The climate and energy challenges for transport research and innovation

The essence of what I will be seeking to argue is that, meeting the challenges of the EU's Energy Union vision and of COP21 will require a paradigm shift in the transport sector. A paradigm shift that goes far beyond the technical challenges of automation, electrification, alternative fuels, tangible break-throughs in vehicle and infrastructure design, manufacturing, monitoring and maintenance technologies, smart telematics and mobility systems.

I will be arguing that the potential of research and innovation can only be realised if we accept the importance of a user focus. A realisation that, unless there is a command economy of the sort that is no longer thought to be compatible with Europe's democratic values, pull is usually more important than push. And that it is pull that will do more than anything else successfully to bring research and development across the 'valley of death' by which it is separated from innovation and market up-take.

Understanding users' needs and aspirations is a pre-condition of success. Any research, innovation and competitiveness strategy must include finding better ways of understanding people's behaviours and the potential contribution of appropriate policy tools, including regulation, to help shape those behaviours.

A second horizontal theme in what I will be talking about is the importance of an holistic approach to our subject: thinking systemically, looking for the impact of what may be going on the whole range of sectors or industries, being alive to any unintended trade-offs or collateral damage caused to other areas of public policy concern such as restraint of personal mobility or economic growth, health impacts, minimising congestion or optimising land use.

I'll also be seeking to argue another theme: some parts of the transport sector strike me as unusually inward-looking, inhibiting the chance of effective paradigm shift – at least for their bit of the transport world. Perhaps they'll be left behind, just withering away.

Or perhaps they will wake up in time to the opportunities arising from a focus on decarbonisation and the demanding implications of the transformation required of the transport sector and to which the Union is committed – joint fulfilment of the binding target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990 and a 60% reduction in transport emissions by 2050.

This is unlikely to be achieved without breaking out from the inward-focussed, self-applauding silo-thinking that provides a seemingly protective comfort-zone for some modes today. And it won't be achieved successfully without a readiness to draw more widely on the experience of other sectors, other industries, to draw in expertise from the energy sector, from advanced manufacturing and nanotechnology, from biometric research and from the digital world.

By the same token, policy makers need to be seen to recognise that the challenges faced in relation to decarbonisation are not driven by climate change alone. These challenges also relate to other powerful drivers, like increasing urbanisation and land utilisation and congestion or to the wider health impacts of our transport system. Transport generated noise pollution – possibly best

principally understood as a sub-set of health impacts - is already a sensitive political issue in a number of member states.

Perhaps more significantly, there is mounting concern about the obscenity of the 400,000 premature deaths each year that the European Environment Agency estimates are attributable to poor air quality, particularly the fine particulate matter and nitrogen dioxide emissions caused principally by road vehicles. This is more than 15 times the number killed in road accidents in the EU.

A significant proportion of that deadly pollution is attributable to non-exhaust emissions, such as road, tyre and brake wear. In itself a reminder that electromobility is only part of the answer to the downside aspects of road transport. In some ways, the vision of platooned, autonomous and electrically fuelled road vehicles is analogous to a network populated by trains on tyres. But we must be careful not to overlook the high proportion of deadly emissions that, according to research by TRL and others, can be attributed to tyre, brake and road wear – especially so in the case of heavy vehicles.

When thinking about the Strategic Transport Research Agenda we need to take an holistic view. But we must also always be wary of unintended trade-offs, mitigation of one set of problems obscuring, or worse, accentuating another set of problems.

Electromobility based on a sustainably sourced energy mix may be part of the answer to the first. But, in the absence of other changes in our social organisation, our business models and economic priorities, what are the likely impacts on the debilitating social and economic effects of congestion? Can the full potential of electromobility be properly realised without the benefit of traffic management systems that optimise the use of road space?

