SUSTAINABLE AUTOMATED AND CONNECTED TRANSPORT

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TRANSPORT AND SUSTAINABILITY
VOLUME 19

SUSTAINABLE AUTOMATED AND CONNECTED TRANSPORT

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The book has been supported by the Action CA16222 of the European Cooperation in Science and Technology (COST) entitled "*Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport*" (WISE-ACT). WISE-ACT offered the opportunity for multiple researchers from different countries with diverse backgrounds and expertise to explore relevant policy implications of autonomous and connected vehicles, and identify required policy developments at global level.

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The book has been supported by the Action CA16222 of the European Cooperation in Science and Technology (COST) entitled "*Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport*" (WISE-ACT). WISE-ACT offered the opportunity for multiple researchers from different countries with diverse backgrounds and expertise to explore relevant policy implications of autonomous and connected vehicles, and identify required policy developments at global level.

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This book could not exist without our authors who have so willingly contributed their knowledge. We also thank the reviewers who supported the peer-review process undertaken to make this volume a success.

More information about WISE-ACT can be found at https://wise-act.eu/

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PART ONE

ACT INNOVATION

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CHAPTER 1

INTRODUCTION TO SUSTAINABLE AUTOMATED AND CONNECTED TRANSPORT

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ABSTRACT

The 26th United Nations Climate Change Conference of the Parties (COP26) has reinvigorated the policy focus on sustainable transport. Automated and Connected Transport (ACT) has been featured as a promising technology-based option to aid in meeting the Sustainable Development Goals (SDGs). Despite progress in certain areas of sustainability, there are still a lot of SDGs where limited progress has been observed since the 2015 Paris Agreement, particularly regarding the social pillar of sustainability which is reflected from the user perspective. This chapter will set the scene for this edited volume first by contrasting ACT potential with the SDGs and then by highlighting the requirement to focus more on addressing user needs through ACT. Remarkably, scholars have been increasingly sceptical about the transition to fully automated and connected vehicles, thus it is pertinent to highlight relevant opportunities and risks. Chapter recommendations foster the promotion of a Quadruple Helix approach to operationalise the inclusion

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of social concerns (e.g. gender balance and equity) in Sustainable Urban Mobility Plans (SUMP) across the world.

Keywords: Automated and connected transport; autonomous; living lab; quintuple helix; responsible innovation; sustainable development goals

INTRODUCTION

Following the COVID-19 shock to transport systems worldwide due to restrictions and lockdowns, the 26th United Nations Climate Change Conference of Parties (COP26) held in Glasgow in late 2021 reinvigorated the policy focus on sustainable transport. The summit was supposed to be the 5-year checkpoint after the historical 2015 climate agreement signed in Paris at COP21. Indeed, COP21 has been celebrated as the first step of a major success for sustainable development, since scientists and researchers have been raising the alarm with policymakers, industry and citizens for a number of years about the irreversible impact of human activities on climate. As a result, the 17 SDGs were also agreed at the 2015 COP21 and projected through the 2030 Agenda for Sustainable Development (UN-IGS, 2019), which was set to be the single agreement with the highest number of signatories in history. Countries in the Global North and the Global South managed to reconfirm at COP26 in 2021 their commitment to climate and sustainability goals, which unavoidably may change over time due to geopolitics, fuel reserves and prices, user preferences, as well as technological advancements.

Transport has been consistently one of the sectors with the largest impact on climate as it '*emits around 23% of the energy related CO_2 that feeds global warming*' (ITF, 2021). OECD countries have been the most polluting countries until 2010, although greenhouse gas (GHG) emissions have been growing significantly also in Asian countries since 2010 (Fig. 1.1), mainly due to the growing use of 2-wheelers and 3-wheelers (Sims et al., 2014). If no action is taken, CO_2 emissions by the transport sector could reach 40% by 2030 and increase by 60% until 2050 (ITF, 2021). Hence,

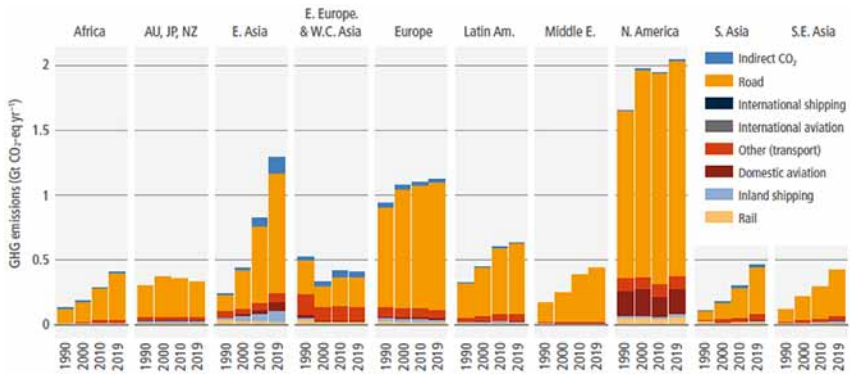

Fig. 1.1. Regional GHG Emission Trends of Transport (Lamb et al., 2021).

