

Building Scenarios for The Connected Autonomous Shared Electric Vehicle (CASE) in Southeast Asia Mega-Urban Regions context: Using the combination of Bibliometric Analysis, Cross-Impact Analysis, and Spatial Analysis

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Abstract

1. Background

The widespread introduction of autonomous vehicle (AVs) and their impact in stimulating individual car dependency can be witnessed among recent urban mobility literature within the last decade. Some scholars envision the combination of AVs and collective transport as opportunities in sharing economy. The sharing concept is much anticipated to mitigate the negative impact of private AVs ownership. Various scholars point Shared Autonomous Vehicles (SAVs) are more suitable for AVs ownership due to price and cost dimensions. However, the interchangeable SAVs implications on ride-hailing and ride-sharing are important to distinguish these terms explicitly. This research aims to introduce a concrete concept of the connected autonomous shared electric vehicle (CASE) as an enabler of the future collective mobility. CASE prioritizes ride-sharing and promotes multi-modal share with public transportation as the backbone, which consists of various mobility modes, including Private autonomous vehicles (PAVs), Connected vehicles (CVs), Shared AVs (SAVs), and Electrification vehicles (EVs). The combination of CASE mobility solution and mobility as a service (MaaS) mobility service offers an individual tailoring service to commuters, which eventually persuades a commuter to use alternative transportation modes rather than an individual ride (Coppola & Esztergár-Kiss, 2019).

Certainty, the urban visions are essential to shape the transition to the uptake of CASE. Nonetheless, the dependence how current urban geography, spatial setting, will influence the governance of CASE deployment have received minimal attention from previous scholars in autonomous mobility. The understanding of specific urban practices trajectories is important in decision-making for the early adoption stage. The reconsideration of the geography of urbanization and urban mobility system aim to shed light on how each city is likely to uptake CASE deployment that best fits their needs and values (Grush & Niles, 2018).

However, the research on shared-autonomous urban mobility concept and AVs deployment are notable geographical imbalance upon contexts of the Global North (Thomopoulos et al., 2021). The diffusion concept of shared autonomous mobility and divergent of short-term technologies

changes and long-term planning are critical for technologies adopters to prepare high-cost new infrastructures that incorporate with emerging technologies.

Meanwhile, most of the capital cities in Southeast Asia are well recognized for their world-ranking traffic congestion problems. These research gaps indicate the need for new related research to mitigate an insufficient theoretical contribution. Therefore, this research intends to serve as the stage zero study in the long-term implication of CASE in the context of the Southeast Asia mega-urban region. Bangkok (BKK) and Ho Chi Minh City (HCM) have been selected due to their urban dynamics, diverse traffic types, and reputation on traffic congestion. The main research questions are the following: 1) What are plausible scenarios for the development of CASE? 2) How path dependence of urbanization and government capacity influence on the plausible scenarios? And 3) How CASE should be governed to promote a collective transport system?

2. Methodology

This study examined plausible scenarios of automated mobilities at the generic level, then identified robust strategies in promoting CASE adoption at BKK and HCM city place-specific level. Regarding uncertainty futures, the scenario building inevitably requires extensive fuzziness data. Combining the scenario technique with the trends' reviewing technique is essential to funnel driving forces and uncertainties. This research proposes a mixed-methods, taking place in three stages of scanning driving forces, identifying critical uncertainties, developing plausible scenarios, and identifying robust strategies.

The first study stage adopted the bibliometric analysis to scan driving forces, then identifies critical AVs adoption uncertainties through a range of research trends based on publications' metadata. The data is derived from the Scopus database using keywords and synonyms related to AVs, then filtered contents relevant to urban and policy dimensions. The bibliometric analysis performed the network clustering technique in VOSviewer software. The characteristic of two prominent clusters is used to determine the critical uncertainty axis. Second, the cross-impact analysis illustrates four-scenario matrix using two critical uncertainties results from the bibliometric analysis. Each scenario of four-quadrant contains a set of narratives, which explain their distinctive story. Third, spatial analyses at the place-specific level of BKK and HCM were performed to find robust strategies as an optimum solution in governing CASE deployment. The proposed strategies should be adaptable and effective to different plausible scenarios. Spatial analyses consist of transit node accessibility analysis and street network capacity analysis, employing a GIS software of ArcGIS and RStudio.

3. Results

First, the bibliometric keywords co-occurrences mapping shows two distinctive cluster of a mobility solution-related topic, and the polarization of governance topic. The first cluster captured the battle between private motorized transport versus collective transport and its societal impact. The second cluster captured friction between the public and private sectors as seen in a clumped dispersion pattern of governance versus technology-related keywords. The development of AVs technology in the private sector remains persistently state of the art from test

areas to streets. In parallel, the challenges are how responsible governments sort out policy pathways in a timely manner.

In the second stage, the four-scenarios matrix was plotted from the axes of the categories of mobility solutions and the polarization of governance approaches, covering “Everyman for Himself”, “Affordable Treats”, “AVs-Public Transport Hegemony”, and “Multi-Modal Prosperity” scenario. The reconsideration of the current urbanization and urban mobility system in spatial analyses highlights a long path dependence of the absence of government intervention, weak transportation network, lack of public transportation accessibility, and the exclusive of feeder mobility. These inherent problems would be highly following the exclusiveness scenarios that could fuel ignorance of CASE adoption.

Indeed, the reaction of anticipatory governance will be unavoidable due to the need for public democratic discussion. This research recommends participatory planning to develop comprehensive urban-regional planning considering multi-level governments of local and regional levels in the metropolis and neighboring cities, private sectors, and communities. The proposed robust strategies involve building seamless user experience, encouraging the attractiveness of public transportation, and enhancing social acceptance of autonomous ride-sharing and multi-modal transportation, underlying the idea of minimizing the maximum regret covering public rights-of-way, incentive zoning, and taxation strategies.

Keywords

Autonomous Vehicles, The Connected Autonomous Shared Electric Vehicle, CASE, Scenario Building, Mega-Urban Regions, Southeast Asia, Bangkok, Ho Chi Minh City

Reference

- Coppola, P., & Esztergár-Kiss, D. (2019). Introduction. In P. Coppola & D. Esztergár-Kiss (Eds.), *Autonomous Vehicles and Future Mobility* (pp. xi–xiii). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-12-817696-2.09988-1>
- Grush, B., & Niles, J. (2018). Chapter 10 - Transit Leap in Theory. In B. Grush & J. Niles (Eds.), *The End of Driving* (pp. 147–181). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-12-815451-9.00010-9>
- Thomopoulos, N., Cohen, S., Hopkins, D., Siegel, L., & Kimber, S. (2021). All work and no play? Autonomous vehicles and non-commuting journeys. *Transport Reviews*, *41*(4), 456–477. <https://doi.org/10.1080/01441647.2020.1857460>