Perhaps this will be eased by the development of autonomous vehicles. But can autonomy be divorced from the need to consider the development of effective, regulated system conditions? System authority may be common place in the aviation and rail sectors. But are the users of the road transport network ready to adapt to the imposition of the previously unfamiliar levels of authorisation and safety validation essential to system viability? How might it sit with, and what will it do to, the personal mobility culture that has increasingly dominated individuals' life styles and attitudes over the history of the internal combustion engine?

And even assuming that we find affordable and practical ways of procuring the sustainably-sourced energy required for full electromobility, even assuming that we learn better how to distribute it or store it and cope with peaks and troughs in demand, even believing that we can identify the appropriate means for effective system regulation, what are the collateral challenges?

What about those wider health impacts of tyre, brake and road wear and the 400,000 premature deaths in Europe that, in relative terms, might make our concern with road safety seem disproportionate – even if not all are attributable to the effects of road traffic?

What about the effect of a successful migration of road traffic to electromobility and autonomous vehicles: what priority should we give to minimising the demand for road – and parking – space? I've already suggested that the answer may lie, at least in part, with intelligent traffic management systems. Should we be seeking to regain road space for other social uses? Barcelona has announced

plans to turn nearly 60% of its streets currently used by cars into 'citizens' spaces', with the idea of mini-neighbourhood blocks, around which traffic flows will be diverted, with the expectation of achieving a desired reduction in traffic levels overall of more than 20%.

Can we afford the space for – and will we still need – vehicles that are individually owned, as opposed to investing in ways of securing a shift to collective forms of individual mobility? Tom Voege has argued a compelling case to the Parliament's TRAN Committee for a shared mobility concept, shifting the focus from vehicle ownership to vehicle user-ship, with dramatically improved vehicle utilisation and loading.

Are we on the verge of a mushrooming of collective vehicle use? How might this impact on attitudes to property or, indeed, the individual needs' states that marketeers so successfully identify and seek to satisfy – the signified and the signifiers, to borrow from the language of semiotics? A Porsche no longer the signifier of success; a Volvo no longer the signifier of the boringly responsible middle-aged bourgeois (I have owned one for years)? And what might a business model so radical do for our economic and social framework?

Now although I have emphasised the importance of understanding the needs and aspirations of end-users in facilitating a successful transition from research and development to innovation and market uptake, I don't want to give the impression that I believe this understanding is sufficient for success. Realising a great innovation can often depend on great marketing – making the crucial link between peoples' needs states and the qualities of a new product or process. Establishing what the signifier may come to signify to the end user.

With the possible exception of everyone in this room and the imagineers in the computer graphics industry human beings generally find it difficult to think beyond their silos. The world that they know.

Much of what I know comes from my professional years working in the media internationally, often at the frontiers of new technology and broadcast innovation. One of the things that I learned was that we are extremely bad at spotting how a new technology might evolve to serve us.

The pioneers of the electric telegraph system – the nineteenth century internet – had a very limited concept of its potential. When the first electric telegraph in England was extended 30 kilometres west from London along the route of the railway to Bristol in the early 1840s it was advertised as a means of ensuring that a horse or carriage of choice could be arranged to meet one off the train. Despite these limited aspirations, the electric telegraph went on to under-pin the nineteenth century explosion in world trade and international finance as well as to form the nerve system in military operations.

Thirty-five years later we got the telephone. Once again, expectations were limited. Even Alexander Graham Bell, who secured the first patents on it, failed to anticipate its scope. He saw it as an instrument that might be used to call up one's servant.

Another thirty-five years on, radio broadcasting got off to an equally inauspicious start. The Marconi Company, the great pioneer of long distance wireless transmission found itself in endless disputes with other key players whose support it needed to advance secure take up for its innovatory ideas. A

Select Committee of the British Parliament, set up to bring reason to these fraught debates, lamented that the main defect of wireless transmission arose from the inability to control its direction since any receiving station could hear its messages.