a lot of attention and investment have been increasingly directed to addressing the impact of transport worldwide, at least nominally. ACT features as a promising technology-based option to aid in meeting relevant sustainability goals. Technology is therefore an important component in this quest as demonstrated by the potential of, for example, Artificial Intelligence (AI), although it is not and should not be the sole means to address these challenges. Indeed, future transport solutions should move beyond a plain 'techno-fix' approach (Thomopoulos & Givoni, 2015). Transport is included in SDG 11 Sustainable Cities and Communities, although is implicitly contained in other SDGs too:

- SDG 3: Good Health and Well-being
- SDG 5: Gender Equality
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth
- SDG 9: Industry, Innovation and Infrastructure
- SDG 10: Reduced Inequalities
- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action
- SDG 17: Partnerships for the Goals

In assessing the 2022 SDG progress chart (UN, 2022) it is evident that whilst progress on some goals is significant in the developed world and some other parts of the Global South, the overall progress is relatively low (Fig. 1.2). The global perspective is relatively 'fair' to 'limited' progress when it comes to the above SDGs. ICSU-ISSC (2015) stressed that SDG-11 targets are not sufficiently specified and better integration is needed. This is rather alarming as despite the progress made on some sustainability challenges, there is still limited progress about a range of SDGs, particularly regarding the social pillar of sustainability which is primarily reflected on the user perspective (Shiftan et al., 2020). Similar challenges exist regarding the two other sustainability pillars of environmental and economic sustainability, even if some progress has been observed across countries and continents. Undoubtedly, there are other frameworks and indicators to monitor global progress in meeting SDGs, but SDGs are used in this chapter and throughout this book due to their widespread adoption following the 2015 Paris Climate Agreement.

Consequently, this chapter sets the scene for this edited volume first by contrasting ACT deployment with SDGs and then by highlighting the requirement to focus more on addressing user needs through ACT. Due to the growing concerns by scholars about the manner and pace of the transition to ACT, it is pertinent to highlight relevant opportunities and risks. Chapter recommendations foster the promotion of a Living Lab approach based on the Quadruple Helix, which expands the standard Triple Helix model of innovation (Carayannis & Campbell, 2010), to operationalise further the inclusion of social concerns (e.g. gender balance and equity) in policies and actions to meet SDGs across the world.

Fig. 1.2. Progress Chart on Selected SDGs (Adapted from UN, 2022) – For the full figure and the latest updates visit: https://unstats.un.org/sdgs/report/2022/progress-chart/

ACT CONTEXT

CO_2 emissions from road transport have increased by more than 37% between 2000 and 2021 (Fig. 1.3), constituting the most polluting transport sub-sector. Based on 2018 rankings by WISE-ACT[1] experts, ACT will introduce challenges and offer solutions primarily for road transport in urban settings (see Fig. 1.4), thus attention should first focus on these modes and settings.

Wider Impacts and Scenario Evaluation of Autonomous & Connected Transport (WISE-ACT) was an Action funded by the COST[2] Programme between 2017 and 2022, which brought together around 200 experts from 42 countries to discuss issues related to ACT implementation.

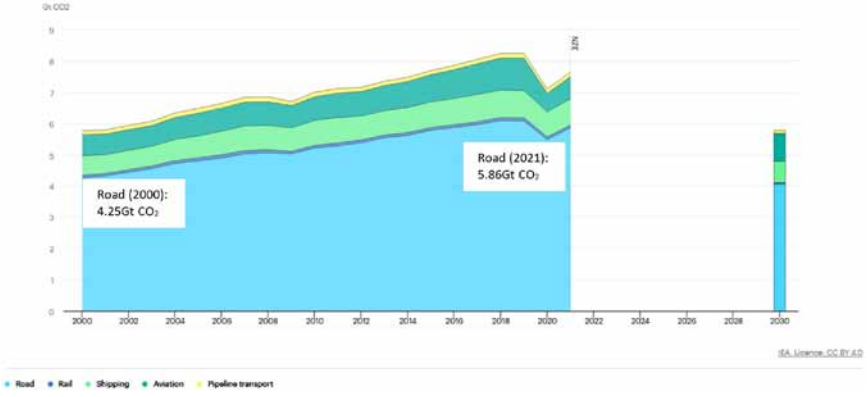

Fig. 1.3. Global CO_2 Emissions from Transport by Sub-Sector in the Net Zero Scenario 2000–2030 (IEA, 2022; Licence: CC BY 4.0).

