Submission to the public consultation on the Industrial Strategy Green Paper

Dr Debbie Hopkins[1,2], Associate Professor Tim Schwanen[1,2], and Mrs Jenny Bird[2,3]

[1] Transport Studies Unit, University of Oxford

[2] Centre on Innovation and Energy Demand

[3] Science Policy Research Unit, University of Sussex

Contact details:

Transport Studies Unit, School of Geography and the Environment, University of Oxford, South Parks Road, Oxford, OX1 3QY, debbie.hopkins@ouce.ox.ac.uk

Contents

Introduction		2
Background		2
Comments and Insights		3
1.	Role of Government	3
2.	UK's Position in the Global Market	4
3.	Infrastructure	4
4.	Skills Development	4
5.	Supporting Businesses and Cultivating World-leading Sectors	5
6.	Delivering Affordable Energy and Clean Growth	5
7.	Industry Structure	6
Conclusions		6
About TSU and CIED		7

Introduction

This response to the Green Paper on the UK's new Industrial Strategy specifically addresses issues related to the automotive industry, robotics, and automation. The submission is informed by a workshop held on Monday 20th March 2017 that examined the roles of vehicle automation and robotics for the freight industry in the UK. It involved ten participants from government, industry, and non-governmental organisations. The workshop was sponsored by a grant from the Economic and Social Research Council Impact Acceleration Account to the University of Oxford and supported by the RCUK funded Centre on Innovation and Energy Demand (CIED).

While the submission speaks broadly to the Industrial Strategy document, it specifically relates to the following questions posed in the Green Paper:

Question 13: What skills shortages do we have or expect to have, in particular sectors or local areas, and how can we link the skills needs of industry to skills provision by educational institutions in local areas?

Question 22: What are the barriers faced by those businesses that have the potential to scale-up and achieve greater growth, and how can we address these barriers? Where are the outstanding examples of business networks for fast growing firms which we could learn from or spread?

Question 29: How can the Government, business and researchers work together to develop the competitive opportunities from innovation in energy and our existing industrial strengths?

Question 33: How can the Government and industry collaborate to enable growth in new sectors of the future that emerge around new technologies and new business models?

Background

HM Government has indicated great interest in becoming a testbed for automated technologies, evidenced through investments in 'demonstration cities'[1] and last year's House of Lords call for evidence[2]. The Department for Transport's 'Pathways to Driverless Cars'[3] document set forth the steps to promote automated vehicles in the UK, albeit with a passenger-transport focus.

The Green Paper specifically speaks of robotics and artificial intelligence, including connected and autonomous vehicles and drones, as one of the key areas where: 1. the global market is potentially large, or fast growing and sustainable; 2. the UK has capabilities to meet market needs in terms of research strength and business capacity; 3. there are significant social and economic benefits; and 4. there is evidence that government support will make a difference.

While much attention has been directed towards passenger vehicles, there is growing evidence to suggest that automation may radically impact upon the freight industry both in the UK and overseas.[4] Since there is no clear 'winning' technology and many different

[1] BIS and DfT (2015) UK to lead development of driverless car technology.
[2] Science and Technology Committee (2017) Connected and Autonomous Vehicles: The future? HL Paper 115.
[3] DfT (2016) Pathways to Driverless Cars: A Detailed Review of Regulations for Automated Vehicle Technologies.
[4] Wadud Z, et al. (2016) Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. *Transportation Research Part A: Policy and Practice* 86, 1-18.

applications of automation to freight transport can be imagined, a clear opportunity exists for the UK to help to develop innovations in freight vehicles.

The freight industry is currently challenged by growing demand, changing consumer preferences, and low profit margins.[5] The rise of the 'gig-economy' and precarious work conditions are leading to low driver satisfaction, and problems recruiting and retaining freight drivers[6]. Automation and robotics may offer some opportunities to decrease the cost of freight transport, and increase the efficiency of the supply chain, particularly when coupled with practices enabled by automation such as platooning. Nevertheless, CIED's research on 'automated and smart freight mobility[7]' is finding evidence of diverging perceptions on the role of drivers in an automated future.

The terms used to discuss automation also contribute to industry, and particularly driver concerns over automated technologies – with 'driverless' and 'self-driving' both implying a *replacement* of the professional driver with automated technologies. This highlights the sensitivity with which automation in the freight industry must be handled – and perhaps displays a divergence from the approach taken for automated passenger vehicles.

The development and testing of automated technologies for heavy and light goods vehicles, as well as other robotic devices (e.g. aerial drones) in the UK may offer opportunities for "economic growth by increasing productivity and driving growth across the whole country"[8], but currently little is known about the size and scale of the opportunity.

Comments and Insights

The autonomous vehicles and robotics industry offers many opportunities for the UK, *if* the hype around these technologies is realised. Since current developments in freight automation vary widely in terms of both size and design, opportunities include the automation of specific features of traditional heavy goods vehicles (e.g. platooning), the use of delivery-bots and possibly drones for delivery in congested urban centres, to autonomous forklifts and other vehicles for transfer and movement of containers and goods in ports.