It took the genius of David Sarnoff, who went on to lead RCA, to turn this perceived short-coming into an advantage. He foresaw the potential of wireless as a mass medium. He proposed that the broadcast of the radio signal could be harvested by receivers designed as what he called radio music boxes. Ten years later, the radio revolution in mass media was slowly beginning to take hold.

Early expectations of television were sometimes similarly at odds with what transpired. A pre-war UK government committee, charged with advising on the development of the fledgling television service, thought it most sensible to use it as a means of distributing material to cinema audiences, dismissing ideas about broadcasting television signals direct to viewers in their homes.

I have made this diversion to underline what I consider a crucial point. Even great technology innovators are inclined to be wrong in foreseeing how what they have come up with might be applied. The supply-side is important. But application and uptake is ultimately determined by the demand-side and by the ability of gifted marketeers to link that demand with product potential.

This has a number of implications. First, perhaps there is more that we can do to understand the potential for innovation and eventual up-take at an earlier stage in the research and development process. Andrea Ricci, the current chair of the Commission's Transport Advisory Group, made an effective plea at the TRA in Warsaw for users to be involved at a very early stage in the Technology Readiness Levels. He was adding a further dimension to comments from Commissioner Bulc who spoke enthusiastically about the need to 'bring users on board, including users in all projects and hearing their needs and what they are willing to pay'. Technological breakthroughs in isolation won't secure innovation and market uptake: relevance to the needs of consumers and other end-users and responding to changing societal challenges are surely key links between research and development and market uptake.

Let me illustrate this with the aspiration to achieve significant modal shift aspired to in the Commission's 2011 Transport White Paper: greater use of collective transport and away from the private car.

If modal shift to public transport is to be encouraged, we need to think much more in terms of facilitating end-to-end journeys. The implications range from the provision of passenger information – times, location of access points, prices, facilities – to enabling easier multi-modality with, for example, user-friendly nodes through to the fleshing-out of concepts such as mobility as a service.

We need to think about trips, whether for passengers or products in a way that is modally neutral. We need to identify ways of facilitating the ability of potential users to make informed judgements on the basis of what mode, or combination of modes, best fits journeys centred on user needs.

I am actively involved in the work of the European Passengers' Federation. It is engaged in consumer advocacy at European level. It links well over 30 national and regional users' groups in 20 European states. EPF has been following the debates and activities around COP21 particularly

keenly. We had healthy discussions on decarbonisation – indeed I spent part of last weekend in one such debate in Copenhagen.

The over-riding view of EPF's membership is that for passengers, especially those living and working in urban areas, the most effective and sustainable answer to the challenges of decarbonisation, congestion, pressure on space and creating a healthier environment is likely to be a step change in the quality of public transport provision whether by road, light rapid transit or rail. EPF stresses the importance of creating a transport system that passengers find affordable, dependable, efficient, comfortable and accessible at times they need it. But their thinking is not limited to just the vehicles, infrastructure, information systems and staffing.

They take a more rounded view. They understand the importance of integrating transport provision and spatial planning – the way we lay out and organise our settlements. They see transport as an enabler of wider policy goals whether economic, social or environmental. They recognise that meeting the challenge of decarbonisation will require both technological advances and behavioural change – both in society as a whole and, particularly, in the stance of transport providers – as well as co-working between disciplines and sectors.

I spent the first part of this week at the TEN-T event in Rotterdam. On Tuesday I moderated the Netherlands Presidency's business conference on Rail Freight Corridors to boost international rail freight. The focus was provided by a forward looking statement developed by the sector, paralleled by a Council declaration, the Declaration of Rotterdam. This emphasised the effort needed to secure the goal to shift 30% of road freight over 300km to rail and waterborne transport by 2030. The Ministers' Declaration gave strong support for the market oriented development of what they see as the environmentally beneficial Rail Freight Corridors, conceived as the back-bone of the TEN-T network. The Council is clear that these corridors contribute to seamless transportation across Europe, especially when integrated in intermodal transport chains.

