise speeds. More recently technologies such as collision avoidance, lane keeping, blind spot radar, night vision systems and even driver alertness monitors and speed limit sign reading have become available. These technologies are primarily aimed at improving the safety of drivers though some also improve vehicle efficiency. There are also examples of ICT being used to improve safety through providing advanced warning of hazards such as obstacles or other vehicles, the presence of emergency vehicles, or reduced surface grip.

V. Conclusion

The research for this report demonstrates that there are many ways in which ICT can help to make mobility and our lifestyles more sustainable. Whether it be through enabling us to avoid the need to travel at all, or by making public transport easier to use and more attractive, through helping us to make more efficient use of cars or by optimizing the use of our transport networks. We also recognize there are challenges. In pursuing these recommendations, care must be taken to ensure that the overall full life cycle impacts of the use of ICT are taken into account, and the necessary funding is provided for hardware and software support, maintenance and updates. It is also important to be realistic in assessing the extent to which travel behaviors can be influenced, and to be sure that encouraging ICT based solutions doesn't lead to increased social exclusion. Overall, we conclude that ICT must be seen as an enabling tool within a wider sustainable transport policy framework designed to create sustainable travel behaviours.

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