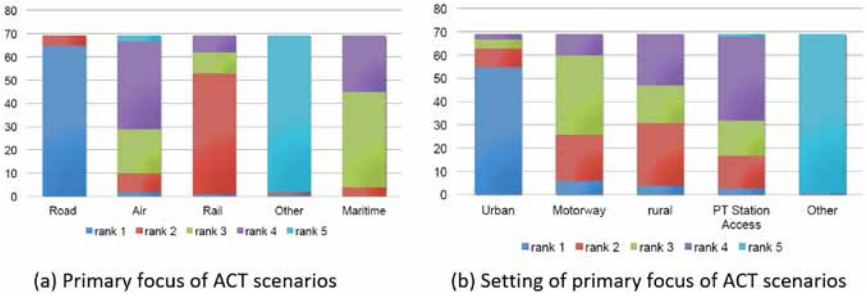

Fig. 1.4. Rankings by WISE-ACT Experts ($n = 35$) Regarding Transport Modes and Settings. (a) Primary Focus of ACT Scenarios. (b) Setting of the Primary Focus of ACT Scenarios. *Source:* Authors' own workings.

[1]WISE-ACT (2017-2022): https://www.wise-act.eu.
[2]European Co-Operation in Science and Technology: https://www.cost.eu.

It is crucial to define ACT and its context before delving into ongoing debates and analyses since there are different definitions used across countries and disciplines. Several terms and acronyms have been used when referring to ACT, for example autonomous, driverless, self-driving cars, automated driving, automated mobility services, AV, CAV, SAV and CCAM (Bala et al., 2023; Harb et al., 2021; Thomopoulos et al., 2021). In spite of relevant terms and acronyms referring to similar technologies, they contain differences which should be clarified and distinguished when planning targets for long-term SDGs. More organisations have been acknowledging the importance of this point, which is demonstrated by the growing use of relevant Glossaries.[3] An early example of such a Glossary attempting to address this need is the WISE-ACT Glossary, which aims at unifying key contemporary ACT terms to support policymakers and practitioners.

Heated debates have taken place among WISE-ACT experts during events and activities about which ACT term to use, mirroring similar debates reported in the academic literature (Hopkins & Schwanen, 2021). Connectivity has been an additional contested element. It is mostly implied to exist for both Automated and Autonomous Vehicles, although this is still not the case for all ACT settings as explained in Chapter 2 of this volume by Makridis, Mattas, Ciuffo and Kouvelas. The WISE-ACT survey distributed in more than 20 countries (Etzioni et al., 2020), used this definition:

> An Autonomous Vehicle is a vehicle which takes over speed and steering control completely and permanently, on all roads and in all situations. The driver-passenger cannot drive manually because the vehicle does not have a steering wheel. The driver-passenger only sets the travel destination.

Lavieri and Bhat (2019) have used a similar one, defining Autonomous Vehicles as:

> Self-driving vehicles, also sometimes referred to as autonomous cars or driverless cars, are capable of responding to the environment and navigating without a human driver in the vehicle controlling the vehicle. In the following questions, whenever you read the term self-driving vehicle, imagine a car with no steering wheel that operates like a personal chauffer.

Whereas, Velasco et al. (2019) defined an Automated Vehicle as 'a vehicle that takes over tasks of human drivers to a certain extent'. In contrast, the Eurobarometer Survey Report (EC-JRC, 2020), which was also based on the WISE-ACT survey, did not use a specific ACT definition and offered respondents three futuristic vehicle image options to consider: a public transport shuttle, a personal car and a truck. 71% of respondents stated that a public transport shuttle corresponds well with their idea of ACT, whereas 60% stated that a personal car also corresponds well with their idea of ACT. Not surprisingly, only 27% of respondents stated that a truck corresponds well with their idea of ACT.

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[3]For example:
ARCADE (2018–2022) https://www.connectedautomateddriving.eu/glossary/
ELTIS-SUMP (2019) https://www.eltis.org/mobility-plans/glossary
HeadStart (2019–2022) https://www.headstart-project.eu/homepage/glossary
WISE-ACT (2017–2022) https://www.wise-act.eu.