

How Governments Influence Autonomous Vehicle (AV) Innovation

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Abstract

While autonomous vehicle (AV) technology is forecast to widely disrupt transport systems, governments' roles in influencing innovation trajectories has not been examined holistically. This empirical study analyses the perceptions of 34 professionals from government and non-government actors in the U.K and Australian contexts. Preliminary findings identify three main categories of government roles: regulator, facilitator and participator. The paper discusses the implications for AV innovation within each context. This research provides a valuable contribution to understanding how local policy environments around the world might shape AV innovation.

1. Introduction

There is broad consensus that AV technologies will bring about significant disruption to transport systems around the world, however when that will occur or what type of impacts they will eventually have, are far from clear (Fagnant and Kockelman, 2015). Future visions of fully autonomous vehicles driving around cities, include both positive (e.g. safety or accessibility) and negative (e.g. urban sprawl or privacy) effects (Fagnant and Kockelman, 2015; Sun et al., 2017). Confounding this disruption is the entry of new providers and the upending of traditional dynamics in areas such as insurance, law enforcement, taxation etc. (Docherty, 2018). At present, no outcomes (positive or negative) can be guaranteed, presenting governments with multiple short- and long-term issues to consider (Docherty et al., 2018). A key challenge for policymakers is to not only keep up with this rapidly evolving innovation space, but also anticipate and shape the evolution of AVs in line with their governmental responsibilities (Mordue et al., 2020).

While it is recognised that governments do have an important role in the development of AV innovation, there are numerous regulatory gaps (Claybrook and Kildare, 2018) and we lack a holistic perspective of how they influence this domain. Previous AV studies have primarily taken a regulatory focus (e.g. Shladover and Nowakowski, 2019; Mordue et al., 2020), however this represents only one available governance tool. Broadening to other innovation contexts, governments are acknowledged to be central actors across different stages of technological transitions and are critical to avoiding negative externalities to market failures (Moon and Bretschneider, 1997). A fundamental understanding of how governments may influence AV innovation is especially critical considering the aforementioned disruption; AV will likely alter current roles and processes, which will vary across different political contexts internationally (Stone et al., 2018).

This study therefore addresses the research question: *how do governments influence AV innovation?* In doing so, we draw upon the relevant literature related to governance and policy perspectives of AVs and situate that within the broader context of socio-technical innovation. To extend beyond simply detailing upcoming regulatory concerns, our study focuses on the role of government as an influential actor and introduces a framework for *how* it influences evolving innovations. Data is drawn from in-depth qualitative interviews with 34 AV experts

across government, industry and academia, in Australia and the U.K. Our preliminary findings illustrate examples of government influence through market regulation, facilitation and participation. These three inductively-derived categories are used as a framework for the organisation of the paper, which will be used to explore potential implications for the manner, extent and timing of government intervention practices.

2. Methodology

In order to examine the role of government in influencing AV innovation, a qualitative approach was adopted. We purposely selected what we consider two revelatory contexts of multi-stakeholder innovation networks as our research settings (Yin, 2003), the U.K and Australia. The two countries have important similarities and differences, which facilitate meaningful comparison. For instance, while they both stem from the same Westminster and common law traditions; the U.K is relatively centralised compared to Australia's more distributed form of governance. Also, from an AV perspective, KPMG (2020) rates the U.K higher than Australia on overall preparedness for the new technology and considers it one of the leading nations for AV policy and legislation, although Australia rates slightly higher for specific regulation. Similarly, the U.K has a much larger and active automotive sector than Australia; however, Australia is a global leader in closed site AV technology use.

To capture a broad as possible range of relevant perspectives, our participants encompassed a wide variety of AV ecosystem actors, including representatives of: manufacturers (both incumbent and AV-specific); trade associations; national and regional government departments; researchers (both industry centres and university); innovation consultants and relevant public stakeholders. We thus conducted semi-structured interviews with 34 managers, all following the same interview guide. Interviews lasted an average of 50 minutes and were a mixture of face-to-face and virtual conversations, including two joint interviews with managers from the same organisation. The interviews began by asking participants to reflect on what AV technology would mean for their own organisations, before considering the potential benefits and risks of AVs more widely, as well as the important influence and milestones.

We conducted a multi-stage thematic analysis, starting with open coding of the interview data undertaken by two researchers independently. This initial descriptive stage recorded relevant actors to AV innovation as identified by participants, as well as key aspects of future visions such as timeframe, critical milestones and corresponding impacts. Based on this preliminary interpretation of the data, the multi-dimensional role of government actors was identified as aligning with three broad categories: *Regulation*, *Facilitation* and *Participation*. A second round of coding was then undertaken, this time explicitly guided by the newly identified conceptual framework, with codes organised under one or more of the three categories (Saldaña, 2015). To further interrogate differences between participant perspectives, transcripts were categorised by context (U.K or Australia) and organisation type (Government, Industry, Research). Cross-coder comparisons were once again conducted and then the final themes were agreed upon by all researchers. QRS*NVivo 12 software was used to store and display data and coding structures.