In thinking about opportunities, Government ought to distinguish between the short term (next 5 years), medium term and the long term (20-25 years from now). Strategies should be developed for each term, and the short term should not be privileged over the medium and longer term. This is particularly important as the diffusion of automated and robotics innovations in the freight industry may be slow and incremental. Not only are significant financial investments required and there are reputational risks associated with new technologies; support from the general public and particularly the unions is not guaranteed, and the embedding of new technologies into organisational routines and institutions (e.g. just-in-time production or delivery) may require substantial restructuring in the freight and logistics industry.

1. Role of Government

There are many important roles and responsibilities for Government, particularly to counteract barriers to the diffusion of automated technologies. These barriers relate to the ability of the technology to meet industry and social expectations (for instance relating

[5] Independent Transport Commission (2015) The challenges facing freight and logistics in the UK.
[6] Hopkins, D. & McCarthy, A. (2015) Change trends in urban freight delivery: a qualitative inquiry, *Geoforum*, 74, 158-170.
[7] http://www.cied.ac.uk/research/emergence/freight
[8] HM Government (2017) Building Our Industrial Strategy, Green Paper, page 58.

to timeframes and automated features), public acceptance of automated vehicles and freight transport, the dominance of Small to Medium-sized Enterprises (SMEs) in the freight industry – particularly for couriers for whom investment in expensive and potentially risky technologies may not be appealing, and the infrastructure required for automated vehicle technologies including ubiquitous 4g Internet, road markings, and smart signage requirements. Roles for the Government may include;

- Coordinating and funding trials and demonstrations;
- Support the scaling-up of start-ups and domestic innovation networks;
- Aiding in the development of convincing business models and improving the business case for automated freight transport;
- Setting policy, regulation and legislation supportive to automated technologies;
- Bringing together and aligning different stakeholders whose interests may diverge – freight and logistics companies, Information Technology (IT) firms, drivers, unions, local and regional authorities, etc.;
- Building a robust evidence base regarding the emergence and diffusion of automated technologies, and funding social science research that examines public and industry perceptions of automated technology and barriers to diffusion and to adaption of existing business practices;
- Raising public awareness about the effects of automation and facilitating public debate about those effects and their desirability;
- Ensuring skills and know-how relating to smart and automated freight transport systems, across wide-ranging stakeholder groups, are developed domestically; and
- Considering automation as one of a suite of options to address the current challenges of growing demand, changing consumer preferences and low profit margins and freight transport's environmental impacts. Other forms of change, such as modal shift towards rail, should not be overlooked.

Nevertheless, there is currently little clarity of what the UK Government wants to achieve from the robotics and automation industry. Bringing together the diverse set of stakeholders (e.g. vehicle manufacturers, IT companies, freight quality partnerships, local councils, owner/operators, freight businesses, unions, residents near freight routes, traffic managers, lobby groups, etc.) into a conversation on the roles of automation as a solution for contemporary issues is a useful starting point to develop clearer objectives and visions.

2. UK's Position in the Global Market

There are specific opportunities for the UK to show leadership on automation technologies with regard to the development of safety standards and technological standardisation. Given the UK's favourable conditions for trialling automated technologies in real-life situations, and progress with codes of practice for trials with autonomous vehicle technology, there are opportunities to share and diffuse these standards internationally.

3. Infrastructure

Infrastructural requirements depend on the technologies being used and on the location where transport takes place – e.g. within the city, on motorways, or in ports. Since dominant designs for technologies have yet to be established, infrastructural

requirements require further thought by the Government going forward. Attention needs to be directed to the range of *likely* future needs. If automated technologies demand Internet connectivity, as some, but not all current designs do, the timely introduction of appropriate connections may delay the uptake and diffusion of the technologies and the capacity of the UK to trial the different technologies in a 'real world' setting.

4. Skills Development

We agree that the development of new skills, and training in new areas is an important feature of the Industrial Strategy. This should also include re-training those drivers and others in the freight industry whose jobs may be lost through automation and robotics, and engaging in analysis of where humans will remain required across the supply chain and in what capacity. Because automated technologies may make the driver job more desirable, automation offers the opportunity to improve the poor reputation of the driver occupation and to alleviate the driver shortage that is being experienced particularly for long-distance truck driving. It is important to consider skills holistically. Instead of narrowly focusing on the skills required to develop the technological innovations, government and the freight industry should consider the jobs that may be affected by automation, and see where up-skilling and retraining needs to be focused.

5. Supporting Businesses and Cultivating World-leading Sectors

The Green Paper admits that "we have a challenge, too, in translating our leadership in global research into commercial outcomes – a longstanding weakness relative to other countries" (page 26). Our workshops reiterated this point, and stressed the need for greater Government involvement in the scaling up of innovations and the retention of valuable businesses and industries in the UK. This will require Government intervention in setting the context for these businesses to grow and remain in the UK instead of moving abroad or selling out to large transnational companies in the transport and/or IT sectors. Without such interventions, the UK's role in the development of automated freight transport may remain limited to research and development (R&D) and being a test-bed, with countries and regions elsewhere harnessing the benefits of scaled-up application of new technology and practices.