The Declaration ends by acknowledging the value of an EU harmonised infrastructure for Information and Communication Technology and of sharing data within the logistic chain, emphasising the importance of governance structures, the importance of resolving infrastructure bottlenecks, regulatory inconsistencies, aligning capacity allocation with market needs. Above all, the Council emphasises that the success of the corridors will depend on the benefits that they bring to shippers and end customers in purchasing transport services as well as to society as a whole in the form of environmental and health benefits – engaging with users and end-users. As such, the intention of the Declaration is near faultless. Its impact, however, will depend on procuring a positive response from one of the more inward-looking and least proactive parts of the transport sector.

I am conscious that I have focused on land transport and said little about the decarbonisation challenge for the future air travel. Here I face a dilemma. I regard mobility as a fundamental right. I recognise the vital role played by long distance travel both in achieving the goals of economic growth and in satisfying human curiosity. I find it extremely difficult to square this with meeting the challenge of decarbonisation.

For some years I argued that people making shorter air trips – say those up to 1000 km - might be better diverted to high speed trains. I was aware of the collapse of air travel on routes like Paris to Brussels, London to Paris or Paris to Lyon in face of dependable high speed services. I was drawn to the notion that an added benefit of linking airports to high speed train routes was the way that, by shifting passengers to rail for shorter trips, scarce slots could be released for use by long-distance flights. But I am not sure that the facts sustain this view. I am told by the UK Department for Transport that the elimination of domestic air links would release less than 1% of slots at London's main airports. Not an answer to the airport capacity problem.

In terms of NOx emissions, I understand that although Heathrow airport is a significant contributor, aircraft movement is by no means the largest cause. Most NOx emissions in the Heathrow locality come from general road traffic. Reading the aspirations of the Clean Sky 2 joint undertaking I am struck by the confidence expressed in successfully delivering a 20-30% reduction in fuel burn and related CO_2 emissions. We need to think holistically when it comes to reducing emissions – think of air travel as part of a wider system, including airport access.

Can more be done in terms of developing and delivering surface access strategies that will contribute to a significant improvement in air quality around airports? Is investment in research into clean local access transportation likely to yield greater dividends over-all than by stifling the network for air travel? And what is the potential of policy tools such as ensuring that fiscal policies to create a level playing field between modes and a better modal split? Aviation fuel duties, the applicability of value added tax and so on.

Which begs a question about how best to nudge forward the necessary behavioural change, both at the individual and at the institutional level. The transition to automation and greater digitisation is bound to be challenging both to predict and to deliver smoothly. And what of the management of the transition stage itself? What will be the inter-action between fully automated and non-automated vehicles, even between automated vehicles and random movers like pedestrians and cyclists? Then there are ethical issues that need to be explored, ranging from data privacy to blunt moral issues around no-win dilemmas – as someone from the automotive supplier industry recently described it, programming a vehicle to make a choice between colliding with a cyclist or a broken down school bus. Then there is what the chair of the Programme Board of Drive Sweden, Catharina Elmsäter-Svärd memorably described as the 'Oh, Shit!' factor: the point at which an unexpected technical glitch is encountered, with possibly disastrous consequences. We need to anticipate, explore and begin to answer such challenges.

Do we yet understand sufficiently the likely needs, demands, acceptability or possible areas of resistance to automation and digitisation? What is the right framework in which to support and encourage research, innovation and competitiveness in the transport sector?

The benefit of investment in research and innovation is easily lost without deployment. Do we understand sufficiently the barriers to and drivers of progress in this area? I am suspicious of the traditional conservatism that characterises some parts of the transport sector – particularly rail. Those who hail from those parts where there was, and to some extent remains, an ambiguity as to whether

the state or the end user is the primary client, seem unwilling to develop a commitment to consumer understanding. Why aren't transport operators more like good retailers?

