Connected and Autonomous Vehicles. Chapter 6, Conclusions

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6. Conclusion

The development of CAVs presents a significant challenge to local policymakers navigating a range of important policy issues and agendas. Connected vehicles are very much here, and more highly automated vehicles are on their way. How the transition to a world where there is a critical mass of autonomous vehicles plays out remains very much uncertain, however.

6.1. An uncertain future

CAVs do not simply represent a like for like replacement of non-CAVs. Their arrival will signify the potential for a fundamental shift in how urban environments are navigated, how goods are moved, and services provided. In observing the development of CAVs the attention of commentators naturally gravitates towards private passenger vehicles, and indeed it is likely that the most significant impacts on society and places will be felt if uptake amongst this part of the vehicle fleet is widespread. However, as we have outlined in this book, the automation of vehicles also reaches across freight, home deliveries, public transport, campus transport, and so on, and it is vital that these are considered as part of the planning process. It is in these arenas – particularly the development of shared autonomous vehicles that complement other transport modes – where we might expect the most tangible change in the near future.

Some of the overarching challenges facing policymakers, both nationally and locally, centre on the uncertainty over what time periods the different levels of automation may appear on public roads and ultimately what level of automation is achievable. Optimistic assessments suggest that by the end of this decade we will see widespread deployment of advanced levels of automation in vehicles operating on public roads. More conservative - and perhaps realistic - views see this taking much longer. Regardless, CAVs represent a highly disruptive innovation.

The type of impact CAVs will have depends on the ownership models that emerge. For several years, shared mobility (for instance, conceptualised through Mobility as a Service) has been presented as one of the solutions to problems facing the transport system. In such a scenario, users share access to vehicles, booking them when they are needed rather than owning them outright. If an arrival of more highly automated vehicles is coupled with an even greater shift towards shared mobility, then the consensus amongst our interviewees and the literature is that CAVs have the potential to make a positive contribution to future transport systems.

The alternative scenario is a model that would reinforce the widespread private car dependencies that have been the norm across the globe for many decades. Under such a model, concurrent efforts by policymakers to deliver necessary enhancements to the liveability of urban environments is likely to be compromised. Even if the ultimate outcome is a hybrid between these two scenarios, it is vital that local policymakers have the appropriate powers, resources, and skills to manage the impact of a widespread deployment of CAVs.

In this book we have also highlighted how preparedness of communities for CAVs is variable. Predominantly, although not exclusively, it is countries in the Global North that are leading the way with taking steps to develop environments that are more conducive to CAVs. For example, in investing in the supporting digital infrastructure or developing regulations to account for the increasing automation of driver tasks in vehicles. But preparing for CAVs by paving the way for their growth is not the same thing as anticipating their myriad impacts and shaping that growth. Where countries are investing time and resources into preparing for CAVs, inevitably this trickles down to the urban level with cities and regions forming the test-bed locations for resulting vehicle trials. It is important that later adopting countries, particularly those in the Global South, are not excluded from the dialogue happening now around CAVs. The case-study box prepared by Dr Aliyu Kawu (Box 2.1) demonstrated how policymakers in Nigeria are grappling with even greater barriers to the deployment of CAVs but this does not mean they should be excluded from the conversation.

Our Policy Expo has shed light on the realities of a transition to CAVs and why it is important to begin thinking about and planning for them now, rather than delaying. For cities and regions to tie in their existing planning goals with the advent of CAVs has been described as a "fleeting opportunity"[1]. There are of course barriers to this. One overriding difficulty is the lack of clarity over where responsibilities to regulate and make decisions are divided. There is evidence that conflict might arise between national (and sometimes state) policymakers and those leading decision-making in cities in the course of pursuing this opportunity. Much of the activity surrounding regulation and legislation is inevitably led from the national or state level. However, where decisions do not align with local objectives or preferences, there is a risk for conflict, as we have seen in the US (see Section **Error! Reference source not found.**).

6.2. Providing the appropriate tools and resources

This raises questions about what tools and powers policymakers at the city level can access to truly shape the impact that CAVs have on their spatial structures and populations. For many cities, stretched budgets and a lack of skills and knowledge can impinge on the ability to respond proactively to CAVs. For instance, net zero objectives are a pressing issue for cities, including how any transition to net zero can be a 'just' one and not impose unfair costs on disadvantaged groups.