The Government's means and capabilities to keep new businesses and technology in the UK should not be exaggerated. However, through policies that are integrated across departments (DfT, BEIS, DoE, DWP, Treasury) and levels (national Government, LEPs, combined and local authorities), Government can help to create environments where the supply of qualified and skilled labour, regulation and support from – and collaboration across – the freight and logistics sector, unions and research institutes offers favourable conditions that may keep firms (or at least key parts or divisions of them) in the UK.

6. Delivering Affordable Energy and Clean Growth

New transport dynamics will have ramifications for energy consumption and these require sustained research attention. There are, for instance, great uncertainties about what the consequences of automated technology adoption in freight transport are for traffic flow [9]. Particularly uncertain are rebound dynamics; the (imagined) travel time and cost savings may be used to reorganise supply chains spatially by moving production facilities or

[9] Wadud et al. *op. cit*.

warehouses into different, possibly cheaper locations.[10] Whilst cost savings may still accrue across the whole logistics process, it is conceivable that total miles travelled increase and that effects on road congestions are negligible. Given that fuel costs represent a large proportion of freight industry expense, rebound effects might be smaller than in passenger transport. However, they can still be substantial and require careful consideration[11]. In addition, while the opportunity to reduce fuel costs may be welcomed by the freight industry, in firms' decision making the benefits of reduced energy consumption will be traded against the additional costs of up-front investment in new technology, other equipment, and personnel. The outcome of this trade-off is currently difficult to predict and will likely vary across firms, sectors, types of automation and geographical location.

7. **Industry Structure**
   The freight industry is largely made up of SMEs, which will often not have the financial stability to invest in new technologies. It has been suggested that the emergence and diffusion of automated freight vehicles will result in consolidation of the industry as larger freight companies that can invest in the new innovations will do so, and will reduce the number of owner-operators. This may have opportunities in terms of platooning vehicles and raising salaries of drivers, but it could also result in large redundancies and shifting industry structures which will need to be anticipated and planned for.

Conclusion

If the Government wants to harness the opportunities of automation and robotics in freight transport and more generally, then they can't afford to leave developments to the market and will need to intervene actively and comprehensively along the lines discussed above. It was evident from our workshop that many stakeholders in UK freight and logistics are currently sceptical about the business case for automated technology adoption. Through active and comprehensive intervention the Government can help to advance that business case, which will improve if the following two key issues are addressed effectively:

- Scaling-up (Question 22): There appears to be a strong bed of domestic innovation and start-up capabilities in the UK, but the culture and practice of scaling-up is not well developed. Barriers to scale-up and achieve greater growth include the global networks, partnerships, and clusters of innovation, as well as innovators' desire to scale-up, with business models sometimes prioritising the sale of innovations to larger, often international businesses.
- Skills (Question 13): Robotics and automated vehicle technologies may change the skills and competencies required for freight transport in the UK. To date, the focus has been on preparedness for skills in robotics, yet there needs to be more attention paid to the skills and associated jobs that are likely to change as a result of the technologies (e.g. professional drivers). Addressing these issues through labour market and education policy may also begin to address some of the concerns by unions and workers about the likely impacts of automation in freight and logistics and beyond.

[10] Wadud et al. *op. cit*.; Matos and Silva (2011) The rebound effect on road freight transport: Empirical evidence from Portugal. *Energy Policy* 39(5), 2833-2841.
[11] Mato and Silva (2011) op. cit.; Sorrell (2009) Jevons' Paradox revisited: The evidence for backfire from improved energy efficiency. *Energy Policy* 37(4), 1456-1469.

The established and imminent trials of autonomous vehicle technologies in the UK provide evidence of opportunities for the Government, business, and researchers to work together to develop innovations, whilst also offering opportunities for the UK to benefit from new technologies (Question 29). These should continue and be expanded in the short and medium-term. With a view to the long term, it is imperative that the Government collaborates with a wide range of stakeholders (Question 33) and plays an active role in reconciling differences in their interests and stakes. There certainly needs to be greater collaboration of the Government with unions and workers around questions of (re)training and the threat of redundancies, and with research institutions around technology-focused R&D and issues of public acceptability and rebound effects. With the freight and logistics, and IT industries, the Government needs to focus on enabling growth and development in robotics and automation. This will involve developing (international) standards, public acceptability and industry expectations.

About the TSU and CIED

The Transport Studies Unit (TSU) is based within the School of Geography and the Environment at the University of Oxford. The TSU aims to be a premier institute for interdisciplinary research on developments in transport and mobility, with particular emphasis on its social, economic and environmental implications over time and space.

The Centre on Innovation and Energy Demand (CIED) is a collaboration between researchers from the Science Policy Research Unit at the University of Sussex, the Transport Studies Unit at the University of Oxford, and the Sustainable Consumption Institute at the University of Manchester. It is one of six Research Centres on End Use Energy Demand funded by the Research Councils UK Energy Programme. Its primary focus is on the processes of innovation – both technological and social – that will contribute to energy demand reduction for a more sustainable energy future.