The increasing awareness in the transport sector of the potential if ICT and data sharing, magnified by conveniently labelled broad concepts like the Internet of Things or Big Data, may provide the opportunity to plug this gap. Transport researchers, operators, service suppliers and manufacturers potentially have a fantastic new resource with which better to understand people's mobility needs empirically. How should access to these new data streams be controlled? Is there a case for the regulation of access to, and the sharing of, data?

I am increasingly convinced of the importance of open data. I see its benefits every day in the travel sector in the UK. Increasingly legislation requires transport operators to release data about route, fare and real-time performance. This has been used imaginatively by app developers. Through open data, app makers will be able to develop products that travellers can use to plan their journeys, giving confidence to leave the car at home and take the bus instead, boosting sustainability, reducing carbon, NOx and particulate pollution

We also need to consider the tools presently at our disposal for making useful cost benefit appraisals. Is proper account yet taken of the importance of whole life-cycle assessments – from manufacture to operation, to maintenance to disposal? What about the wide variations in planned asset lives within the transport sector – from several hundred years for a tunnel to just a couple for some ICT? We need the tools for whole-system appraisals. What are the system-wide implications for renewal or system conversion? Does an emphasis on securing maximum asset life deter innovative change and potentially paradigm shift?

And we need to go further. We need to look at the complete value chain associated with each mode – vehicles, infrastructure, spatial impacts, social and health effects to name but a few elements. In other words, we need to be working on a tool kit to inform policies in pursuit of behavioural change – internalisation of external costs, the wider alignment of decarbonisation strategies and programmes, the priority attached to system resilience or to the encouragements that may be mooted to promote collective forms of individual mobility as opposed to individual vehicle ownership.

At this stage in a discussion of research and innovation strategies in Europe it is usual to emphasise the goal of global leadership for European industry. I confess to approaching this goal with cautious scepticism. I don't believe in a Europe that seeks economic advance through policies designed to protect its presently dominant players. I am sufficiently old to remember the indigenous – and unlamented – British automotive industry. Inward investment from Japan, India and Germany has revolutionised that industry: it is now a dynamic pillar of the British economy and its export markets.

Rather, I am drawn to international cooperation in the transport sector, engaging the European supply chain with innovators around the world, playing to our society's creative and innovative strengths. Building walls to shelter old monoliths from competitive challenge and the need to innovate and renew is not the answer.

A final point. I need to ask your indulgence here because I am going to illustrate it with some more particularly British examples. But today is a rather special day for all us from the UK committed to

the development of the European Union. We don't know what tomorrow will bring: we may be heard on the continent no more.

The point that I want to make is this: the pace of adaptation to the challenge of decarbonisation will be determined in no small part by the level of political will and commitment. Congestion charging in central London was introduced successfully in central London, accompanied by a big modal shift to public transport - a 30% growth in bus patronage with 86% user satisfaction - through the energies of London' first Mayor, Ken Livingstone. He made it happen.

London's second Mayor Boris Johnson - a dedicated urban cyclist - threw his energy into establishing cycling super highways throughout the capital in an effort to make cycling an integral part of the mega-city's transport network. According to Transport for London, the number of motorists entering central London during the morning peak in 2000 outnumbered the number of cyclists by more than 11 to 1. By 2014, the ratio was under 2 to 1. The Mayor demanded change and got it.

Boris Johnson's recently elected successor as Mayor is Sadiq Khan. He is a victim of adult onset asthma. He is making a point of focusing on the need to remedy London's poor air quality, drawing attention to the fact that almost 10,000 Londoners die prematurely each year, because of air that is so filthy that it is illegal.

There is clear evidence of the effectiveness of political commitment. It is particularly important because, in or out, London is likely to remain Europe's largest mega-city. COP21 and the Energy Union have both demonstrated that political will can work at the supranational level. As an unashamed federalist, I take the view that the promise of delivery on the COP21 commitments is strengthened by it embracing a 'bottom-up' as well as a 'top-down' commitment. And that's about engaging more widely with citizens and end-users. It's about helping to create the opportunity for an innovative and a more competitive economy.

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