For some cities, CAVs might be seen as a threat to efforts to enhance the liveability of their environments. Indeed, the literature suggests that places that are already more amenable to motor vehicles are likely to see their populations more willing to travel further because of CAVs[2]. For those places striving to reduce private car dependency, CAVs might be seen as a threat. The arrival of earlier forms of disruptive mobility technology, such as ridesharing platforms, e-scooters, and bike sharing schemes have all posed regulatory problems for urban policymakers. The challenges and experience of adapting the environment and wider transport network to these is a precursor to some of the inevitable problems that CAVs will bring.

Responding to an increasing presence of CAVs will require wide-ranging actions delivered across different spatial scales. The regulatory environment is currently being developed but there is evidence of potential conflicts between national or state and local government. Clear demarcation of roles and responsibilities are important, but equally, cities must be provided with the tools to fully shape how their transport systems develop. The responsibility for preparing for the arrival of CAVs extends far beyond transport planning and will involve the full range of urban policymaking domains (see the checklist in 6.4 below).

The availability of standardised guidance and ability to share best practice remains underdeveloped and, for those later adopting cities, more consistent and accessible

information will help broaden the extent to which they can engage with these issues. Whilst the public is increasingly exposed to CAVs through trials there remains a lack of public debate over CAVs and what role they should, or could, play in future transport systems and this is an essential next step.

6.3. References

[1] Freemark Y, Hudson A and Zhao J (2019) Are Cities Prepared for Autonomous Vehicles? Journal of the American Planning Association, 85(2): 133–151. doi:10.1080/01944363.2019.1603760.

[2] Botello B, Buehler R, Hankey S, Mondschein A and Jiang Z (2019) Planning for walking and cycling in an autonomous-vehicle future. *Transportation Research Interdisciplinary Perspectives*, 1. doi:10.1016/j.trip.2019.100012.

6.4. Key considerations for policymakers and their potential impacts

Issues	Considerations	Potential impacts	Possible mitigations
Accessibility and equity	High costs of travel can exclude certain groups of the population.	Existing transport inequalities may be exacerbated.	CAVs should complement rather than compete with active and public transport policies and infrastructure.
Built environment	Possible segregation of different vehicle types and users.	Segregation of users can be detrimental if not planned well, e.g. pedestrians forced to navigate less direct routes to destinations; reduced legibility and permeability of the built environment.	Planning new infrastructure to take a people-first approach. Requiring CAVs to revert to manual control to enter certain areas.
	Intensified usage of road space crowds out other road users.	Pedestrian and cyclist congestion and conflict. Increase in risky crossing behaviour. Cyclists have greater difficulty in finding and defending road space.	Vehicle algorithms cooperate to break up platoons. Junction signals reprioritised to give back space and crossing time to pedestrians and create breaks in traffic flows.
Employment and economy	AVs replace human drivers.	'At risk' occupations are not replaced by other opportunities creating unemployment issues.	Long-term economic development and skills policies to reduce reliance on logistics sectors.
	Spatial impacts of CAVs pushes employment opportunities further from the city centre.	Workers forced into longer and more costly journeys. Aggregate vehicle miles on network increases.	Spatial planning policies and practices designed to minimise the need for travel: approaches to density, site suitability for different land uses, transit-oriented development, etc.
Energy and environment	Reliance (at least in short-term) on petrol/diesel vehicles. CAVs produce particulates (tyres, brakes).	Increase in CAVs adds to existing pollution in urban areas.	CAV algorithms optimised to reduce tyre impacts and brake wear in urban areas.

Health	Increase in sedentary lifestyles with more reliance on private vehicles for individual mobility	Obesity epidemic exacerbated; public health worsened.	Complementary active travel and public transport investment.
IT infrastructure	Significant investment needed to ensure IT infrastructure able to handle CAV demands.	Requirements on local government agencies to improve physical, software and human infrastructure supporting intelligent transport systems.	Ensure new intelligent transport infrastructure based on open/interoperable standards
	Resilience of vehicle systems and data networks.	Safety and congestion issues which result from any systems failure or security breach. Terrorist use of CAVs.	Junction and built environment designs with redundancy and 'fail-safe' features, including design and technical standards for protecting crowded places.
Public engagement	Lack of engagement and dialogue with public.	Public not given sufficient voice in developments around CAVs and their impacts on the built environment. Lack of understanding of potential benefits leads to continuance of private ownership model and less emphasis on shared models. Conflicts over parking and kerb space.	Urban parking and street management policies should sensibly anticipate and shape behaviours. Sufficient land and facilities for shared CAV drop-off, parking and circulation.
Road safety	Over or under estimation of the abilities of CAVs to navigate safely, particularly as the technology continues to develop.	Increased safety risk to pedestrians, cyclists etc.	Local and national public education campaigns. Updating road safety curricula within schools, cycling safety courses, driving tests and driver guidance.