4. Findings (Preliminary)

While the analysis process has yet to be finalised, preliminary insights are available. Focusing on the identified framework, participants identified numerous government activities, which could be aligned under the three categories of regulator, facilitator and participator. At this level of analysis, we do not distinguish between U.K and Australian contexts and many of the

activities mentioned by participants were hypothetical, referring to potential changing governance roles in future scenarios. A sample of these are presented in brief in Table 1.

Table 1. Government Roles

Regulator	Facilitator	Participant
<ul style="list-style-type: none"> • Updating traffic laws to accommodate driverless control • Establishing AV testing guidelines • Updating data privacy protections • Clarifying liability issues for insurance and policing • Harmonising laws with international standards • Reforming taxation structures to adapt to changing vehicle performance and usage • Flexible or temporary legislation which can accommodate AV development and trialling 	<ul style="list-style-type: none"> • Collaborating on trials on public roads • Developing national AV strategies and delegating responsibilities to departments • Upgrading supporting infrastructure e.g. roads, telecommunications • Tax incentives or grants for AV research and development • Public awareness and education programs • Funding for industry-research collaborations and knowledge sharing • Funding primary public research via universities 	<ul style="list-style-type: none"> • Transport equipment/technology purchasing policies e.g. buses, trams • Integration of AVs into publically-owned assets e.g. airports, ports, postal service • Setting AV contracting conditions for privately run services • Commercialising public research • Fee structures for use of public infrastructure e.g. roads, parking, charging • Private-Public partnerships

Many participants raised topics relating to the influence of *regulation*, which we define as the ‘Process of developing, enacting and communicating legislation and prescribed rules relating to the acceptable public operation of AV technologies’. As the sole domain of government, regulation was understandably perceived to be a critical role of government in supporting AV innovation. Government was not considered solely responsible for determining regulatory environments, various industry and academic stakeholders also play an important role in educating and lobbying policy makers to make appropriate decisions. As an innovation lever, regulation was recognised as balancing the emerging needs of industry with risks associated with public safety, as evidenced in the following quote:

I think it all comes down to the kind of risk appetite of policy makers. So policy makers essentially determine the regulatory environment because that's their role, and the regulatory environment determines the type of innovations that occurs and then the type of innovations determines the solutions that actually have an impact on people's lives. I think traditionally we've had this kind of proportionally risk adverse approach [...]and I think if we continue along that path then it's just going to hamstring innovation”
 - Industry Association Manager, U.K

In contrast, many Australian participants considered longer term regulatory implications, particularly in relation to eventual public use of AV technology. Regulatory roles were often distinguished between local, state and federal jurisdictions, with each having unique yet interrelated spheres of influences over the AV use. As the following quote suggests, coordination of approaches is an important aspect to consider within this context:

“at a federal level we decide what can come in the country and import and because Australia doesn't manufacturer it all it's important that we present a united front as a nation, so I think there's a real important role for federal agencies to play, but the transport use cases I think are on a jurisdictional (state) level”- State Department of Transport Director, Australia

Government was also recognised as being important *facilitator* of AV innovation, which we define as ‘processes to improve the environment for AV innovation by reducing barriers, providing incentives and encouraging collaboration’. The establishment of specific pools of funds for AV R&D, as well as delegating supporting responsibilities to government agencies, were commonly mentioned as positive government activities. Many participants considered government particularly influential in facilitating AV testing on public roads, which had dual purposes of advancing technological suitability to local settings and increasing community exposure to AVs. These collective efforts were described in the quote below:

“The research grants are already in place; as a matter of fact government has disbursed quite a lot of money already. I think if I'm not mistaken, probably in the region of £250 million of government money is based for projects, collaborative R&D, feasibility studies and test space involving more than 80 projects in more than 200 organisations”
- Industry Association Manager, U.K

In addition to facilitating the development of AV technology, government policy interventions were also perceived to influence the applications of AVs and their integration into transport systems. This included establishing units to research transport scenarios, inform policymakers and engage with manufacturers. These activities enable government to be active contributors to the innovation process and ensure their views and interests are taken into account. The following quote demonstrates the perceived importance of proactive facilitation of innovation as a way to influence its direction:

“Department of Transport set up an autonomous vehicle team, last year I think, so slowly they're waking up and realise they need to anticipate different scenarios where they can have good and bad influences, then work out what is the desired future and work it backwards so what they call back casting, so you choose your desired path and you design your policy to make sure we go towards that desired path, manage the implementation of this technology rather than let it run its own course” – Research Centre Fellow, Australia

Governments’ role as a market *participant* was primarily discussed in relation to potential future involvement in public transport and hypothetical scenarios of AV application. We define this category as ‘Involvement in commercial activities relating to AV technology development and usage which leads to direct economic outcomes for government’. Many participants discussed the disruptive impact AVs will have on future public transport models, thereby positioning governments as a potentially influential player in determining how AVs will be integrated into current systems. A number of participants also perceived public transport to be one of the first areas of use for AVs, which would influence the business models being planned by manufacturers, as they must align with the resources and needs of government clients. Beyond direct application to public transport provision, the potential cost advantages and time efficiencies of AVs were envisioned to potentially disrupt areas such as healthcare, aged care and waste. Given the state of AV technology, government participation is not yet considered a priority or realistic, however as the following quote suggests, some participants anticipate future involvement which may send a signal to the market:

“government hasn't realised because they keep on saying, ‘why should we care about these autonomous vehicles, we don't make cars, leave it to the manufacturers’. What I'm saying is

look, you can, you have influence, you can demand to automate our buses” –Transport Academic, Australia

4.1 Contextual Differences

Overall, there was considerable similarity in how British and Australian participants discussed the role of government. Numerous examples were identified in each context, under one of the three broad roles. Differences were primarily found in the extent of current government involvement in AV innovation, the structure of government support, and future visions of the country’s global position.

The U.K government was considered highly active in supporting AV innovation and had already taken several steps to ensure they are a leading market for this technology. Many participants were aware of key policy activities and investments that had been made and there was recognition of the Government’s strategic national aims in this domain. As one of the major vehicle manufacturing nations, the U.K. is attempting to secure its future position once AVs rise to prominence. Therefore, many of the Government’s roles are interpreted within the goal of achieving competitive advantages, as illustrated in the following quote:

“if the U.K wants to grab a piece of the action, then funding and other measures, like favourable legislation, maybe temporary legislation and other things such as standards, might just get you a competitive advantage” – Industry Research Centre Advisor, U.K

In contrast, many Australian respondents did not consider the Government to have a role in developing the country as a leading AV market. While some participants considered State and Federal governments to potentially become leaders in legislative approaches to AVs, it was also recognised that the country is a small and isolated vehicle market, without a globally competitive manufacturing sector. Most Australian respondents therefore envisioned the country to be a global follower, which meant government roles could be focused on monitoring international trends and steadily planning for how best to integrate imported AV technologies.

“we’re just going to be receivers of technology and so we’ll really have a good chance to observe how these technologies are rolled out and are implemented in other countries before they come here” – Policy Manager, State Infrastructure Body, Australia

5. Conclusion

This research has sought to highlight the role of government within the AV context, by specifically focusing on the different ways in which they influence innovation. Preliminary findings from the U.K and Australia identify a number of government practices which are currently or could in future influence the development and diffusion of AV technologies. Our analysis aligns these practices into regulatory, facilitative and participative roles, which we offer as a useful framework for understanding how future scenarios for AV technologies are shaped by the policy decisions within local environments and comparison between government approaches. The finalised analysis will expand on these findings by refining the framework to include the objectives of various practices and use this to draw out implications for the manner, extent and timing of government intervention practices.

References

- Beerepoot, M. and Beerepoot, N., 2007. Government regulation as an impetus for innovation: Evidence from energy performance regulation in the Dutch residential building sector. *Energy Policy*, 35(10), pp.4812-4825.
- Claybrook, J., and Kildare, S., 2018. Autonomous vehicles: No driver... no regulation. *Science*, 361(6397), pp.36-37.
- Docherty, I., 2018. New Governance Challenges in the Era of 'Smart' Mobility, in Marsden, G. and Reardon, L. (Ed.) *Governance of the Smart Mobility Transition*, Emerald Publishing Limited, Bingley, pp. 19-32
- Docherty, I., Marsden, G. and Anable, J., 2018. The governance of smart mobility. *Transportation Research Part A*, 115, pp.114-125.
- Fagnant, D. & Kockelman, K., 2015. Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations. *Transportation Research Part A*, 77, pp. 167-181.
- KPMG, 2020. *Autonomous Vehicles Readiness Index*. Available from: <https://home.kpmg/xx/en/home/insights/2020/06/autonomous-vehicles-readiness-index.html> [Accessed 29/6/21]
- Moon, M.J. and Bretschneider, S., 1997. Can state government actions affect innovation and its diffusion?: An extended communication model and empirical test. *Technological Forecasting and Social Change*, 54(1), pp.57-77.
- Mordue, G., Yeung, A. and Wu, F., 2020. The looming challenges of regulating high level autonomous vehicles. *Transportation Research Part A*, 132, pp.174-187.
- Saldaña, J., 2015. *The coding manual for qualitative researchers*. 2nd Edition. Sage. London, U.K.
- Shladover, S.E. and Nowakowski, C., 2019. Regulatory challenges for road vehicle automation: Lessons from the California experience. *Transportation Research Part A*, 122, pp.125-133.
- Stone, J., Legacy, C., Curtis, C., 2018. The driverless city? *Planning Theory & Practice*, 19(5), pp.756-761.
- Sun, Y., Oлару, D., Smith, B., Greaves, S., and Collins, A., 2017. Road to autonomous vehicles in Australia: an exploratory literature review, *Road and Transport Research*, 26(1), pp.34-47.
- Yin, R., 2003. *Case study research: design and methods*. Thousand Oaks, CA: Sage.